TECHNICAL SPECIFICATIONS

VOLUME II

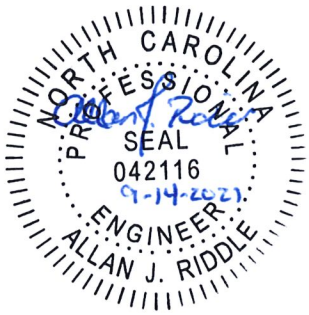
ANNEXATION PHASE V AREA B/C

CLIFFDALE ESTATES, VILLAGE HILLS, & KINGS MILL SUBDIVISIONS

FAYETTEVILLE PUBLIC WORKS COMMISSION
OF
THE CITY OF FAYETTEVILLE
NORTH CAROLINA

SEPTEMBER 2021

for



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02110 SITE CLEARING

SCOPE

Work described in this section includes clearing and grubbing site, protecting adjoining property and trees as indicated on the drawings or as specified herein. The work shall include the complete removal and satisfactory disposal of all growth including trees, stumps, logs and roots; organic material, and other debris or items that interfere with construction operations. The site clearing operations shall be conducted in a manner to insure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

PROTECTION OF TREES AND VEGETATION

Trees and vegetation to be left standing shall be protected from damage incidental to clearing, grubbing, and construction operations, by the erection of timber barriers or by such other approved means. Such barriers must be placed and approved by the Engineer before construction operations can proceed. The protection shall include unnecessary cutting, breaking or skinning of roots; skinning and bruising of bark; smothering of trees by stockpiling construction materials or excavated material within the drip lines; excessive foot and vehicular traffic including parking of vehicles within drip line. Trees and vegetation receiving damage shall be repaired or replaced in a manner acceptable to the Engineer.

Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1½ inches or more in diameter and shall be trimmed of live branches to such heights and such manner as directed. Limbs and branches to be trimmed shall be neatly cut close to the hole of the tree or main branch. Cuts more than 1½ inches in diameter thus made shall be painted with an approved tree wound paint.

CLEARING AND GRUBBING

Clearing shall consist of the felling, trimming and cutting of trees into sections, and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring within the areas to be cleared. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface except such trees and vegetation as may be indicated or directed to be left standing. Clearing operations shall be conducted so as to prevent damage by falling trees to trees left standing, to existing structures and installations and to those under construction, and so as to provide for the safety of employees and others.

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. This material, together with logs and other organic or metallic debris not suitable shall be excavated and removed to a depth of not less than 3

feet below any subgrade shoulder and slope surfaces in excavated areas indicated to be grubbed and in areas indicated as construction areas under this contract such as areas for buildings, roads, streets, shoulder areas, sidewalks. Depressions made by grubbing shall be filled with suitable material compacted to make the surface conform to the original adjacent surface of the ground. The required fill material will not be measured or paid for but should be included as part of the grubbing cost. Grubbing inside the drip line of trees to be left standing shall be by hand methods.

The combined item of clearing and grubbing shall also include the removal and satisfactory disposal of fences, steps, walls, building foundations, pavement, other rubble and debris.

DISPOSAL

All timber, logs, stumps, roots, brush, rotten wood, and other debris from the clearing and grubbing operations shall be disposed of off-site in an approved disposal pit. Such approval will include the conditions covering the disposal of such logs and stumps without burning, including the disposal area off-site. The contractor will be responsible for compliance with all state and local laws and regulations. Burning of timber and other refuse is not allowed within the City of Fayetteville.

DIVISION 2 SITE WORK

02211 GRADING, UTILITIES

GENERAL

This section covers grading for the roadways and drives including all excavations, formation of embankments, preparation of subgrade for pavements and finishing and dressing of graded earth areas, shoulders, and ditches.

MATERIALS

Topsoil, material obtained from excavation suitable for topsoils, is defined as natural, friable soil, characteristics of representative soils in the vicinity that produce heavy growth of crops, grass, or other vegetation. Topsoil shall be free from roots, stones, and other materials that hinder grading, planting, and maintenance operations, and free from objectionable weed seeds.

Satisfactory soil materials are defined as those in accordance with AASHTO Soil Classification Groups, A-1, A-2-4, A-2-5 and A-3 (or in accordance with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, SP, SC.) as determined by the Engineer. Satisfactory material shall be free from roots, organic matter, trash, debris, frozen material or stones larger than three (3) inches in any dimension.

Unsatisfactory soil materials are defined as those in accordance with AASHTO Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, A-7 (or in accordance with ASTM D2487 soil classification groups GC, ML, MH, CL, CH, OL, OH, and PT) as determined by the Engineer.

Materials determined by the Engineer as too wet or too soft to provide a stable subgrade, foundation, or fill will be classified as unsatisfactory regardless of soil classification. The Engineer may require the Contractor to condition the wet and/or soft soils to provide a stable subgrade, foundation, or fill. The Contractor shall recondition the materials at no additional cost to the Owner.

CONSERVATION OF TOPSOIL

Areas designated for operations that contain a blanket of soil, which is more satisfactory for the growth of grass than the embankment material to be placed, shall be stripped to a depth of approximately four (4) to six (6) inches and placed in convenient stockpiles as directed in the field, for later use as a topsoil blanket on the new graded areas specified herein, or as designated. The stripping of material for use as topsoil shall be carefully determined and only the quantity required shall be stripped and stockpiled. Material ordered stockpiled shall be placed in a satisfactory manner to afford drainage. When grading operations permit, instead of stockpiling, the topsoil shall be hauled and spread directly on the areas to receive topsoil.

Topsoil shall be placed on all shoulders, slopes, ditches, and other earth areas graded under this

contract, excluding borrow areas, unless otherwise specified on the plans. Topsoil shall be uniformly placed on these areas to a compacted depth of not less than three (3) inches or more than four (4) inches. The material shall be free from clods of soil, matted roots greater than ½ inch in diameter, and any other objectionable material which might hinder subsequent grass and mowing operations. The material shall be placed, leveled, and lightly compacted with at least one pass of a cultipacker, or other approved equipment weighing 100 to 160 pounds per linear foot of roller, to required cross sections, but shall be left one-tenth of a foot below the finished earth grade as specified in the paragraph FINISHED EXCAVATION.

BORROW EXCAVATION (Select Backfill)

Where satisfactory materials are not available in sufficient quantities from the required excavation, approved materials shall be obtained from borrow areas. Borrow excavation material shall be supplied by the Contractor from borrow areas located off-site. The work covered by this section shall consist of the excavation of approved material from borrow sources and the hauling and utilization of such material as required on the plans or directed by the Engineer. The borrow material shall be approved by the Engineer and shall not contain roots, root mats, stumps, highly plastic clay or other unsatisfactory materials. The material shall be a soil material which meets requirements of AASHTO Ml 45 for soil classification A-i-a, A-i-b, A-2-A, A-3 acceptable for select backfill. All borrow material shall be in accordance with the NCDOT Standard Specification for Roads and Structures, most recent edition. Borrow excavation shall be in accordance with the NCDOT Standard Specification for Roads and Structures, most recent edition. Excess material removed within the work limits, suitable for borrow excavation, during "Unclassified Excavation" operations shall not be considered or paid for as borrow excavation.

UNDERCUT EXCAVATION

When the Owner determines that the natural soil materials in areas where fill is to be placed, or in the finished graded subgrade roadway cross section, or in areas supporting structures or pipes, are determined to have a poor supporting value, the Engineer may require the Contractor to remove the materials and backfill with approved properly compacted material to the finished graded section. The Contractor shall conduct undercut operations in such a way that the Engineer can take the necessary measurements before any backfill is placed. Any material removed and backfilled without the approval of the Engineer, and/or all necessary measurements taken, and/or to a depth, length or width exceeding the dimensions shall not be considered undercut excavation and will not be paid for such. All undercut excavation shall be in accordance with the NCDOT Standard Specification for Roads and Structures, most recent edition. Undercut excavations suitable for backfill on toes of slopes and other approved areas will not be paid for as borrow excavation.

FINISHED EXCAVATION

All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be reasonably smooth,

compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified. Ditches shall be finished to permit adequate drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials. Surfaces shall be finished not more than 0.15 foot above or below the established grade and approved cross section. In areas where the bulking of soil as a result of grassing operations will tend to retard surface drainage along the edge of pavements, the finished grades shall be left 0.1 foot below grade prior to grassing.

Newly graded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades re-established to the required elevations and slopes. Embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained in such a manner as to drain effectively at all times. The finished subgrade shall not be disturbed by traffic of other operations and shall be protected and maintained by the Contractor in a satisfactory condition until subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade shall not be permitted. No base course or pavement shall be laid until the subgrade has been checked and approved, and in no case shall base, surfacing, or pavement be placed on a muddy, spongy, or frozen subgrade. All work shall be conducted in accordance with the environmental protection requirements of the contract.

DIVISION 2
SITE WORK

02222 EXCAVATION AND BACKFILLING FOR UTILITY SYSTEMS

GENERAL

Work described in this section consists of the excavation, backfill, compaction, and finish grading required to install the utility systems. The intent and purpose of these specifications is to require a complete and satisfactory installation in every respect and any defect in material or workmanship shall be cause for the replacement and correction of such defect as directed by the Public Works Commission.

RELATED SECTIONS

A. 02305 – Pipe Bursting
B. 02660 – Water Distribution
C. 02730 – Sanitary Sewer Systems
D. 02732 – Sewage Force Mains
E. Chapter 24 of the City of Fayetteville Ordinance (most recent version)

MATERIALS

Suitable soil materials are defined as those in accordance with AASHTO Soil Classification Groups A-1, A-2-4, A-2-5 and A-3 (or in accordance with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, SP, SC) as determined by the Public Works Commission. Suitable material shall be free from roots, organic matter, trash, debris, frozen material or stones larger than three (3) inches in any dimension.

Unsuitable soil materials are defined as those in accordance with AASHTO Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, A-7 (or in accordance with ASTM D2487 soil classification groups GC, ML, MH, CL, CH, OL, OH, and PT) as determined by the Public Works Commission. Unsuitable material as defined above shall be replaced with select material as determined by the Public Works Commission.

Suitable materials determined by the Public Works Commission as too wet or too soft to provide a stable subgrade, foundation, or fill will be deemed as unsuitable regardless of soil classification. Materials deemed unsuitable shall be conditioned or replaced, as directed by the Public Works Commission. The Contractor shall recondition and stockpile the materials at no additional cost to the Public Works Commission.

EXCAVATION

All excavation shall be to the lines and grades indicated. The work shall consist of the excavation, placement, and compaction of suitable material as outlined in this Specification and proper disposal of all unsuitable materials. During excavation, suitable material for backfilling shall be stockpiled. The stockpiles shall be protected from contamination by unsuitable excavated material or other material. If any material becomes unsuitable, such material, if directed, shall be removed and replaced with suitable on-site or imported material from approved sources at no additional cost to the Public Works Commission.
Where the line parallels a creek and/or ditch the excavated material shall be stockpiled opposite the creek, with the trench separating the two. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. Grading shall be done to prevent surface water from entering the excavation. Any water within the trench shall be removed.

Suitable excavated material shall be stockpiled or placed in the excavation's backfill. Excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Unauthorized over excavation shall be backfilled with select bedding material at no additional cost to the Public Works Commission. The Contractor, at their expense, shall properly dispose of all excess excavated material unless directed to place it in another area of the project by the Public Works Commission. The Contractor's obligation to remove and dispose of excess materials shall in no manner convey to him any rights of property in any material taken from any excavation.

It shall be the Contractor's responsibility to investigate the site and existing conditions. No compensation will be allowed due to excavation and/or grading being different than anticipated.

TRENCH EXCAVATION

The trench width shall be in accordance with the PWC standard details. All work shall be in accordance with the applicable OSHA regulations.

The subgrade beneath the centerline of the pipe shall provide uniform support for each section of the pipe. Stones three (3) inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed.

Where unsuitable material is encountered at the elevation established for installation of pipe or structures, additional undercut excavation shall be done as directed by the Public Works Commission. The additional undercut excavated area shall be backfilled with stone bedding material. Unauthorized undercut excavation shall be backfilled with stone bedding material and compacted as directed by the Public Works Commission. The Contractor shall conduct undercut operations in such a way that the Public Works Commission can take the necessary measurements before any backfill is placed. Any material removed and backfilled without the approval of the Public Works Commission, and/or all necessary measurements taken, and/or to a depth, length or width exceeding the dimensions shall not be considered undercut excavation and will not be paid for such.

Where unsuitable material is encountered at the elevation established for installation of roads, parking lots, or other paved areas, additional undercut excavation shall be done as directed by the responsible agency (i.e., City of Fayetteville, Town of Hope Mills, NCDOT, etc.). The additional undercut excavated area shall be backfilled with stone bedding material. Unauthorized undercut excavation shall be backfilled with stone bedding material and compacted as directed by the responsible agency. The Contractor shall conduct undercut operations in such a way that the responsible agency can take the necessary measurements before any backfill is placed. Any material removed and backfilled without the approval of the responsible agency, and/or all necessary measurements taken, and/or to a depth, length or width exceeding the dimensions shall not be considered undercut excavation. All undercut excavation shall be in accordance with the NCDOT Standard Specification for Roads and Structures (most recent edition), or the responsible agency's specifications.

Excavation for manholes, meter vaults, or similar structures shall leave a minimum of 12-inches clear space around the structure. Removal of unsuitable material shall be as specified above. Preparation of the subgrade shall be in accordance with the applicable detail and as directed by the Public Works Commission.

PIPE LAYING

All pipe shall be installed in accordance with PWC Specification Section 02660 – Water Distribution, Specification Section 02730 – Sanitary Sewer Systems, and/or PWC Specification Section 02732 – Sewage Force Mains.

TRENCH SAFETY

All excavations shall comply with all Federal, State, and local rules and regulations. The Contractor shall have a trenching and shoring "competent" person on the job at all times when there is an open excavation. Under no circumstance shall an employee of the Public Works Commission be considered the "competent" person for the operation.

TRENCH STABILIZATION (SHORING)

The Contractor shall furnish, install, and maintain all necessary shoring to ensure a safe excavation. The method of shoring and excavation shall be in strict accordance with OSHA Regulations. The Contractor shall be responsible for installation, maintenance, and removal of all trench stabilization measures. The Contractor shall be responsible for any damage to adjacent structures resulting from the installation, maintenance, removal, or absence of trench stabilization measures.

DEWATERING

Excavations shall be kept dry at all times. Any required dewatering shall be the Contractor's responsibility. The Contractor shall be responsible for any damage to the adjacent property resulting from the installation, maintenance, discharge, and removal of the dewatering system. All discharge

from the dewatering system shall be in accordance with the applicable erosion control rules and regulations.

BACKFILL

Backfill shall consist of suitable material free from debris, stone, etc. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. The backfill operation shall be conducted to prevent damage and/or movement of the pipe.

Backfill material in trenches shall be placed in layers not exceeding six (6) inches loose thickness to a point at least 12-inches above the pipe compacted to 90 percent maximum density. The remainder of the trench shall be backfilled in layers not exceeding six (6) inches in loose thickness compacted as specified in subparagraph COMPACTION. Each layer shall be thoroughly compacted by an approved mechanical tamping device.

Backfill material around structures shall be placed in a manner that the structure will not be damaged. No backfill shall be placed around manholes, thrust blocks, or similar structures until the concrete has been allowed to cure for three (3) days. The backfill material shall be compacted as specified in subparagraph COMPACTION.

No backfilling will be allowed when weather conditions prevent compliance with these Specifications.

BORROW EXCAVATION (Select Backfill)

Borrow excavation material shall be supplied by the Contractor when sufficient quantities of suitable materials are not available within the project limits. The borrow material shall be approved by the Public Works Commission and shall not contain roots, root mats, stumps, highly plastic clay or other unsatisfactory materials. All borrow material shall be in accordance with the NCDOT Standard Specification for Roads and Structures, most recent edition.

COMPACTION

Backfill shall be compacted in accordance with the following table as a percentage of the maximum density at optimum moisture content as determined by the Standard Proctor Test, ASTM D-698.

Area	Percent ASTM D-698 Maximum Dry Density
Around and 1' above top of pipe	95
Remaining trench (within 4' of subgrade)	95
Pavement subgrade and shoulders	
Last 1' of fill (below subgrade)	100
Last 3' of fill to 12" below subgrade	98

Base material	100
Adjacent to structures (Areas not paved)	95
Under structures	98
Utility Outfalls (Cross Country)	95

Compaction testing may be performed at the option of the PWC Project Coordinator, or as required by the responsible agency (i.e., City of Fayetteville, NCDOT, etc.). Compaction testing shall be done in accordance with the responsible agency's requirements. Deficiencies shall be corrected by the Contractor without additional cost to PWC.

FINISHED EXCAVATION

All areas covered by the project shall be uniformly graded to the established elevations and approved cross sections. Ditches shall be graded to permit proper drainage. Newly graded areas shall be protected from traffic and/or from erosion, and any settlement or washing prior to acceptance shall be repaired and the required grades re-established. Ditches and drains along the subgrade shall be maintained to drain at all times. The finished subgrade shall be protected and maintained by the Contractor. The storage or stockpiling of materials on the finished subgrade shall not be permitted. No base course or pavement shall be laid until the subgrade has been checked and approved. All work shall be conducted in accordance with the environmental protection requirements of the Contract.

DIVISION 2
SITE WORK

02272 EROSION CONTROL - GENERAL PROVISIONS

GENERAL

The Contractor shall be responsible for conducting his site grading and drainage operations in such manner as to prevent or lessen excessive soil erosion of the construction site work areas. He shall at all times provide satisfactory means to prevent or minimize the movement and washing of large quantities of soil. The Contractor is expected to review his site grading and drainage operations periodically to determine the areas most susceptible to erosion by excessive rainfall and periodically maintain all installed measures for the project duration. The Contractor shall correct any deficiencies or problem areas as directed by the Owner or the North Carolina Department of Environment and Natural Resources (NCDENR) inspector within 48 hours.

EXECUTION

The Contractor's attention is directed to the fact that unless exposed earth areas are properly cared for during construction, they may result in substantial sedimentation damage downstream from the construction area. He shall at all times provide satisfactory means to prevent or minimize the movement and washing of quantities of soil onto pavements or into adjacent ditches, swales, inlets, and drainage pipes, to avoid the possibility of these structures becoming clogged with soil. Should this happen as a result of erosion at the site of this construction, the Contractor will be required to immediately provide means for removal of the soil and/or debris from the structures to restore the proper functioning of these structures. The Contractor shall assume all responsibilities to the affected property owners for correction of all damages. The Contractor is expected to review his site grading and drainage operations periodically with the Owner with the view in mind of determining the areas most susceptible to erosion by excessive rainfall and shall take necessary temporary measures in sufficient time to minimize the washing away of the site soils that would likely occur before the areas are finished graded, topsoiled and planted. The temporary measures to be provided by the Contractor at the critical areas may consist of, but not limited to, any one or a combination of the following, or by other approved means selected by the Contractor:

Silt Fence
Gravel Construction Entrance/Exit
Inlet Protection

If any earthwork is to be suspended for any reason whatsoever for longer than 15 days, the disturbed areas shall be seeded with temporary vegetative cover or otherwise protected against excessive erosion during the suspended period. Suspension of work in any area of operation does not relieve the Contractor of the responsibility for the erosion control and temporary measures will not be considered cause for a change in the price bid.

MAINTENANCE

The Contractor shall inspect and maintain each erosion control measure until the project is stabilized and accepted. After each significant rainfall, the Contractor shall remove and dispose of silt accumulation from each individual measure. The following maintenance may be required for each specific erosion and sediment control measure:

Silt Fence:	Fabric shall be removed and replaced whenever deteriorated to such an extent the effectiveness is reduced. The toe of the fabric shall be buried a minimum of 6 inches.
Gravel Construction Entrance/Exit:	Periodic top dressing with two inches (2") of graded stone. Remove all objectionable materials spilled, washed or tracked onto public roadways.
Sediment Trap:	Remove sediment and restore trap to original dimensions when accumulated silt volume equals ½ the design depth. Replace the contaminated gravel facing.
Gravel Inlet Protection:	Remove sediment as necessary to provide adequate volume. Replace contaminated gravel facing if required.
Rip-Rap:	Make repairs to dislodged stone and/or supplement as required if erosion occurs during heavy rainfalls.

REMOVAL

After the area has been stabilized and the project accepted, the Contractor shall remove all temporary erosion and sediment control measures. Silt fences shall be removed, sediment traps/pits and/or basins filled with suitable soil, compacted and seeded. The materials removed shall remain the property of the Contractor and shall be disposed of off-site, or may be reused in other locations if approved by the Owner.

DIVISION 2
SITE WORK

02273 TEMPORARY SILT FENCE

GENERAL

The work covered by this section consists of furnishing, installing, maintaining and removing a water permeable filter type silt fence for the purpose of removing suspended particles from the water passing through it.

The quantity of temporary silt fence to be installed will be affected by the actual conditions which occur during the construction of the project. The quantity of temporary silt fence may be increased, decreased, or eliminated entirely at the direction of the Owner. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

MATERIALS

Either wood posts or steel posts may be used. Wood posts shall be a minimum of 6 feet long, at least 3 inches in diameter, and straight enough to provide a fence without noticeable misalignment. Steel posts shall be 5 feet long, 1 3/4 inches wide and have projections for fastening the wire to the fence.

Wire fence fabric shall be at least 32 inches high, and shall have at least 6 horizontal wires. Vertical wires shall be spaced 12 inches apart. The top and bottom wires shall be at least 10 gauge. All other wires shall be at least 12½ gauge.

Burlap shall be at least 36 inches wide and shall weigh at least 6.7 ounces per square yard. Other materials may be used in lieu of burlap, provided those materials have been approved by the North Carolina Department of Environment and Natural Resources (NCDENR).

Wire staples shall be No. 9 staple and shall be at least 1½ inches long.

INSTALLATION

The Contractor shall install temporary silt fence as shown on the plans and details. The silt fence shall be constructed at the locations shown on the plans and at other locations directed by the Owner.

Posts shall be installed so that no more than 3 feet of the post shall protrude above the ground and at least 18 inches are driven into the ground. Filter fabric shall be attached to the wire fence fabric by wire or other acceptable means. The fabric shall be continual in length. The fabric shall extend into a 6"x 6" trench along the uphill side of the fence. The trench shall be backfilled and compacted. Place 6 inches of No. 57 stone along the toe of the fence to secure the fabric in place. The single stripe located approximately 6 inches form the silt fence outer edge should not be visible if the fabric and fencing are installed properly.

DIVISION 2
SITE WORK

02274 GRAVEL CONSTRUCTION ENTRANCE/EXIT

GENERAL

The work covered by this section consists of furnishing, installing, maintaining and removing temporary gravel construction entrance/exits. The entrance/exit shall be located at points where vehicles enter and exit the project and as indicated on the plans to limit sediment "tracked" off the site.

Where there are differences or conflict between this specification and those requirements outlined in an approved Erosion Control Plan, the specifications in the erosion control plan shall take precedence.

MATERIALS

The stone shall be two inches (2") to three inches (3") washed stone.

INSTALLATION

The Contractor shall install the gravel construction entrance as shown on the plans and details. The construction entrance shall be constructed at the locations shown on the plans and at other locations directed by the Engineer.

The area to receive the stone shall be cleared of all vegetation, roots and other objectionable materials. The subgrade shall be graded and properly compacted. Areas yielding shall be covered with engineering fabric or undercut as directed by the Engineer. The stone shall be placed, graded and compacted to a minimum depth of eight inches (8") and as shown on the plans. The minimum construction entrance dimensions shall be 50 feet in length and 12 feet in width. The construction entrance/exit shall be maintained and the stone supplemented throughout the life of the project and shall be removed upon stabilization and disposed of off-site at the Contractor's expense.

DIVISION 2
SITE WORK

02275 BLOCK AND GRAVEL INLET PROTECTION

GENERAL

The Contractor shall install block and gravel inlet protection when storm drain inlets are to be made operational before permanent stabilization of the disturbed drainage area. The inlet protection applies to areas of heavy runoff and provides for overflow capacity to prevent excessive ponding; however, shallow temporary flooding should be anticipated.

INSTALLATION

The Contractor shall install the block and gravel inlet protection as shown on the detail drawing and at the locations indicated. As an option, the concrete blocks may be omitted and the entire structure made of gravel and stone. A structure made entirely of stone is commonly called a "gravel doughnut". In this case, keep the stone slope toward the inlet at 3:1 or flatter. Stone shall be washed stone with minimum 3-inch size on the basin side for stability and 1 inch or smaller (No. 57) on the flow side.

DIVISION 2
SITE WORK

02301 BORING AND JACKING (ROADWAYS AND RAILROADS)

GENERAL

Installation shall be by dry boring and jacking of a smooth wall steel pipe that is true to line and grade under roadways or where indicated on the plans, all in accordance with these specifications and recommendations of the pipe manufacturer. The Contractor shall notify the Public Works Commission's Project Coordinator a minimum of seven (7) days prior to any contemplated work. All required permits and approvals shall be secured prior to commencing work.

MATERIALS

Materials to be used shall be appropriate for the installation method chosen by the contractor. All materials shall be submitted to the Public Works Commission for approval, prior to the Contractor commencing operations.

Dry Boring & Jacking

The casing pipe shall be spiral welded or smooth wall steel pipe in accordance with ASTM A53, Grade B having minimum yield strength of 35,000 psi. The carrier pipe installed for water or force main applications, within the casing pipe shall be CL 50 ductile iron restrained joint pipe. Use of pressure class ductile iron pipe for water mains is acceptable, in accordance with Specification Section 02660. Mechanical joint restraint systems (i.e., Mega-Lugs, grip-rings, field-lok gaskets, etc.) are not an acceptable means of restraint within the casing pipe for water mains or force mains.

The material for the gravity sanitary sewer carrier pipe shall be CL 50 ductile iron restrained joint pipe. All carrier pipes in sewer service shall have the appropriate lining and coating. Use of restraining gaskets (i.e., field-lok gaskets) is an acceptable means of restraint for gravity sewer mains. Use of mega-lugs (or equivalent) is not approved for restraint within casings.

The casing pipe minimum size and minimum wall thickness shall be in accordance with the following chart unless indicated otherwise on the drawings.

CARRIER PIPE (dia, in inches)	MIN CASING SIZE (inches)	WALL THICKNESS (inches)	RAILROAD WALL THICKNESS (inches)
4	10	0.188	0.188
6	12	0.250	0.281
8	16	0.250	0.281

12	24	0.250	0.375
16	30	0.312	0.469
18	30	0.312	0.469
24	36	0.375	0.532
30	42	0.500	0.625
36	48	0.500	0.688

The Contractor may substitute larger size casing pipe (particularly for sewer mains where grade and alignment are critical) with the proper wall thickness. A manual steering head or other approved guidance system is recommended for casing pipe 30 inches and larger and/or bores exceeding 100 feet in length.

INSTALLATION

Installation using the selected method shall be true to line and grade, where indicated on the plans, all in accordance with these specifications and recommendations of the pipe manufacturer. The Contractor shall notify all affected parties a minimum of seven (7) days prior to any contemplated work.

It is recommended that the Contractor perform each bore before beginning the sewer line construction. The boring shall be performed from the "upstream" to "downstream" direction maintaining the critical downstream invert elevation. Should the bore termination not be on grade, a revised plan shall be submitted to PWC Water Resources Engineering for approval. No additional payment shall be made for any required corrective actions. The boring operations shall be conducted at all times in such a manner so as not to create a hazard to nor impede the flow of traffic.

The Contractor will be responsible for any repair costs if any settlement or damage to the roadway or railroad bed resulting from the boring operation occurs within one year after completion of the work. The Contractor shall maintain proper insurance as required by the permitting agency.

The Contractor shall submit all requested information as required by the permitting agency.

Dry Boring & Jacking

The alignment and grade of the jacking shall be carefully established prior to beginning the operation. A licensed professional land surveyor shall provide staking to establish the correct alignment and grade. The licensed surveyor (or a licensed professional engineer) shall provide cut sheets to the Public Works Commission and the contractor.

Lubricants such as bentonite may be applied to the outside of the pipe to reduce frictional resistance during jacking. The boring auger shall not be a greater diameter than the outside diameter of the encasement and removal of the excavated material ahead of the pipe will be held to a minimum to prevent the formation of voids.

Voids occurring outside the encasement pipe shall be filled with 1:3 Portland cement grout and the ends of the encasement pipe closed with masonry after the carrier pipe placement. The voids shall be filled with 1:3 Portland cement grout at sufficient pressure to prevent settlement of the roadway or railroad. The method of grouting shall be as approved by the permitting agency.
If the installed casing is deemed to be unusable by the Public Works Commission and/or the permitting agency, the casing shall be abandoned by bricking each end and filling the casing with grout, or as directed by the permitting agency.

The Contractor shall locate all existing utilities in the proposed location of the jack and bore. Design of the casing shall be in accordance with PWC standards, and subject to PWC approval. The casing should have a minimum separation of 12-inches from existing utilities.

In the event two parallel casings are being installed, the minimum separation between the outside edges of each casing shall be five (5) feet, or as directed by the permitting agency. In the event of a conflict between this specification and the permitting agency's requirements, the more stringent shall apply.

The use of "back-taps" is not encouraged. The design engineer shall take all necessary steps to determine the location of existing utilities and evaluate the necessity of a back-tap. Should it be necessary to install a back-tap, the top of casing shall be a minimum of 12-inches below the bottom of the pipe to be tapped. All pipe and fittings from the tap location to the carrier pipe shall be restrained joint. Use of mechanical joint restraint systems (i.e., mega-lugs, grip-rings, etc) are allowed in such instances. The Public Works Commission shall review and approve all proposed back-tap locations.

DIVISION 2
SITE WORK

02500 – TRAFFIC CONTROL

GENERAL

The purpose of these specifications is to outline the Contractor's requirements for furnishing, erecting, maintaining, relocating, and removing traffic control devices for the maintenance of traffic during the Contractor's construction operations. The Contractor shall furnish all labor, materials, accessories, equipment and tools for performing all required traffic control operations.

REFERENCES

All work shall be in accordance with:

A. The North Carolina Department of Transportation Standards and Specifications for Roads and Structures (most recent edition)
B. The North Carolina Department of Transportation Roadway Standard Drawings (most recent edition)
C. The Manual on Uniform Traffic Control Devices (MUTCD) – most recent edition
D. The North Carolina Supplement to the MUTCD
E. Section 01000 – Special Provisions of these Contract Documents

REQUIREMENTS

TRAFFIC CONTROL PLAN

The Contractor shall submit a traffic control and phasing plan for the overall project to be reviewed and approved by the PWC Project Engineer, prior to starting construction. The Contractor shall obtain an approved copy of the traffic control plan for the overall project area prior to any excavation within roadways. The plan must indicate how traffic will be managed, signage to be used, and potential traffic patterns resulting from plan implementation. The plan shall be submitted to the PWC Project Engineer in accordance with Section 01000 "Special Provisions" and Section 01300 "Submittals" of these Contract Documents. Failure of the Contractor to submit the required traffic control plan sufficiently in advance shall not entitle the Contractor to any extension of Contract Time.

TRAFFIC CONTROL DEVICES

The Contractor working in public rights-of-way on streets open to vehicular traffic, shall be required to provide, erect, and maintain all necessary traffic control devices throughout the project area to include any connecting streets affected by construction activities. The Contractor shall provide a sufficient number of personnel, and take all precautions for the protection of the work and safety of the public. All traffic control devices in place shall be in accordance with the approved traffic control plan. All traffic

control devices and device installation shall be placed and maintained in strict accordance with the resources listed above.

The Contractor shall be liable for any damages resulting from using unapproved and/or inadequate work zone traffic control. The Fayetteville Public Works Commission reserves the right to stop any work for non-compliance. The Contractor shall have no claim for delay due to stoppage of work as a result of non-compliance.

TRAFFIC CONTROL PLAN AND ROAD CLOSURE NOTIFICATION

1. TRAFFIC CONTROL PLAN – The Contractor shall notify the PWC Project Engineer, in writing, by 5:00 p.m. Wednesday, indicating which roadways will be affected by the work the following week. The Contractor shall notify NCDOT of work to be done per the terms of the approved encroachment agreement. The PWC Project Engineer shall receive copies of all correspondence via fax or email (PWC fax 910-829-0203; email addresses will be provided at the pre-construction meeting).

Traffic cannot be altered without notification as outlined in the above paragraph. Failure to do so will result in the Contractor not being able to work within the street the next week.

No work on the individual streets shall start until all the traffic control devices required for the particular work activity have been installed in accordance with the approved traffic control plan.

2. ROAD CLOSURE NOTIFICATION - When deemed to be in the best interest of the public, the Fayetteville Public Works Commission and the Contractor, a street may be closed for a duration mutually agreed upon. The Contractor shall submit a request in writing to the PWC Project Engineer for approval to have a street closed. The PWC Project Engineer will forward the request to the appropriate agency (i.e., City, NCDOT) for approval of the closure. The PWC Project Engineer will include their recommendation regarding approval or disapproval of the request. The PWC Project Engineer will respond in writing with any recommendation for approval or disapproval of the request.

   The request shall be submitted a minimum of five (5) business days prior to the desired closure date. The request shall include the street name and the limits of the closure based on the points of intersection. The request shall also state the proposed duration the street is to be closed and shall include a traffic control plan showing the detour route, traffic control devices, etc. The traffic control plan submitted shall be in accordance with the requirements listed in this Specification.

Once the street closure has been approved, in writing, by the PWC Project Engineer, the Contractor accepts full responsibility for the closure, to include the installation, maintenance, and removal of all traffic control devices and all implied liability.

STEEL PLATING ROADWAYS

Steel plating shall not be used without the prior written approval of the Project Engineer. The Contractor shall submit their proposed plan to utilize steel plates a minimum of five (5) working days prior to the proposed activity. Plating shall only be considered if the trench depths are 14 feet or greater. Should plating be approved the Contractor shall adhere to the following:

1. The trench shall be adequately shored to support bridging and traffic loads.
2. The trench box shall be sealed so there are no open voids.
3. Steel plates shall rest on trench box.
4. Steel plates shall extend beyond the outer edges of the trench box on all four sides.
5. There must be a minimum of two (2) feet of compacted backfill above steel plates.
6. Compacted backfill shall match existing street grade.
7. Provide documentation that the plates are capable of supporting potential loads.

Steel plating shall not exceed two (2) consecutive calendar days in any given week. However, provided that work is progressing in that particular section of sewer the Contractor may be allowed to utilize plating for a longer duration as approved in writing by the Project Engineer.

STEEL PLATING ROADWAYS (NCDOT STREETS)

Steel plating shall not be used without the prior written approval of the Fayetteville Public Works Commission Project Engineer. The Contractor shall submit their proposed plan to utilize steel plates a minimum of five (5) business days prior to the proposed activity. Should plating be approved, the Contractor shall adhere to the following:

1. The plates shall be secured against any movement from traffic. Options include “countersinking” the plates to be flush with the existing pavement, or bolting the plates to the pavement.
2. The plates shall overlap the excavation a minimum of two (2) feet on all sides.
3. The plates shall be sufficient to withstand the expected traffic loads.
4. Provide documentation that the plates are capable of supporting potential loads.

Steel plating shall not exceed two (2) consecutive calendar days in any given week. However, provided that work is progressing in that particular section of the project, the Contractor may be allowed to utilize plating for a longer duration as approved in writing by the Fayetteville Public Works Commission Project Engineer.

MATERIALS

A. The Contractor shall utilize interim pavement marking paint as specified in the North Carolina Department of Transportation Standards and Specifications for Roads and Structures (most recent edition)

B. Traffic cones may be utilized when approved by the Fayetteville Public Works Commission Project Engineer. If approved, traffic cones shall either be double stacked or weighted to prevent movement by traffic.

C. All traffic control devices furnished by the Contractor shall remain the property of the Contractor, unless otherwise specified in these Contract Documents.

INSTALLATION

The furnishing, erecting, maintaining, relocating, and removal of traffic control devices shall be in accordance with the MUTCD (most recent edition), the requirements outlined in the approved traffic control plan, and these Contract Documents.

All traffic control devices shall be in place prior to the Contractor beginning work, removed during intervals when work is not on-going, and removed at the end of each business day (unless otherwise approved, as outlined in this specification).

The Contractor shall not obstruct or impede any traffic on adjacent streets, during the installation or removal of the traffic control devices, or during construction.

The Contractor shall not close a lane to through traffic after normal working hours and during periods of construction inactivity, unless otherwise approved in writing by the Fayetteville Public Works Commission Project Engineer.

The Fayetteville Public Works Commission Project Engineer may restrict the Contractor from placing lane closures during certain hours, holidays, or as deemed necessary for the convenience of the public. All lane closure types, hours of installation, and durations shall be as approved in writing by the Fayetteville Public Works Commission Project Engineer.

The use of police and/or trained flaggers to control traffic through the work site shall be provided by the Contractor as required. The Contractor shall be responsible for obtaining trained personnel to direct traffic and contacting local authorities for use of police for traffic control where applicable.

INTERIM PAVEMENT MARKINGS

The Contractor shall be required to place interim pavement markings (centerlines, lane lines, edge lines, railroad, and school symbols) daily on any street with existing pavement markings that have been obliterated.

THERMOPLASTIC PAVEMENT MARKINGS

The Contractor shall be required to place thermoplastic pavement marking centerlines, lane lines, and edge lines within three (3) calendar days after the completion of the resurfacing operation.

The Contractor shall be required to place all thermoplastic pavement marking symbols (arrows, crosswalks, stop lines, school symbols, railroad symbols, raised pavement markers, etc.) within seven (7) calendar days of the completion of the project.

NCDOT STREETS

All traffic control measures for work within NCDOT road rights-of-way shall be in accordance with the approved NCDOT encroachment agreement, and as specified herein. Where there is a conflict between the requirements of this specification and the approved encroachment, the requirements of the approved encroachment shall govern.

DIVISION 2
SITE WORK

02505 ADJUSTMENT OF EXISTING STRUCTURES

GENERAL

The work covered by this specification consists of the raising or lowering of existing manholes and valve boxes encountered within the limits of the project to match the adjacent finished work.

RELATED SECTIONS

A. 02222 – Excavation and Backfilling for Utility Systems
B. 02660 – Water Distribution
C. 02730 – Sanitary Sewer Systems

Where conflicts occur between the specifications, the more stringent requirement shall apply.

MATERIALS

All materials shall be in strict accordance with the requirements of the Public Works Commission and as set forth in this standard.

Adjustable riser rings are not approved for use within the Public Works Commission water and/or sewer system. All manhole adjustments shall be done utilizing a concrete grade ring. If a concrete grade ring cannot be utilized, the manhole shall be broken down and rebuilt to the proper grade, in accordance with PWC standards.

INSTALLATION

Adjustment of structures shall not be performed until after placement of base course and/or any leveling course, and prior to placement of final course. All adjustments of structures shall be accomplished a minimum of 72 hours prior to placing the final surface course. All defective, damaged, or worn castings shall be replaced with new castings provided by the Public Works Commission at no cost to the Contractor. The Contractor shall be responsible for exchanging castings at the Public Works Commission's facility.

The Contractor shall take all necessary precautions to prevent debris from entering the sanitary sewer system. Any debris that falls into the manhole or valve box during adjustment shall be removed immediately.

Manholes

For all manholes that need adjustment, the Contractor shall remove all concrete grade rings to the top of the cone section. All loose material shall be removed and properly disposed of. The Contractor shall utilize new concrete grade rings to ensure that the new manhole ring and cover will be at final grade. If no concrete grade rings are required to adjust the structure to final grade, the Contractor shall set the ring and cover in a bed of clean fresh mortar.

If the manhole needs to be lowered, and there are no existing concrete grade rings, then the Contractor shall tear down the existing manhole and rebuild it, utilizing new riser and cone sections, in order to ensure that the installed ring and cover will be at final grade. The Contractor shall remove all necessary sections of the existing manhole in order to make the adjustment.

If the manhole needs to be raised, and there are 12-inches of concrete grade rings already in place, the Contractor shall tear down the existing manhole and re-build it. The Contractor shall utilize new riser and cone sections, as required, to ensure that the installed ring and cover will be at final grade. The Contractor shall remove all necessary sections of the existing manhole in order to make the adjustment.

Valve Boxes

In order to adjust valve boxes, the top section of the valve box shall be raised or lowered as required to meet the final grade. If the height of the final grade exceeds the length of the existing top section, the Contractor shall remove the existing valve box and install a new one at final grade.

All adjustments shall be protected for at least 72 hours before the placement of any surfacing material, in order to allow the concrete to properly set. The Contractor shall be responsible for protecting the raised structure from damage due to traffic. After the 72 hours, a temporary asphalt transition shall be placed around the raised structure, to allow vehicular traffic to pass over. The asphalt transition shall extend a minimum of 18 inches from the structure in every direction. The Contractor shall be responsible for maintaining this asphalt transition until such time the final surface course is placed. Immediately prior to paving, the asphalt transition shall be removed. In the event paving is stopped for the day prior to completing the work, the Contractor shall re-install the temporary asphalt transition. The finish surface tolerance shall not vary more than ¼" (0.25 inch) in any direction. Every effort shall be made to ensure that the surface course and castings provide as smooth a ride as possible.

DIVISION 2
SITE WORK

02573 PERMANENT PAVEMENT PATCH

GENERAL

Permanent pavement patching shall be completed as indicated on the Contract Plans and in accordance with these Contract Documents. The intent and purpose of these specifications is to require a complete and satisfactory installation in every respect and any defect in material or workmanship shall be cause for replacement and correction of such defect as directed by the Public Works Commission. All materials and workmanship shall be in complete accordance with the standards and specifications of the Public Works Commission and subject to Public Works Commission inspection and approval. The materials and installation shall conform to the North Carolina Department of Transportation (NCDOT) Standards, (latest revision), the NCDOT HMA/QMS Manual (latest revision), and as specified herein. The Contractor shall schedule an on-site pre-paving conference with the PWC Project Engineer and Project Coordinator prior to performing any paving operation. The conference should include discussion on the definition and determination of a lot.

REMOVAL

The Contractor shall cut the existing pavement to straight uniform widths parallel and perpendicular to the roadway. Jagged saw cuts will not be acceptable. The pavement shall be removed its entire depth. The Contractor shall properly dispose of all removed pavement. If the Contractor elects to mill the asphalt, the millings cannot exceed two (2) inches in size, and shall be swept into the trench and re-compacted. The removal limits shall extend a minimum of six (6) inches into solid undisturbed base course prior to patching or as directed by the Public Works Commission.

Pavement removal shall not exceed 3,000 feet total for the entire project at one time. It shall be the Contractor's responsibility to maintain the trench (swept, wetted, compacted, etc.) until paved.

PAVEMENT

Replacing the pavement shall consist of the following:

Tack Coat

All existing pavement edges shall be tacked in accordance with the North Carolina Department of Transportation Standard Specifications for Roads and Structures (latest revision).

Asphalt Surface Course

The asphalt surface course shall be Type S9.5, placed in accordance with the PWC Standard Detail M.2. All asphalt surface course shall be in accordance with the NCDOT HMA/QMS Manual (latest revision) and the North Carolina Department of Transportation Standard Specifications for Roads and Structures (latest revision).

The pavement repair shall be constructed to the line, grade, crown and cross section of the existing street. The asphalt plant mix shall be compacted to density in accordance with the HMA/QMS Manual (latest revision). The Contractor shall provide a smooth transition from the existing pavement to the top of the backfill, so as to have no vertical drop (in any direction). The transitions shall only be removed the day of patch paving.

The permanent pavement patch shall be made within 30 days of installation of the line. If settlement should occur within one (1) year warranty period, the Contractor shall be required to remove asphalt, re-compact base and sub-base, and re-patch any areas of settlement at no expense to PWC. All repairs shall be in accordance with these Contract Documents.

Base Course

The base course shall be aggregate base course (ABC) installed to a minimum eight (8) inches thickness (compacted) and extending a minimum of six (6) inches beyond the edge of the trench as indicated on the PWC Standard Detail M.2. The base course shall be compacted to 100% maximum dry density at optimum moisture content as determined by the AASHTO T-99 as modified by NCDOT.

The Contractor, with permission of the Public Works Commission, may use asphalt concrete intermediate course, placed in a minimum four (4) inch layer extending a minimum of six (6) inches beyond the edge of the trench as indicated on the Permanent Patch Detail. The Asphalt Concrete Intermediate Course shall be in accordance with the North Carolina Department of Transportation Standard Specifications (latest revision), and the NCDOT HMA/QMS Manual (latest revision).

Prior to patch paving, the Contractor shall remove the upper ten (10) inches of backfill, if ABC is to be used or upper six (6) inches if Asphalt Concrete Intermediate Course is to be used, in the trench. All asphalt edges along the trench shall be cut straight, uniform width, parallel and perpendicular to the road with no jagged edges. The outer six (6) inches (minimum) of the trench adjacent to the newly removed asphalt shall be on undisturbed soil.

The pavement repair shall be constructed to the line, grade, crown and cross section of the existing street. The asphalt plant mix shall be compacted to density in accordance with the HMA/QMS Manual.

Maintenance shall be performed at least weekly, after a rainfall, or at the direction of the Public Works Commission. Maintenance shall include sweeping the adjoining pavement, blading, wetting and compacting the stone to insure smooth drivable surface.

DIVISION 2
SITE WORK

02574 TEMPORARY PAVEMENT PATCH

GENERAL

Open cutting and replacing existing pavement shall be performed in accordance with these Contract Documents. The materials and installation shall conform to the North Carolina Department of Transportation Standard Specification (most recent edition), the NCDOT HMA/QMS Manual (most recent edition), and as specified herein. Encroachment permits will be obtained by the Public Works Commission, but all necessary insurance as required by NCDOT shall be furnished and paid for by the Contractor.

REMOVAL

The Contractor shall cut the existing pavement to straight uniform widths parallel and perpendicular to the roadway. Jagged saw cuts will not be acceptable. The pavement shall be removed its entire depth. The Contractor shall properly dispose of all removed pavement. If the Contractor elects to mill the asphalt, the millings cannot exceed two (2) inches in size, and shall be swept into the trench and re-compacted. The removal limits shall extend a minimum of six (6) inches into solid undisturbed base course prior to patching or as directed by the Public Works Commission.

Pavement removal shall not exceed 3,000 feet total for the entire project at one time. It shall be the Contractor's responsibility to maintain the trench (swept, wetted, compacted, etc.) until paved.

PAVEMENT

Replacing the pavement shall consist of the following:

Tack Coat

All existing pavement edges shall be tacked in accordance with the North Carolina Department of Transportation Standard Specifications for Roads and Structures (most recent edition).

Asphalt Surface Course

Where streets are indicated to be temporarily patched and overlaid with an asphalt surface course, the patch shall be constructed of asphalt intermediate course, Type I-19.0. The Asphalt Intermediate Course, material shall be in accordance with NCDOT Standard Specifications for Roads and Structures (most recent edition) and the NCDOT HMA/QMS Manual (most recent edition).

The pavement repair shall be constructed to the line, grade, crown and cross section of the existing street. The asphalt plant mix shall be compacted to density in accordance with the NCDOT HMA/QMS Manual (most recent edition).

The temporary pavement patch shall be a minimum three (3) inches compacted thickness and extend a minimum of six (6) inches beyond the edge of the trench in accordance with the PWC Standard Detail. No more than 24 hours prior to patch paving, the Contractor shall remove the upper three (3) inches of backfill in the trench. All asphalt edges along the trench shall be cut straight, uniform width, parallel and perpendicular to the road with no jagged edges. The outer six (6) inches (minimum) of the trench adjacent to the newly removed asphalt shall be on undisturbed soil. The Contractor shall provide a smooth transition from the existing pavement to the top of the backfill, so as to have no vertical drop (in any direction). The transitions shall only be removed the day of patch paving.

The temporary pavement patch shall be made within thirty (30) days of installation of the line. If settlement should occur within the one (1) year warranty period, the Contractor shall be required to remove asphalt, re-compact base and sub-base, and re-patch any areas of settlement at no expense to PWC. All repairs shall be in accordance with these Contract Documents.

DIVISION 2
SITE WORK

02575 DRIVEWAY REPLACEMENT

GENERAL

Removal and replacement of existing driveways is required as indicated in the Contract Drawings and shall conform to the requirements of this Specification and the Contract Documents. The Contractor shall furnish all labor, equipment, materials, and incidentals necessary for the removal and replacement of the driveways disturbed as part of the utility construction. The intent and purpose of these specifications is to require a complete and satisfactory installation in every respect and any defects in material or workmanship 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.

All work shall be done in accordance with the terms and conditions outlined herein, the Public Works Commission "Manual for the Design and Construction of Water and Wastewater System Extensions" (most recent edition), in accordance with the North Carolina Department of Transportation "Standard Specifications for Roads and Structures" (most recent edition), and subject to final approval and acceptance by the Public Works Commission. In case of conflicting requirements between this Specification and the above referenced documents, this Specification shall govern.

The Contractor shall provide resident's access to their driveways at all times. The Contractor shall coordinate with the resident to provide access to their home during removal and replacement of the driveway. The Contractor shall make every attempt to coordinate their efforts with the schedule and wishes of the resident.

RELATED SECTIONS

A. 02222 – Excavation, Trenching, and Backfill for Utility Systems

REMOVAL

The Contractor shall provide a neat edge along the concrete or asphalt driveway pavement being retained by sawing, straight and true, approximately two (2) inches deep before breaking away. The portion of driveway to be removed shall be as indicated on the Contract Drawings or as directed by the PWC Project Coordinator. The concrete or asphalt driveway pavement shall be removed for its entire depth, removed from the site, and disposed of at the Contractor's sole expense.

The Contractor shall remove the existing gravel drive to the limits shown on the Contract Drawings or as directed by the PWC Project Coordinator. The driveway shall be removed for its entire depth, removed from the site, and disposed of at the Contractor's sole expense.

ASPHALT DRIVES

Replacing the asphalt driveway shall consist of the following:

Base Course:

The stabilized aggregate base course shall be installed to a minimum eight (8) inches compacted thickness as indicated on the Asphalt Driveway Patch Detail. The base course shall be compacted to 100% maximum dry density at optimum moisture content as determined by the AASHTO T-99 as modified by NCDOT. In lieu of utilizing aggregate base course, the Contractor, with approval from the City of Fayetteville, may utilize a minimum of four (4) inches of I-19.0 intermediate course.

In locations approved by the PWC Project Engineer, where the stone base course is to remain for a defined period of time prior to asphalt paving, the stone base course shall be maintained by the Contractor. Maintenance shall include sweeping the adjoining pavement, blading and/or leveling the stone, compacting and wetting the stone to insure smooth driveable surface. The Contractor shall have on the project the proper equipment to complete this work. Maintenance shall be performed at least weekly, after a rainfall, or at the direction of the PWC Project Engineer.

Tack Coat:

All existing pavement edges shall be tacked in accordance with the North Carolina Department of Transportation Standard Specifications for Roads and Structures (most recent edition).

Bituminous Concrete Surface Course:

The bituminous concrete surface course shall be Type SF9.5, placed in a two (2) inch minimum thickness or to the existing full depth thickness whichever is greater and in strict accordance with the North Carolina Department of Transportation Standard Specifications for Roads and Structures (most recent edition).

CONCRETE DRIVES

Where new concrete is to be placed against existing concrete, preformed expansion joint filler, three-quarter inches in width and of a depth extending for the full thickness of the slab, shall be used. All concrete shall have a minimum 28 day compressive strength of 3,000 psi and shall be placed to the same thickness as the removed portion except that in no case shall any new slab be less than five (5) inches thick. The concrete shall be accurately screed to produce a uniform surface, floated, and given a broom finish. All work shall be in accordance with PWC standard details and City of Fayetteville requirements.

GRAVEL DRIVES

Gravel driveways shall be restored or replaced in all locations disturbed by construction. The replacement gravel driveway shall consist of six (6) inches thick compacted Number 57 stone or aggregate base course stone, whichever matches or more closely matches the existing gravel driveway.

ACCEPTANCE

Acceptance of the installed driveways shall be based on the conformance with the requirements outlined herein, the Public Works Commission's review of the installation, and written concurrence from the property owner. The Public Works Commission will not accept any installation without the written release from the property owner. The Contractor shall be responsible for obtaining the written release from the property owner.

WARRANTY

If settlement should occur within one (1) year, the Contractor shall repair/re-pave the area to provide a smooth transition between the new and existing driveways. The finished product shall be neat in appearance and of equal or exceeding quality of the surrounding driveway or area.

DIVISION 2
SITE WORK

02584 ROADWAY AND PARKING LOT MARKING

GENERAL

The pavement markings shall be in strict accordance with both NCDOT Standard Specifications for Roads and Structures (most recent edition) and U.S. Department of Transportation, Federal Highway Administration's Manual for Uniform Traffic Control Devices for Streets and Highways.

MATERIALS

The traffic and zone marking paint shall be white, yellow or blue alkyd-chlorinated rubber chlorinated paraffin as manufactured by PPG Industries, General Paint and Chemical Company, Sherwin-Williams or an approved equal. The paint shall be in accordance with AASHTO M248, Type III.

INSTALLATION

The Contractor shall lay out all work including traffic lanes, arrows, spaces, handicap aisles, etc and other pavement markings as indicated on the Contract Drawings. Prior to the application of any paint, the pavement surface shall be cleaned of all dirt, trash and the surface shall be free of any material that would prevent adherence of paint. The paint shall be applied to a dry surface using either a template or striping machine. Stripes shall be uniform weight and width. Stripe width shall be 4 inches unless otherwise shown on the Contract Drawings.

DIVISION 2
SITE WORK

02660 WATER DISTRIBUTION

GENERAL

Water lines and all appurtenant items shall be constructed of materials specified and/or as indicated on the approved drawings. The intent and purpose of these specifications is to require a complete and satisfactory installation in every respect and any defects in material or workmanship shall be cause for the replacement and correction of such defect as directed by the Fayetteville Public Works Commission (PWC) at no expense to the Fayetteville Public Works Commission.

RELATED SECTIONS

A. 02211 – Grading, Utilities
B. 02222 – Excavation and Backfilling for Utility Systems
C. 02301 – Boring And Jacking (Roadways And Railroads)

MATERIALS

MANUALLY OPERATED GATE VALVES

All manually operated gate valves four (4) inches and larger shall be ductile iron or cast iron body resilient wedge type rated for 250 psig working pressure gate valves and shall conform to American Water Works Association (AWWA) C-509/C-515 and NSF 61. All valves must open counter-clockwise equipped with a two (2) inch square operating nut. The operating nut shall have an arrow cut in the metal, indicating the direction of opening. All valves shall have a non-rising stem. All valves up to and including thirty-six (36) inch diameter shall have triple "O" ring stem seals. The design and machining of valves shall be such as to permit the replacement of the upper two (2) "O" rings without undue leakage while the valve is wide open and in service. The wedge shall be ductile iron encapsulated in nitrile rubber (for four (4) inch through 12 inch) and SBR rubber for 14-inch through 24-inch sizes.. All internal and external surfaces of the valve body and bonnet shall have a fusion bonded epoxy coating complying with ANSI/AWWA C550 applied electrostatically prior to assembly, conforming to AWWA C-550-90. All valves up to and including 36-inch diameter shall have a safe working pressure of 250 psi. Valve connections shall be as required for the piping in which they are installed. 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.

Gate valves installed in meter vaults shall have a wheel in lieu of a square operating nut and shall also have a non-rising stem. The wheel shall have an arrow cut in the metal indicating the direction of opening. Flanges shall not be buried. An approved pit shall be provided for all flange connections.

Resilient seated tapping valves shall be furnished with the tapping flange having a raised face or lip designed to engage the corresponding recess in the tapping sleeve flange in accordance with MSS-SP60.

Tapping valves without the raised face on the tapping flange are not permitted since they do not assure the proper alignment required to prevent damage by a misaligned shell cutter. The interior of the waterway in the body shall be a full opening and capable of passing a full sized shell cutter equal to the nominal diameter of the valve.

All valves shall be manufactured in strict accordance with the latest specifications of the American Water Works Association (AWWA). Valves shall be manufactured by: Mueller Company, Clow Corporation, or American Darling Company. Certification shall be furnished to the Fayetteville Public Works Commission by the manufacturer that all valves are in accordance with PWC standards. Where specified on the plans and approved by the Fayetteville Public Works Commission, resilient wedge gate valves may be furnished with spur gearing for valves installed in a vertical position and bevel gearing for valves installed in a horizontal position. All gate valves shall be installed in accordance with PWC standard details.

BALL VALVES

For all valves smaller than four (4) inches, ball valves shall be used. Ball valves shall be installed in accordance with PWC standard details.

Ball valves shall be all bronze construction, with tee head operator and having a removable disc. Ball valves shall have threaded connections, in accordance with PWC standard details. Ball valves shall be manufactured and tested in accordance with AWWA/ANSI C800. The valve shall be equipped with packing nut, gland, and packing material. Ball valves shall be of an approved type made from approved materials conforming to ASTM Specifications and shall also meet the approval of the Public Works Commission. The turn required to travel from fully closed to fully open on the ball valve shall be 90 degrees.

VALVE BOXES

Valve boxes shall be "slip-type" made of close-grained, gray cast iron metal painted with a protective asphaltic coating. Construction shall be in three pieces as follows: The lower of base pieces, which shall be flanged at the bottom, the upper part which shall be flanged on the lower end, and of such size as to telescope over the lower part, the upper end being constructed in the form of a socket to receive the cap or cover; and the cover or cap shall have cast on the upper surface, in raised letters, the word "WATER". All valve boxes shall be equal in quality and workmanship to those manufactured by Sigma Corporation (VB-462), Tyler Union (6855 Series), Star Pipe Products (VB-0004), or an approved equal. The valve box shall be installed in accordance with PWC standard details. The valve box shall have a 3/8-inch hole drilled in the upper part four (4) to six (6) inches from the top of the box to accommodate a ¼-inch x 1-1/2-inch galvanized bolt for securing tracer wire.

Valve box protector rings shall be installed to protect valve boxes located outside pavement. The ring shall be constructed and installed in accordance with PWC standard details.

FIRE HYDRANTS

All fire hydrants shall be dry barrel, traffic type and conform to the latest revision of AWWA Specification C-502 except as listed below or as otherwise directed by the Public Works Commission. All working parts shall be bronzed. The size of the fire hydrants (designated by the nominal diameter of the valve opening) shall not be less than four and one-half (4 ½) inches. All hydrants shall be able to deliver a minimum of 1,000 gallons per minute with a friction loss of not more than five (5) pounds per square inch (psi) total head loss through the hydrant. Hydrants shall be of compression type (opening shall be of such design that when the barrel is broken off the hydrant valve will remain closed and reasonably tight against leakage). All hydrants shall be mechanical joint to accommodate the spigot end of six (6) inch Pressure Class 150, AWWA Standard, ductile iron pipe. The installation of the fire hydrant shall be in accordance with PWC standard details. Bosses (6") may be substituted for tees in pipe sizes exceeding 24 inches in diameter, with prior approval from PWC. The boss shall be welded to the bottom of the main to provide effective flushing of the system.

All hydrants shall be furnished with two (2) two and one-half (2 ½) inch nozzles and one (1) four and one-half (4 ½) inch pumper nozzle. Outlets shall have American National Standard fire hose coupling thread, in accordance with the City of Fayetteville standard, and shall be provided with nozzle caps securely chained to the body of the hydrant. The base of the hydrant shall have two (2) cast lugs suitable for use in strapping the hydrant to the connecting pipe. The operating nut shall be pentagonal in shape, finished with a slight taper to one and one-half (1 ½) inches from point to flat to conform to the standard wrench used by the Fayetteville Public Works Commission. All hydrants shall open left or counter-clockwise. Hydrants shall be suitable for working pressure of 150 psi and a test pressure of twice the working pressure. Fire hydrants shall be specific models manufactured by Mueller Company (Model Centurian 200), Clow Corporation (Medallion), American Darling (Model Mark 73-1) or approved equal. The interior of the hydrant shoe shall be coated with a four (4) mil thickness FDA approved epoxy coating.

COMBINATION AIR VALVES ASSEMBLY

Combination air valves shall be of the single housing style that combines the operation features of both an air/vacuum and air release valve. The combination air valve shall have a two (2) inch inlet and one (1) inch outlet connections and an orifice diameter to be determined by the Design Engineer for each project for a maximum working pressure of 300 psi. The assembly shall be equipped with a two (2) inch cut-off valve as shown on the PWC standard detail. The combination air valve body shall be constructed of 316 stainless steel or reinforced nylon with the only exception being the Buna-N Rubber seat and gasket. Valves shall be as manufactured by Crispin (Model UX20), ARI (D-020), or approved equal. Combination air valves shall be installed in accordance with PWC standards.

WATER DISTRIBUTION PIPE

DUCTILE IRON PIPE

The raw material from all ductile iron pipe and fittings shall have an average minimum content consisting of 90% recycled iron and steel. Ductile iron pipe and fittings shall be manufactured in the United States of

America in accordance with ANSI/AWWA A21.51/C151. The manufacturer of the ductile iron pipe shall be a member of the Ductile Iron Pipe Research Association (DIPRA).

All ductile iron pipe shall be designated as "Pressure Class", unless otherwise specified. The pipe furnished shall have a minimum thickness calculated in accordance with ANSI A 21.50 (AWWA C-150), with a factor of safety of two (2); a working pressure of 150 psi to 350 psi, plus 100 psi water hammer allowance; and AASHTO H-20 live truck load with 2.5 feet of cover. In no case shall "Pressure Class" pipe's nominal thickness be less than the following:

SIZE	PRESSURE CLASS	NOMINAL THICKNESS (In.)
4"	350	0.25
6"	350	0.25
8"	350	0.25
10"	350	0.26
12"	350	0.28
16"	250	0.30
24"	250	0.37

PUSH-ON JOINTS

Push-on joints shall be as specified and installed in accordance with AWWA C-600 and shall conform to AWWA Standard C-111. Push on joints, rubber gaskets and lubricant shall conform to ANSI A21.11. Pressure rating shall not be less than 200 psi unless otherwise specified. All ductile iron pipe shall be lined with standard thickness cement mortar lining and asphaltic seal coat in accordance with ANSI A21.4 (AWWA C-104). The pipe shall have an outside asphaltic coating as specified in AWWA Standard C-151.

RESTRAINED JOINTS

Factory Restrained Joints

Factory restrained joint pipe shall be utilized for all pipe greater than 12-inches in diameter, unless otherwise approved by the Fayetteville Public Works Commission. Factory restrained joint pipe shall be furnished for the locations shown on the approved drawings. The pipe, joints, and gaskets shall be in accordance with ANSI/AWWA Standards as specified for ductile iron pipe. Factory restrained joints shall be rated for a working pressure of 350 psi for sizes up to 12-inches and 250 psi for larger sizes.

All factory restrained joint pipe shall have the restraints internal to the pipe (i.e., "boltless"). All restrained joint ductile iron pipe and fittings larger than 12-inches shall be as manufactured by U.S. Pipe's TR-Flex, Griffin Pipe Products SNAP-LOK, American Cast Iron Pipe Company's Flex-Ring Joint, or approved equal. The method of restraining the valves to the factory restrained ductile iron pipe shall be reviewed and approved by PWC on a case by case basis. The valves shall have the same working pressure as the pipe.

Flanged Joints

Flanges shall be specifically designed for each application. The flange pipe shall be in accordance with ANSI/AWWA C-115/A21.15. Threads for threaded flange pipe shall be in accordance with ANSI B2.1, shop fabricated as outlined by AWWA 115 with serrated faces furnished on the pipe, completely factory installed. Welding of flanges to the body of the pipe will not be acceptable.

Ductile iron fittings and flanges shall be in accordance with ANSI/AWWA C-110/A21.10 with a minimum working pressure of 250 psi. Gaskets shall be full faced SBR rubber per ANSI/AWWA C-111/A21.11 with a minimum 1/8 inch thickness. Linings and coatings shall be as previously outlined for all ductile iron pipe and fittings.

Mechanical Joints

Mechanical joints shall be as specified and installed in accordance with AWWA C-600 and shall conform to AWWA Standard C-111. Mechanical joints shall be of the stuffing box type and shall conform to ANSI A21.11 for four (4) inch pipe through 12-inch pipe. Mechanical joints, rubber gaskets and lubricant shall conform to ANSI A21.11. Pressure rating shall not be less than 200 psi unless otherwise specified.

Special accessories such as mechanical joint retainer glands or mega-lugs are acceptable on pipe 12-inches and less in diameter, upon approval from the Fayetteville Public Works Commission. Mega-lug and/or grip-ring restraint mechanisms will not be an acceptable method of restraint for pipe, fitting and/or valves on sizes larger than 12-inches in diameter. For mains larger than 12-inches and at locations specified by the Fayetteville Public Works Commission, factory restrained joints shall be utilized, in accordance with these Specifications.

Field Lok Gaskets

Special accessories such as US Pipe's Field-LOK gasket, Ford’s Uni-Ring, or Romac’s Grip-Ring are acceptable on pipe 12-inches and less in diameter, upon approval from the Fayetteville Public Works Commission. Mega-lug and/or grip-ring restraint mechanisms will not be an acceptable method of restraint for pipe, fitting and/or valves on sizes larger than 12-inches in diameter. For mains larger than 12-inches and at locations specified by the Fayetteville Public Works Commission, factory restrained joints shall be utilized, in accordance with these Specifications.

FITTINGS

Mechanical Joint

All fittings shall be ductile iron and shall be manufactured in accordance with AWWA Standard C-110 (ANSI A21.11). Compact fittings shall be mechanically restrained, ductile iron in accordance with ANSI A 21.53 (AWWA C-153) for four (4) inch through 12 inch sizes only. Where thrust blocking is utilized, fittings shall be full body ductile iron in accordance with ANSI A 21.53 (AWWA C110).

All ductile iron fittings shall be lined with standard thickness cement mortar lining and asphaltic seal coat in accordance with ANSI A21.4 (AWWA C-104). All fittings shall have an outside asphaltic coating as specified in AWWA Standard C-151 and C-110, respectively.

Factory Restrained

Factory restrained joint fittings shall be utilized for all pipe greater than 12-inches in diameter, unless otherwise approved by the Fayetteville Public Works Commission. Factory restrained joint fittings shall be furnished for the locations shown on the approved drawings. The fittings, joints, and gaskets shall be in accordance with ANSI/AWWA Standards as previously specified for ductile iron pipe. Factory restrained joints shall be rated for a working pressure of 350 psi for sizes up to 12-inches and 250 psi for larger sizes. All factory restrained joint fittings shall have the restraints internal to the fitting (i.e., "boltless"). All fittings shall be compatible with the factory restraint system. All restrained joint ductile iron fittings larger than 12-inches shall be as manufactured by U.S. Pipe's TR-Flex, Griffin Pipe Products SNAP-LOK, American Cast Iron Pipe Company's Flex-Ring Joint, or approved equal.

Bosses

Tangential welded on outlets (i.e., bosses) shall only be utilized on pipe 24-inches and larger, as approved by PWC. All bosses shall be factory welded; field fabrication is not allowed. The pipe shall be in accordance with these specifications. Bosses shall be of the size and location indicated on the approved drawings.

AERIAL CROSSINGS

For aerial crossings, the ductile iron pipe shall be thickness class, as specified on the plans and standard details. All thickness class pipe shall be in accordance with ANSI A21.51 and AWWA C-151, with a minimum working pressure of 200 psi.

For aerial crossings which are four (4) inches to 12 inches in diameter, Class 53 manufactured factory restrained joint or Class 53 flanged ductile iron pipe shall be used in accordance with the PWC standard details. No other means of restraint are allowed for aerial crossings. For aerial crossings larger than 12 inches, or as noted specifically on the plans, Class 53 flanged ductile iron pipe shall be used in accordance with the PWC standard details.

All aerial crossings shall be designed and installed in accordance with PWC standard details.

PIPE IN CASINGS

All ductile iron pipe (regardless of diameter) within casings shall be factory restrained, in accordance with these specifications and the applicable PWC standard details. The use of any other restraints (i.e., mega-lugs, grip-rings, etc.) shall not be utilized on pipe within casings.

All restrained joint ductile pipe in casings shall be in accordance with the PWC standard details.

TRENCHLESS APPLICATIONS

All ductile iron pipe (regardless of diameter) utilized for trenchless installations (i.e., horizontal directional drilling, pipe-bursting, etc.) shall be factory restrained, in accordance with these specifications and the applicable specification section for the trenchless technology. The use of any other restraints (i.e., mega-lugs, grip-rings, etc.) shall not be utilized.

PVC PIPE

Two (2) inch water main pipe shall be manufactured using Grade 1 PVC compound material as defined in ASTM D-1784 and shall be SDR21, pressure class 200 in accordance with ASTM D 2241. Fittings for two (2) PVC pipe shall be solvent weld Schedule 80 PVC. Brass FIP x pack joint for PVC fittings shall be used to transition from PVC to brass. The pipe shall be plainly marked with the manufacturer's name, size, material (PVC) type and grade or compound, NSF seal, date of manufacture, pressure rating and reference to appropriate product standards.

All PVC pipe (4-inches through 12-inches diameter) shall be manufactured using virgin compounds as defined in ASTM D-1784, with a 4,000 psi HDB rating and designated as PVC 1120 to be in strict accordance with AWWA C-900. The pipe shall be Class 150 and conform to the thickness requirements of DR18. The pipe shall be manufactured to withstand 755 psi quick burst pressure tested in accordance with ASTM D-1599 and withstand 500 psi for a minimum of 1,000 hours tested in accordance with ASTM D-1598. The pipe joints shall be of the integral bell type with rubber gaskets and shall conform to the requirements of ASTM D-3139 or ASTM F-477.

PVC fittings are not acceptable for water mains four (4) inches or greater. Fittings and specials shall be ductile iron, bell end in accordance with AWWA C-110, 150 psi pressure rating unless otherwise shown or specified. Ductile iron fittings to PVC pipe shall be adequately supported on a firm trench foundation. Ductile iron fittings and specials shall be cement mortar lined (standard thickness) in accordance with ANSI A21.4.

Mechanical restraining systems (i.e. mega-lug, grip-ring) shall not be used on PVC pipe.

TRACING WIRE

For the purpose of locating non-metallic pipes, a continuous "detectable" tracing wire shall be installed. The wire shall be a minimum 12 gauge, single strand, coated copper or copper clad steel wire that is suitable for underground use. Splices shall be accomplished utilizing a corrosion proof wire connector. The connectors shall "lock" the wires in place and contain a dielectric sealant to prevent corrosion. The connector shall be the "Snake Bite" connector manufactured by Copperhead Industries, LLC, or approved equal. The wire shall be buried continuously along the pipe. The wire shall be secured into valve boxes such that a direct/conductive metal detector may be used to trace the pipe location. Bolts shall be used to secure the wire and the attachment location shall be readily available from finished grade without special equipment.

POLYETHYLENE PLASTIC WATER TUBING

Polyethylene (PE) plastic water tubing shall be installed in accordance with PWC standard details. All services installed in new construction shall be one continuous run of pipe with no splices from the corporation stop to the meter. The PE water tubing shall meet the requirements of ASTM D2737, AWWA C901, and NSF Standards 14 and 61. Pipe dimensions shall meet Iron Pipe Size (IPS) standards.

The PE tubing material shall be high density polyethylene conforming to the minimum requirements of cell classification 445574E, as defined and described in ASTM D3350. The resin shall have a material designation code of PE4710 by the Plastic Pipe Institute.

The PE water tubing shall be SIDR 7, with a minimum pressure rating of 250 psi. Fittings for the PE water pipe shall be cast brass compression fittings, made to the PE water pipe dimension. All brass fittings shall have a 300 psi minimum pressure rating.

For the purpose of locating plastic water services during trenching, a continuous tracing wire shall be installed. The wire shall be a minimum 12 gauge, single strand, coated copper or copper clad steel wire that is suitable for underground use. The wire shall be buried along the water service lateral from the main to the meter box. The wire shall extend a minimum of 12 inches into the meter boxes.

COPPER WATER TUBING

Copper water tubing shall be installed in accordance with PWC standards. All services installed shall be one continuous run of pipe with no splices from the corporation stop to the meter.

Copper water tubing shall be Type K, soft copper manufactured in accordance with ASTM B88. The minimum pressure rating for the copper water pipe shall be 655 psi. Fittings for the copper water pipe shall be brass compression fittings, made to the copper water pipe dimensions. All brass fittings shall have a 300 psi minimum pressure rating.

TAPPING SLEEVES

Tapping sleeves shall be ductile iron mechanical joint or stainless steel and have a minimum working pressure of 150 psi for all tapping of mains up to and including 24-inch diameter with a branch less than or equal to 12-inches diameter. Branch diameter greater than 12-inches on a 16-inch diameter pipe and larger shall require full body ductile iron mechanical joint tapping sleeve.

Ductile iron mechanical joint tapping sleeves shall be as manufactured by Clow, M&H, Mueller, American, or an approved equal and shall be furnished with complete joint accessories. The mechanical joint sleeve shall be compatible with type and class of pipe being tapped. The outlet flange shall be class 125 per ANSI B16.1 compatible with approved tapping valves.

Stainless steel tapping sleeves shall be as manufactured by Romac, Smith-Blair, or approved equal, and shall be furnished with all accessories. The sleeve, lugs, bolts and nuts shall be 18-8 type 304 stainless steel, as provided by the manufacturer. The outlet flange shall be ductile iron or stainless steel. The gasket shall be a grid pattern design and shall provide full circumferential sealing around pipe to be

tapped. The sleeve shall include a 3/4 NPT test plug. All welds shall be passivated. The outlet flange shall be class D per AWWA C-207-ANSI 150 lb. drilling compatible with approved tapping sleeves.

The tapping sleeve and valve shall be in accordance with PWC standard details.

All tapping sleeves shall be hydrostatically pressure tested prior to the tap being accomplished. **Use of air to complete the pressure test is not acceptable.** The tapping sleeve shall be tested to 150 psi. The PWC Project Coordinator shall witness and approve the testing.

WATER SERVICE SADDLES

All water service saddles for use on two (2) inch PVC shall be one (1) inch brass saddles as manufactured by Ford, McDonald, or Mueller.

Water service saddles for one (1) and two (2) inch taps on four (4), six (6), eight (8), 12-inch and larger size PVC and asbestos-cement (AC) and also four (4) inch and larger size iron pipe shall be ductile iron with stainless steel strap(s), bolts, nuts and washers. Ford Models FS 101, FS 202; Romac Models 101S, 202S; or Smith-Blair Model 315.317 shall be used. Stainless steel straps must be pre-formed at the factory to the specified outside diameters of the pipe.

Water service saddles with a two (2) inch outlet shall be double strap.

Water service saddles for pipe sizes 12-inch through 24-inch shall be double strap.

Water service saddles for pipe sizes exceeding 24-inches shall be as specified by the PWC Water Resources Engineering Department.

INSTALLATION

GENERAL

Pipe installation shall be in strict accordance with Specification Section 02222 – Excavation and Backfilling for Utility Systems and as outlined herein.

PIPE INSTALLATION

Pipe installation shall be in accordance with the manufacturer's instructions. All pipes and fittings shall be handled to prevent damage to the protective coatings and linings.

All dust, dirt, oil, tar, or other foreign matter shall be cleaned from the jointing surfaces, and shall be lubricated with lubricant recommended by the manufacturer.

All pipe shall be installed in accordance with the approved drawings and cut sheets, unless otherwise directed by PWC.

All dead ends on new mains shall have a two (2) inch blow-off assembly as indicated on the approved drawings. The blow-off assembly shall be in accordance with PWC standard details.

For pipe sizes up to 12-inches, mechanical equipment should not be utilized to assemble the pipe. For pipe sizes over 12-inches, mechanical equipment may be utilized, in accordance with the pipe manufacturer's instructions. Any damage resulting from the use of mechanical equipment shall be replaced as directed by PWC.

Adjustments in grade by exerting force on the barrel of the pipe with excavating equipment shall not be allowed. The Contractor shall verify line and grade after assembling each joint.

When pipe installation is not in progress, the open ends of the pipe shall be closed by a water tight plug or other means approved by the PWC Project Coordinator. If water is present, the plug shall remain in place until the water is lowered to a level that allows for proper installation. No pipe shall be laid in water or where in the PWC Project Engineer's and/or PWC Project Coordinator's opinion trench conditions are unsuitable. Every precaution shall be taken to prevent material from entering the pipe while it is being installed.

ALIGNMENT AND GRADE

The Contractor shall be responsible for installing the pipe and appurtenances to proper line and grade.

All ductile iron pipe and fittings shall be installed in accordance with ANSI/AWWA C-110/A21.10. All C-900 pipe shall be installed in accordance with ASTM D-2774. The amount of deflection in the PVC or ductile iron pipe shall not exceed the applicable AWWA standards and the manufacturer's recommendations. If the required deflection exceeds the specified limitations or as determined by the Public Works Commission, mechanical joint bends shall be utilized.

Pipe passing through walls of NCDOT bridges, retaining walls, and other concrete structures shall be factory restrained joint ductile iron and be installed in casings/sleeves in accordance with NCDOT specifications. Annular space between walls and sleeves shall be filled with an approved cement mortar that meets NCDOT specifications. The annular space between the sleeve and the pipe shall be filled with an approved mastic.

Pipe passing through the walls of meter vaults, valve pits, and storm drainage structures shall be restrained joint ductile iron, as specified by PWC. Pipe shall be installed in a casing/sleeve if determined to be necessary. Annular space between walls and sleeves shall be filled with an approved cement mortar. Annular space between pipe and sleeves shall be filled with an approved mastic. Proposed conflict boxes with storm and water shall be reviewed by the PWC Water Resources Engineer and approved on a case by case basis.

All ductile iron pipe (regardless of diameter) within casings shall be factory restrained, in accordance with these specifications and the applicable PWC standard details. The use of mechanical restraints (i.e., mega-lugs, grip-rings, etc.) shall not be utilized on pipe within casings.

When pipe is field cut, the cut end shall be smooth and at right angles to the axis of the pipe. All sharp edges shall be removed. All field cut pipe shall be beveled. The beveled end of PVC pipe shall be removed, when installing into mechanical joint ductile iron fittings.

When connecting unlike (class, material, etc.) pipe, an approved PWC fitting shall be used. All pipe shall be installed in accordance with AWWA C-600 or C-605 as applicable, for buried lines and the manufacturer's recommendations. For mechanical joint pipe and fittings, all nuts shall be torqued to the manufacturer's recommendations.

Concrete thrust blocking shall be utilized on all PVC water mains. The concrete thrust blocking shall be in accordance with PWC standard details. When thrust blocking is to be utilized, backfilling shall not occur until the concrete has time to set. No hydrostatic pressure testing shall occur until the concrete thrust blocking has cured for a minimum of five (5) calendar days.

FIRE HYDRANTS

Fire hydrants shall be installed as shown on the approved drawings. Each fire hydrant shall be connected to the main with a six (6) inch branch line and shall have a minimum of 42-inches of cover. Fittings between the valve and fire hydrant may be utilized, with prior approval from PWC. The valve shall be located at the main unless otherwise approved by PWC. Hydrants shall be set plumb with pumper nozzle facing the roadway. The hydrant branch shall not be backfilled until inspected and approved by the PWC Project Coordinator. Fire hydrants shall be installed in accordance with PWC standard details.

HYDROSTATIC TESTS

All mains and laterals shall be subjected to a hydrostatic pressure test. Each valved section maybe tested individually.

The Contractor shall furnish all labor and material, including test pumps, taps, and corporations, necessary to complete the work. Any taps which are not to be utilized shall be killed out at the main. If any taps are to be used for irrigation laterals they shall be installed in accordance with PWC standard details. A PWC Project Coordinator shall be present and observe all valve operation by the Contractor. Under no circumstances shall a Contractor operate any PWC-owned valves unless it is an emergency.

The duration of the pressure test shall be at least one hour or longer, as directed by the PWC Project Coordinator. The hydrostatic pressure shall be 200 psi. The pipe to be tested shall be slowly filled with water and the specified test pressure shall be applied. Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants or blow offs are not located to properly expel the air, taps shall be made as approved by PWC.

Damaged or defective materials discovered as a result of the pressure test shall be removed and replaced with new material, and the test shall be repeated until the test results are satisfactory to the Public Works Commission.

All replacement, repair or retesting shall be accomplished by the Contractor at no additional cost to the Public Works Commission. All repairs shall be reviewed and approved by PWC prior to backfill. The use of couplings, fittings, sleeves, etc. shall be reviewed and approved by PWC prior to use. The main must successfully pass the hydrostatic test prior to sterilization.

STERILIZATION

Sterilization shall be in accordance with the requirements of NCDEQ, the North Carolina Rules Governing Public Water Supply, AWWA C651, and AWWA C655 (most recent editions). The Contractor shall furnish all chlorinating equipment, sterilization solution, materials, excavation, barricades, backfilling, and any taps and corporations necessary to complete the work. The Contractor shall fully cooperate with the PWC Project Coordinator, furnish any needed assistance, and schedule the testing.

Prior to performing the hydrostatic test, water mains, laterals, and appurtenances shall be flushed to remove air, sediment, contaminants, and/or foreign matter. After completion of a successful hydrostatic test, the water system shall be disinfected by the thorough dispersion of a chlorine solution. The chlorine level shall be between 50 parts per million (ppm) and 100 ppm throughout the water system. In no case shall the chlorine level exceed 300 ppm. If the chlorine level is over 300 ppm, the system shall be completely flushed and re-chlorinated. **In no case shall chlorine be introduced into the water system in a dry solid state.**

The chlorine solution shall remain in contact with the interior surfaces of the water system for a minimum period of 24 hours and shall result in not less than 10 ppm of chlorine throughout the system. Then the water system shall be flushed with water from the existing PWC water system until the chlorine solution is dispelled. The Contractor shall take all necessary measures to prevent downstream erosion caused by flushing the lines. All erosion/damages shall be repaired at no additional expense to the Public Works Commission. All environmental regulations governing the release and/or disposal of chlorinated testing water shall be met by the Contractor. AWWA C655 defines “highly chlorinated” water as water having more than four (4) ppm. Any water with a chlorine level greater than four (4) ppm shall be de-chlorinated by the Contractor prior to being released to the environment.

If any disruption to the disinfection process occurs, or if any repair procedure is necessary then the disinfection process shall start over.

After disinfection, the water supply shall not be accepted or placed into service until bacteriological tests results or representative water samples analyzed in the Public Works Commission’s laboratory are found to be satisfactory. The disinfection shall be repeated until tests indicate the absence of pollution for at least two (2) full days. The PWC Project Coordinator shall be responsible for taking the sample(s) and transporting them to the PWC laboratory.

If the initial sample taken after disinfection and flushing does not indicate that the water main is sterilized, the Contractor shall, in conjunction with the PWC Project Coordinator, flush the lines. Once flushing is complete, another sample will be taken to the Public Works Commission’s laboratory for analysis. Should this second sample also fail to indicate that the main is sterilized; the Contractor shall repeat the disinfection process. This process shall be repeated until the samples are satisfactory. The Contractor

shall fully cooperate with the PWC Project Coordinator, furnish any needed assistance, and schedule the testing.

DIVISION 2
SITE WORK

02662 FIRE HYDRANT PAINTING

GENERAL

The object of these specifications is to provide the material and workmanship necessary to produce a first class job.

The Contractor shall paint all exposed exterior fire hydrant surfaces. Minor items not specifically specified, but necessary for proper completion of the work, shall be painted as directed by the Owner.

Painting shall be done at such times the Contractor and Engineer may agree upon in order that a dust free and neat work may be obtained. All painting shall be done in strict accordance with the paint manufacturer's recommendations and shall be satisfactory to the Engineer. Protective covering shall be utilized, as necessary and extreme care taken for protection of adjacent areas, equipment, shrubbery, or other items while painting is in progress. After painting is complete, all spilled paint drops, or other defects shall be removed from surfaces and the entire area thoroughly cleaned up. The Contractor shall submit to the Engineer, upon completion of the painting, certification from the paint manufacturer indicating that the quantity of paint, purchased for each item, was sufficient to properly coat all surfaces.

PAINT

All paint materials shall be first quality and shall be delivered on the job in the original sealed containers bearing the manufacturer's name and trademark. Paint shall conform to the requirements of Federal Spec. TT-V-51 or Military Spec. MIL-C450 or equal. The prime coat from the ground line up shall conform to Federal Spec. TT-P-86 (Type IV), Federal Spec. TT-P-636 or equal.

Thinners: Where thinning is necessary, only the products of the manufacturer furnishing the paint, and for the particular purpose, shall be allowed and all such thinning shall be done strictly in accordance with the manufacturer's instructions as well as with the full knowledge and approval of the Engineer.

SURFACE PREPARATION

All surfaces to be painted shall be prepared in a workman-like manner with the objective of obtaining a smooth, clean and dry surface. All painted surfaces shall be prepared and finished in accordance with the following specifications and shall be approved by the Engineer.

Metal: All exposed surfaces of fire hydrant and other ferrous metal items generally are to be shop primed and shall have all rust, scale, dust, grease or other deleterious substances removed by

sandblasting or pickling in accordance with SSPC-SP-6. Cleaned metal shall be immediately primed to prevent new rusting. All ferrous metal items, not shop primed, shall be field cleaned by wire brushing (if approved by the Engineer) or sandblasting and immediately primed. Non-ferrous metals shall be solvent cleaned just prior to the application of prime coat or pre-treatment. Equipment not shop finished to the Engineer's satisfaction shall also be painted.

Application: Paint shall be applied evenly. Where necessary to obtain a smooth finish, the surface shall be sanded after application of the prime coat. Paint shall be applied, for each coat, at the rate specified by the manufacturer. Any difficulties in film thickness shall be corrected by the application of additional coats until the recommended thickness is obtained. If material has thickened or must be diluted for application by a spray gun, the coating shall be built-up to the same film thickness achieved with un diluted material. Additional coats of paint shall not be applied nor shall units be returned to service until paints are thoroughly dry. Paint shall not be applied in rain or damp weather or when the temperature is lower than 50°F. Painting shall be suspended when relative humidity exceeds 85% or when air temperature will drop to below 40°F within 18 hours of application.

PAINTING SCHEDULE

Schedule of colors and coating requirements are as follows: Acceptable dry mil thickness will be 4-6 for each coat. Bonnet of hydrant shall be Acrylic Enamel, Dark Green paint or approved equal. Fire hydrant barrel, caps, chain and other exterior surfaces shall be Quick Drying Acrylic Enamel Yellow Paint or approved equal.

DIVISION 2
SITE WORK

02730 SANITARY SEWER SYSTEMS

GENERAL

Sanitary sewer lines and all appurtenant items 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 and any defect in material or workmanship shall be cause for the replacement and correction of such defect as directed by the Public Works Commission.

RELATED SECTIONS

A. 02211 – Grading, Utilities
B. 02222 – Excavation and Backfilling for Utility Systems
C. 02732 – Sewage Force Mains

MATERIALS

SEWER MAINS

Prior to shipment each joint of pipe shall be stamped by an independent testing laboratory, certifying compliance with the specifications stated therein. Pipe sizes indicated shall be understood to be nominal inside diameter of the pipe. All sewer pipe materials shall be either PVC (as specified herein) or ductile iron (as specified herein), unless otherwise approved in writing by the Public Works Commission. Written approval shall be obtained prior to installation.

DUCTILE IRON PIPE

The raw material from all ductile iron pipe and fittings shall have an average minimum content consisting of 90% recycled iron and steel. Ductile iron pipe and fittings shall be manufactured in the United States of America in accordance with ANSI/AWWA A21.51/C151. The manufacturer of the ductile iron pipe shall be a member of the Ductile Iron Pipe Research Association (DIPRA).

All ductile iron pipe and fittings shall be in strict accordance with ANSI A21.51 and AWWA C151, Class 50 or Class 51, as applicable, in every respect. The working pressure shall be a minimum of 200 psi. Pipe shall be furnished in 18 or 20-foot lengths. All pipe joints used in open trench construction shall be furnished with "push-on" joints, unless otherwise indicated on the drawings or specified. All joints and fittings shall be in accordance with ANSI A21.11 and AWWA C111. All ductile iron interior surfaces shall be lined with two (2) coats of ceramic epoxy to produce a total minimum dry film thickness of 40 mils (Protecto401 or approved equal). The exterior pipe surfaces shall be protected with asphaltic coating as specified in AWWA C151 and C110. Specifications for the ceramic epoxy can be found in Specification Section 09802.

For aerial crossings which are 4 inches through 12 inches in diameter, manufactured restrained joint ductile iron pipe Class 53, or Class 53 flanged ductile iron pipe shall be utilized in accordance with the standard Public Works Commission detail for aerial crossings. Mega-lugs, field-lok, and gripper rings are not an allowable means of restraint for aerial crossings. For aerial crossings larger than 12 inches, or as noted specifically on the plans, flange joint ductile iron pipe, Class 53, shall be utilized in accordance with the standard Public Works Commission details. The location of flanges shall be specifically designed for each application. The flange pipe shall be in accordance with ANSI/AWWA C-115/A21.15. Threads for threaded flange pipe shall be in accordance with ANSI B2.1, shop fabricated as outlined by AWWA 115 with serrated faces furnished on the pipe, completely factory installed. Welding of flanges to the body of the pipe will not be acceptable. Ductile iron fittings and flanges shall be in accordance with ANSI/AWWA C-110/A21.10 with a minimum working pressure of 250 psi. Gaskets shall be full faced SBR rubber per ANSI/AWWA C-111/A21.11 with a minimum 1/8" thickness. Linings and coatings shall be as outlined for ductile iron pipe.

If the Public Works Commission determines that an expansion coupling is required, it shall be installed as indicated on the drawings. The expansion coupling shall not be buried.

For subsurface water crossings (i.e., streams, wetlands), restrained joint ductile iron pipe shall be utilized. No mechanical restraint systems (e.g., mega-lugs, field-lok gaskets, etc.) shall be utilized. The pipe shall be installed in a casing, in accordance with the approved Public Works Commission detail, unless otherwise specifically approved by the Public Works Commission.

PVC PIPE

PVC sewer pipe and fittings 4 inches thru 15 inches shall be in accordance with ASTM D-3034 with a standard dimension ratio (SDR) of 26 for sewer mains and laterals. Larger diameter pipe (18 inches through 27 inches) shall be in accordance with ASTM F-679, with a SDR of 26. Both pipe and fittings shall be made of PVC plastic having a cell classification of 12454 as specified in ASTM D-1784.

Pipe joining shall be push on elastomeric gasket joints only and the joints shall be manufactured and assembled in accordance with ASTM D-3212. Elastomeric seals shall meet the requirements of ASTM F-477. The pipe shall be furnished with integral bells and with gaskets that are permanently installed at the factory and in accordance with ASTM D-3212 and contain a steel reinforcing ring. PVC sewer pipe shall be made by continuous extrusion of prime green unplasticized PVC and contain identification markings as required by the applicable ASTM standard.

SEWER FITTINGS

Ductile Iron Push-on Fittings:

Ductile iron sewer fittings on PVC mains shall be deep bell, gasketed joint, and air test rated. Gasket groves shall be machined in the factory. Material shall be ductile iron, in accordance with ASTM A536, Grade 65-45-12 and ASTM F1336. Wall thickness shall meet the requirements of AWWA C153. Gaskets shall have a minimum cross sectional area of 0.20 square inches, and conform to ASTM F477.

All ductile iron fittings shall have an interior coating of Protecto 401, or approved equal. All ductile iron fittings on PVC pipe shall provide a flow line that provides a smooth transition between the materials. Ductile iron fittings shall be as manufactured by the Harrington Corporation (Harco), or approved equal.

Mechanical Joint Fittings:

Joints shall be installed in accordance with AWWA C-600 and shall conform to AWWA Standard C-111. Mechanical joints shall be of the stuffing box type and shall conform to ANSI A21.11 for four inch (4") pipe and larger. Fittings and specials shall be ductile iron and shall be manufactured in accordance with AWWA Standard C-110 (ANSI A21.11). Compact fittings shall be ductile iron in accordance with ANSI A 21.53 (AWWA C-153) for 4" thru 24" sizes only. Note: mechanical joint wyes are not included in the AWWA C-153 specification. Pressure rating shall be not less than 200 psi unless otherwise specified. All ductile iron fittings shall have an interior coating of Protecto 401, or approved equal. Mechanical joint fittings shall be utilized on ductile iron mains and ductile iron laterals. Mechanical joint fittings shall not be utilized on PVC mains, unless otherwise approved by the Public Works Commission.

PVC Fittings:

PVC fittings shall be manufactured in accordance with ASTM D-3034, F-1336, and F-679. Molded fittings shall be utilized in sizes from 4” to 8” (or larger, if available). Fabricated fittings shall only be utilized with prior approval from the Public Works Commission. Fabricated fittings are defined as those fittings that are made from pipe or a combination of pipe and molded components. All PVC fittings shall contain identification markings as required by the applicable ASTM standard. All PVC fittings shall be gasketed joint, except as indicated for interior drop structures. Plastic fittings shall be as manufactured by GPK Products, Inc., Plasti-Trends, the Harrington Corporation (Harco), or approved equal.

Ductile Iron Pipe Size x SDR26 Transition Adapter:

All ductile iron x PVC transition adapters shall be one (1) piece, bell x bell (gasket x gasket). Transition adapters shall range in size from four (4) inches through 12 inches. Transition adapters for pipe larger than 12-inches shall be as specified by the Public Works Commission. All transition adapters shall have a flow way tapered to allow a smooth transition between the ductile iron and PVC. Transition adapters shall be either PVC or ductile iron, in accordance with the following:

PVC – All PVC transition fittings shall be made from DR 18 C900 pipe stock. The C900 pipe stock shall meet the requirements of AWWA C900/C905, and have a minimum cell classification of 12454 as defined in ASTM D1784. The wall thickness shall meet or exceed DR 18. PVC transition fittings shall have SBR gaskets in accordance with ASTM F477. All six (6) inch and eight (8) inch adapters shall be molded. Molded fitting joints shall be 235 psi rated, in accordance with ASTM D3139, and shall have SBR rubber gaskets. Four (4) inch, ten (10) inch and 12 inch transition adapters shall have SBR Rieber style gaskets meeting ASTM F477. Joints shall be 235 psi rated, in accordance with ASTM D3139 for the C900 (ductile iron) bell, and in accordance with ASTM D3212 for the sewer (SRD26) bell. Molded C900 bell depths shall comply with AWWA C907. Fabricated (4-inch, 10-inch and 12-inch) bell depths and molded sewer (SDR26) bell depths shall be in accordance with ASTM F1336. PVC transition adapters shall be manufactured by the Harrington Corporation (Harco), GPK Products, or approved equal.

Ductile iron – Ductile iron transition fittings shall be deep bell, push-on joint, and air test rated. The ductile iron material shall comply with ASTM A536, Grade 65-45-12 or 80-55-06. The bell depth shall be in accordance with ASTM F1336. Gaskets shall be of SBR rubber, in accordance with ASTM F477. Transition gaskets are not allowed. All ductile iron transition fittings shall have an interior coating of Protecto401 or approved equal. Ductile iron transition fittings shall be manufactured by the Harrington Corporation (Harco) or approved equal.

Saddles:

Sewer service saddles may be utilized for sewer lateral installations. All sewer service saddles shall be ductile iron with stainless steel straps, bolts, nuts, and washers. The nuts shall be coated to prevent galling. The saddle body shall be ductile iron, in accordance with ASTM A536, Grade 65-45-12. The gasket material shall be SBR, in accordance with ASTM D2000. Saddles for PVC or DI laterals shall have an alignment flange. Sewer service saddles shall be as manufactured by Geneco, or approved equal. All stainless steel straps shall be pre-formed at the factory, to the specified outside diameters of the pipe.

SEWER LATERALS

Ductile iron laterals – For ductile iron mains, utilize mechanical joint fittings or an approved saddle with an alignment flange (Geneco or approved equal). For PVC mains, utilize an approved saddle with an alignment flange (Geneco or approved equal) or ductile iron fittings as specified above.

PVC laterals – utilize a saddle with an alignment flange (Geneco or approved equal) on PVC or ductile iron mains; utilize a mechanical joint tee with SDR 35 transition gaskets on ductile iron mains; or utilize PVC fittings as specified above on PVC mains.

The following table summarizes the materials to be utilized for sewer main to lateral connections:

	PVC Main	DI Main
DI Lateral	DI fitting or approved saddle	MJ fitting or approved saddle
PVC Lateral	PVC fitting or approved saddle	MJ fitting with transition gasket or approved saddle

Sewer laterals shall be in accordance with these Specifications and PWC standard details S.10, S.11, and S.12.

PRECAST CONCRETE MANHOLES

Pre-cast circular reinforced concrete manhole units shall be in accordance with ASTM C-478. The tongue and groove ends of the manhole sections shall be manufactured for jointing with rubber gaskets (i.e., con-seal). An eccentric cone shall be utilized on all manholes, unless otherwise approved by the Public Works Commission.

Manhole steps shall be placed in all manholes and shall be steel reinforced (½" grade 60) copolymer polypropylene plastic steps in accordance with ASTM C-478 for material and design. The steps shall be spaced 16" on center with serrated treads and wide enough to stand on with both feet.

Manhole frames and covers shall be made of gray cast-iron, and the iron shall possess a tensile strength of not less than 18,000 psi. Cast iron shall conform to ASTM Specification A 48-83 Class 35. The frame and cover shall be manufactured by the same manufacturer. All castings shall be in accordance with Public Works Commission standard details. Any defective castings shall be removed and replaced.

Any special linings and coatings that are specified for a manhole and installed at the production facility, in the field, or during repairs, shall be applied in accordance with the applicable special coatings specification and the manufacturer's specifications for that material.

Camlock ring and covers shall be in accordance with Public Works Commission standard details. Camlock bolt head shall be compatible with PWC standard tool for turning camlock mechanism. Camlock ring and covers shall be installed as indicated on the drawings, in accordance with PWC standard details.

SELECT BEDDING MATERIAL

Select bedding material shall be crushed stone (No. 57 or No. 5), in accordance with Public Works Commission standard details. Bedding material shall be provided for all pipe materials.

INSTALLATION

Pipe installation shall be in strict accordance with Specification Section 02222 – Excavation and Backfilling for Utility Systems and as outlined herein.

PIPE LAYING

Pipe installation shall be in accordance with the manufacturer's instructions. Proper equipment shall be utilized to perform the work in a manner satisfactory to PWC. All pipes and fittings shall be carefully lowered into the trench in such a manner to prevent damage to the protective coatings and linings. Under no circumstances shall pipe materials be dropped or dumped into the trench. Pipe shall be carried into position and not dragged.

All dust, dirt, oil, tar (other than standard coating), or other foreign matter shall be cleaned from the jointing surfaces, and the gasket, bell, and spigot shall be lubricated with lubricant recommended by the manufacturer.

The pipe shall be laid upgrade, beginning at the lower end with the tongue or spigot ends pointing in the direction of the flow to the correct line and grade, unless otherwise approved by PWC. The pipe section to be installed shall be aligned by batter board or laser beam with the last installed pipe section. Mechanical equipment should not be used to assemble the pipe. Pipe shall be assembled in accordance

with the pipe manufacturer's instructions. Any damage resulting from the use of mechanical equipment shall be replaced as directed by PWC.

Adjustments in grade by exerting force on the barrel of the pipe with excavating equipment shall not be allowed. The Contractor shall verify line and grade after assembling each joint.

At any time when pipe laying is not in progress, the open ends of the pipe shall be closed by a water tight plug or other means approved by the PWC Project Coordinator. If water is in the trench, the plug shall remain in place until the trench is pumped completely dry. No pipe shall be laid in water or where in the PWC Project Engineer's and/or PWC Project Coordinator's opinion trench conditions are unsuitable. Every precaution shall be taken to prevent material from entering the pipe while it is being installed.

ALIGNMENT AND GRADE

All pipe shall be installed to the required lines and grades. Structures shall be installed at the required locations. The lines and grades of the pipe will generally be indicated by stakes parallel to the line of the pipe. The Contractor shall be responsible for installing the pipe to proper line and grade.

Pipe shall be visually inspected by shining a light between structures and /or by closed circuit television inspection. Any defects discovered, including poor alignment, shall be corrected as directed by the Public Works Commission.

The bottom of the trench shall be excavated to a minimum of four inches (4") below the outside bottom of the pipe being installed to allow adequate placement and compaction of bedding material prior to installation.

Select bedding material shall be placed a minimum of four inches (4") and a maximum of six inches (6") under the pipe for full width of the trench and halfway up the pipe on the sides. Bedding material shall be placed in layers not exceeding six inches (6") loose thickness for compacting by vibratory mechanical tamps under the haunches and concurrently on each side of the pipe for the full width of the trench. The final result shall be "Class B" bedding for rigid pipe. If the existing material under the pipe bedding material is unsuitable, the unsuitable material shall be removed and replaced with select bedding material (No. 57 or No. 5 stone), as authorized and approved by the Public Works Commission Project Coordinator.

The same material pipe shall be utilized from manhole to manhole, unless otherwise approved by PWC. If the section of pipe between manholes is 250 feet or less, no transitions will be allowed (either all PVC or all ductile iron). Should the length between manholes exceed 250 feet, only one transition will be allowed. Use of a C900 x SDR 26 adaptor shall be used to accomplish the transition. A transition is defined as the use of one C900 x SDR26 adaptor. No more than one (1) adaptor shall be utilized in any given manhole to manhole segment.

All manholes shall be constructed to Public Works Commission's standards. Installation shall be in accordance with ASTM C-891 and PWC standards.

Manholes shall be constructed of precast reinforced concrete circular sections installed on a base riser section with integral floor and shall be cored to accommodate the various pipe connections, as indicated on the drawings. Pipe connections to a manhole shall be by gasketed flexible watertight connections (boot for small diameter and A Loc for larger diameter pipe) or as approved by the Public Works Commission. The manhole size shall be in accordance with the following table, unless otherwise specified:

Pipe Size	Manhole Diameter **
24" and less	48" *
27" - 36"	60"
42"	72"

* Where interior drop structures are required, use 60" diameter as required in the Public Works Commission standard details.
** Where multiple connections or acute angles are required, larger diameter manhole may be required as indicated on the plans.

The invert channel shall be constructed of brick and mortar, in accordance with Public Works Commission standard details. **Precast inverts are not allowed**. The invert channel shall be smooth and semicircular in shape conforming to the inside of the connecting sewer section. Changes in direction of flow shall be made with a smooth curve as large as a radius as the size of the manhole will permit without a decrease in flow velocity. Changes in size and grade of the channel shall be made gradually and evenly. The invert channel walls shall be constructed to three quarters (3/4) of the height of the crown of the outlet sewer and in such a manner not to obstruct maintenance, inspection or flow in the sewers. The inverts shall have a minimum slope of one (1) percent across the bottom of the manhole. A shelf shall be provided on each side of any manhole invert channel. Inverts in manholes with standing water will not be acceptable. The shelf shall be sloped not less than 1:12 (min) and no more than 2:12 (max). The bottom of the boot for the new sewer main or lateral shall be set one inch above existing shelf unless otherwise indicated.

When used in a paved street, the ring and cover shall be set in suitable mortar surrounded by a concrete collar in accordance with Public Works Commission standard details. When used in places other than in a paved street, the ring and cover shall be set to the grade shown on the plans or directed by the Public Works Commission. In unpaved areas cam-lock ring and cover shall be used. Camlock ring and cover shall be installed in accordance with Public Works Commission standard details.

The interior manhole riser joints, lift holes and grade adjustment rings shall be sealed with non-shrinking mortar to provide a watertight manhole. Lift holes sealed by the manufacturer with plastic caps do not require mortar seal. The hardened mortar shall be smooth to rub with no sharp edges. Use of grade rings with cam-lock ring and cover are not allowed, unless approved by the PWC Project Coordinator. **Use of grade rings is not allowed for above grade adjustments**.

All exterior manhole riser joints, including the joint at the cone, shall be sealed with an external rubber sleeve. The sleeve shall be made of stretchable, self-shrinking rubber, with a minimum thickness of 30

mils. The back side of each wrap shall be coated with a cross-linked reinforced butyl adhesive. The butyl adhesive shall be a non-hardening sealant, with a minimum thickness of 30 mils. The seal shall be designed to stretch around the manhole joint and then overlap to create a fused bond between the rubber and butyl adhesive. The application shall form a continuous rubber seal for the life of the application. The sealing system shall be as manufactured by Concrete Sealants, Inc. (Con-Seal), Sealing Systems, Inc., or approved equal. The wrap shall be a minimum of six (6) inches in width, and shall be centered on the joint. All manhole joints (including the cone section to the last riser) shall be wrapped and sealed. Care shall be taken to prevent damage to the wrap during backfill operations. The manhole surface shall be prepared in accordance with manufacturer's specifications, prior to installing the joint wrap.

Materials shall not enter the sewer line during construction of the manhole. The manhole shall be kept clean of any and all debris or materials. Any debris or material that entered the manhole shall be immediately removed. This condition shall be maintained until final acceptance of the work.

CONNECTION TO EXISTING MANHOLES OR LIFT STATIONS

All connections to existing manholes and/or lift stations shall be approved by the Public Works Commission. Where new mains are to be connected to existing active sanitary sewers, the active sewers shall remain in service. Unless otherwise indicated, where new lines are connected into existing manholes, all or such portion of the manhole invert as is necessary shall be removed and a new invert shall be constructed to accommodate both new and existing flows. All work shall conform to the requirements specified for new manholes. The existing structure connection shall be cored and a flexible watertight connection (i.e., boot) installed. The boot shall be installed in accordance with Public Works Commission standard details and requirements. The Contractor shall coordinate and cooperate with the Public Works Commission's Project Coordinator.

PIPE TO MANHOLE CONNECTOR (BOOT)

A watertight, flexible pipe-to-manhole connector shall be utilized on all pipe to manhole connections, for both new and existing manholes and pipes, unless otherwise specifically authorized in writing by the Public Works Commission.

The connector assembly shall be the sole element to provide a watertight seal of the pipe to the manhole or other structure. The connector shall consist of a rubber gasket, an internal compression sleeve, and one or more external take-up clamps. The connector shall consist of natural or synthetic rubber and Series 300 non-magnetic stainless steel. No plastic components shall be allowed.

The rubber gasket shall be constructed of synthetic or natural rubber, and shall meet or exceed the requirements of ASTM C-923. The connector shall have a minimum tensile strength of 1,600 psi. The minimum cross-sectional thickness shall be 0.275 inches.

The internal expansion sleeve shall be comprised of Series 300 non-magnetic stainless steel. No welds shall be utilized in its construction.

Installation of the connector shall be performed utilizing a calibrated installation tool furnished by the connector manufacturer. Installation shall require no re-tightening after the initial installation. Installation shall be done in accordance with the manufacturer's instructions.

The external compression take-up clamps shall be Series 300 non-magnetic stainless steel. No welds shall be utilized in its construction. The clamps shall be installed utilizing a torque-setting wrench furnished by the connector manufacturer. Installation shall be done in accordance with the manufacturer's instructions.

The Contractor shall utilize the proper size connector in accordance with the connector manufacturer's recommendations. All dead-end pipe stubs shall be restrained in accordance with ASTM C-923.

The finished connection shall provide a sealing to a minimum of 13 psi, and shall accommodate a minimum pipe deflection of seven (7) degrees without the loss of seal.

The pipe to manhole connector shall be PSX: Direct Drive as manufactured by Press-Seal, or approved equal.

INSIDE DROP MANHOLE STRUCTURE

Inside manhole drop structures shall be constructed and installed in accordance with Public Works Commission standard details.

CLEANING

Prior to final inspection, all sanitary sewer laterals, mains, and manholes newly installed on the collection system shall be flushed and cleaned. During the flushing operation, the downstream manhole shall be closed with a watertight plug to protect the existing sewer main. All water and debris shall be removed and properly disposed of by the Contractor. This condition shall be maintained until the Public Works Commission issues final acceptance for the project.

TESTING

Completed sewers shall be tested in accordance with the provisions outlined below. The Contractor shall furnish all equipment, labor, materials, and pay all costs associated with the tests performed. The Contractor shall schedule all testing with the Public Works Commission's Project Coordinator, a minimum of 48 hours in advance. The Contractor shall cooperate with the Public Works Commission's Project Coordinator and furnish any needed assistance necessary to complete the required testing.

For annexation and/or retrofit projects: No testing shall be conducted prior to successful completion of the compaction testing.

For all other projects: No testing shall be completed until all utilities are installed, prior to preparation of the road subgrade. The Contractor may elect to perform testing to satisfy them that the sewer utility is

installed properly prior to commencing installation of other utilities. However, such testing shall not be construed as acceptance by PWC.

The deflection/mandrel test shall not be performed until a minimum of thirty (30) calendar days after backfill operations are completed and the area graded to final contours. In lieu of waiting thirty (30) calendar days, the Contractor has the option to have an independent testing laboratory verify that compaction has been completed to achieve the maximum density as shown in the detail. The location and elevation of the compaction testing shall be determined reviewed and approved by the Public Works Commission's Project Coordinator. The Contractor shall provide the Public Works Commission with a copy of the density testing results.

Compaction testing shall be done in accordance with Specification Section 02222 – Excavation and Backfilling for Utility Systems.

Vacuum Testing Manholes:

All precast sanitary sewer manholes installed by the Contractor shall be vacuum tested for leakage. This test shall be done in accordance with ASTM C-1244 and in the presence of a Public Works Commission Project Coordinator. The Contractor shall be responsible for providing all the necessary labor, materials, equipment, testing apparatus, and all other incidentals necessary to complete the vacuum test. All testing equipment utilized shall be approved for use in vacuum testing manholes.

Each manhole shall be tested after assembly. All lift holes shall be plugged with an approved non-shrink grout. All lines, including laterals, entering the manhole shall be temporarily plugged. The Contractor should take care to ensure that the pipes and plugs are secure in place to prevent them being drawn into the manhole. The test head shall be placed directly on top of the concrete surface of the manhole following the manufacturer's recommendations, rather than to the cast iron seating ring.

Manholes may be tested either prior to backfill or post backfill at the contractor's option. For pre-backfill testing, a vacuum of 10 inches of Mercury (inches Hg) shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 inches of Mercury (inches Hg). The manhole is acceptable if the time for the vacuum reading to drop from 10 inches of Mercury to 9 inches of Mercury meets or exceeds the values indicated below:

	Diameter of Manhole		
Manhole Depth	**4' Diameter**	**5' Diameter**	**6' Diameter**
10' or less	**25 sec**	**33 sec**	**41 sec**
11' to 15'	**38 sec**	**49 sec**	**62 sec**
16' to 20'	**50 sec**	**65 sec**	**81 sec**
21' to 25'	**62 sec**	**82 sec**	**101 sec**

25' to 30'	**74 sec**	**98 sec**	**121 sec**

Vacuum testing backfilled manholes is not recommended in the presence of groundwater. Vacuum testing a backfilled manhole that is subjected to hydrostatic pressure may exceed the design limits of the flexible connecters and could lead to failure of the structure, joints, and/or connectors. Where groundwater is present a reduction in the vacuum pressure applied to the manhole will be required. The vacuum shall be reduced by 1 inch of Mercury for every 1 foot of hydrostatic head between 12 feet and 21 feet. A vacuum test should not be performed when the hydrostatic head exceeds 22 feet. See the chart below:

Hydrostatic Head (ft)*	12	13	14	15	16	17	18	19	20	21	22
Vacuum Pressure (in Hg)	10	9	8	7	6	5	4	3	2	1	**

*Hydrostatic head above the critical connector (critical connector is bottom most flexible connector)
**Do not perform vacuum test

If the manhole fails the initial test, the manhole shall be repaired by an approved method until a satisfactory test is obtained. All repair methods shall be approved by the Public Works Commission prior to being utilized. Retesting shall be performed until a satisfactory test is accomplished.

Mandrel Testing:

Deflection tests shall be performed on all PVC pipe installations. PVC pipe's maximum deflection after backfilling shall not exceed five (5) percent. The rigid ball or mandrel used for the deflection test shall have a diameter not less than 95 percent of the base inside diameter or average inside diameter of the pipe depending on the type of pipe manufactured and the applicable ASTM Standard. The PVC pipe shall be measured in compliance with ASTM D2122 "Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings". The Contractor shall supply all labor, equipment and materials necessary to perform the test in the presence of the Public Works Commission's Project Coordinator. The test shall be performed without mechanical pulling devices. The mandrel shall be constructed so as to preclude any yield in diameter, and with a pull line on each end to facilitate withdrawal. If the deflection exceeds the allowable, the Contractor shall remove and replace the pipe.

Air Testing:

Air testing shall be performed on all mains and laterals to determine acceptability. The length of sewer subject to an air test shall be the distance between two adjacent manholes. The tests shall be conducted in accordance with the appropriate ASTM standard. The air test shall be coordinated with the Public Works Commission. The Contractor is required to supply all equipment, labor, materials and pay all costs associated with the test performed.

Air Test for PVC Pipe

The low pressure air test on PVC pipe shall be performed with satisfactory results in accordance with ASTM F1417 "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using

Low-Pressure Air". The pipe, including lateral assemblies, shall be plugged and air added slowly until the internal pressure of the line is raised to 4.0 psi. After the pressure of 4.0 psi is obtained, regulate the air-supply so that the pressure is maintained between 3.5 and 4.0 psi for at least two (2) minutes, depending on air/ground temperature conditions. The pressure will drop slightly until equilibrium is obtained; however, a minimum of 3.5 psi is required. Once the 3.5 psi is maintained, the test will begin. If the pressure drops 1.0 psi within the time indicated below, the test fails.

Pipe Dia (in)	Minimum time (minutes)	Length for Min Time (ft)	Time for Longer Length (sec)
4	3:46	597	0.380L
6	5:40	398	0.854L
8	7:34	298	1.520L
10	9:26	239	2.374L
12	11:20	199	3.418L
15	14:10	159	5.342L
18	17:00	133	7.692L
21	19:50	114	10.470L
24	22:40	99	13.674L
27	25:30	88	17.306L
30	28:20	80	21.366L
33	31:10	72	25.852L
36	34:00	66	30.768L

The Contractor shall observe all safety precautions to include allowing no one in the manholes during testing, securing all plugs and providing additional plug bracing. The Contractor shall be required to furnish, install and remove after testing at no additional cost, a temporary glue cap/plug to be airtight for all cleanout stacks to accomplish air testing. The air pressure shall never exceed 8 psi. All gauges shall be accessible outside of the manholes.

HYDROSTATIC TESTS

After the ductile iron sewer pipe has been laid within the "protected" area and backfilled to finished grade, the pipe shall be subjected to a hydrostatic pressure test. All laterals within the "protected" area shall be ductile iron. All sewers subject to hydrostatic testing shall include (1) sewers entering or crossing streams, (2) sewers located less than 100 feet from any public or private water supply source including any WS-I waters or Class I or Class II impounded reservoirs, (3) where the minimum 18 inch vertical and 10 feet horizontal separation cannot be maintained between sewers and water mains (see NC DENR Regulations), or (4) as specified and/or indicated on the drawings. The Contractor will furnish all labor and material, including test pumps, plugs, and all other incidentals for making hydrostatic tests. Hydrostatic pressure testing shall be conducted on the completed main, including the laterals.

The duration of the pressure test shall be at least one hour or longer, as directed by the Public Works Commission. The hydrostatic pressure shall be 150 psi. Each section of pipe shall be slowly filled with water and the specified test pressure based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the

pipe in a manner satisfactory to the Public Works Commission. Before applying the specified test pressure, all air shall be expelled from the pipe.

All joints showing visible leaks shall be made tight. Cracked or defective pipe, joints, laterals, and fittings discovered in consequence of the pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic test may be waived by the Public Works Commission in certain situations. The test shall be repeated until satisfactory to the Public Works Commission.

The results of the pressure tests shall be satisfactory as specified. All replacement, repair, or retesting shall be accomplished by the Contractor. All repairs shall be reviewed and approved by the Public Works Commission prior to backfill. The use of couplings, sleeves, etc. shall be reviewed and approved by the Public Works Commission prior to use.

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DIVISION 2
SITE WORK

02732 SEWAGE FORCE MAINS

GENERAL

Sewage force mains and all appurtenant items shall be constructed of materials as specified or indicated on the drawings. The intent and purpose of these specifications is to require a complete and satisfactory installation in every respect and any defect in material or workmanship shall be cause for replacement and correction of such defect as directed by the Public Works Commission and at no expense to the Public Works Commission. All materials and workmanship shall be in complete accordance with the standards and specifications of the Public Works Commission and subject to Public Works Commission inspection and approval.

RELATED SECTIONS

A. Section 02222 – Excavation and Backfilling for Utility Systems
B. Section 02660 – Water Distribution
C. Section 02730 – Sanitary Sewer System
D. Section 02736 – High Density Polyethylene Pipe
E. Section 02753 – Submersible Lift Stations
F. Section 02754 – Self-Priming Lift Stations
G. Section 09801 – Special Coatings – Anti-Microbial Admixture
H. Section 09802 - Special Coatings – Ceramic Epoxy

MATERIALS

PVC PIPE

In order to prevent the sanitary sewer force main from being mistaken for a water main, **all force main PVC pipe shall be green in color.**

Two (2) inch PVC pipe shall be manufactured using Grade 1 PVC compound material as defined in ASTM D-1784 and shall be SDR21, pressure class 200 in accordance with ASTM D 2241 or SDR-17 with a pressure rating of 250 psi, in accordance with ASTM D-2241. Fittings for two (2) inch PVC shall be solvent welded Schedule 80 PVC. The pipe shall be plainly marked with the manufacturer's name, size, material (PVC) type and grade or compound, NSF seal, pressure rating and reference to appropriate product standards.

All PVC pipe four (4) inches through 12 inches and couplings shall be manufactured using virgin compounds as defined in ASTM D-1784, with a 4000 psi HDB rating and designated as PVC 1120 to be in strict accordance with AWWA C-900. The pipe shall be Class 150 and conform to the thickness requirements of DR18. The pipe and fittings shall be manufactured to withstand 755 psi quick burst

pressure tested in accordance with ASTM D-1599 and withstand 500 psi for a minimum of 1,000 hours tested in accordance with ASTM D-1598. Couplings shall be compression, twin gasket type in accordance with ASTM D-3139 for push-on joints and ASTM F-477 for elastomeric seals (gaskets). PVC fittings are not acceptable for mains other than two (2) inch. The pipe joints shall be of the integral bell type with rubber gaskets shall conform to the requirements of ASTM D-3139 or ASTM F-477. Fittings and specials for mains four (4) inches and larger shall be ductile iron, bell end in accordance with AWWA C-110, 200-psi pressure rating unless otherwise shown or specified, except that profile of bell may have specials of the same material as the pipe with elastomeric-gaskets, all in conformance with the requirements of AWWA C-900. Ductile iron fittings to PVC pipe shall be adequately supported on a firm trench foundation. Fittings shall be for bell and spigot pipe or plain end pipe, or as applicable.

Mechanical restraining systems shall not be used on PVC pipe.

DUCTILE IRON PIPE

The raw material from all ductile iron pipe and fittings shall have an average minimum content consisting of 90% recycled iron and steel. Ductile iron pipe and fittings shall be manufactured in the United States of America in accordance with ANSI/AWWA A21.51/C151. The manufacturer of the ductile iron pipe shall be a member of the Ductile Iron Pipe Research Association (DIPRA).

All ductile iron pipe and fittings (six (6) inches and above) shall be in strict accordance with ANSI/AWWA C-150/A21.50 and ANSI/AWWA C-151/A21.51, Class 50 in every respect. Four (4) inch ductile iron pipe shall be Class 51. Joints shall be mechanical joint or push on joint as specified and installed in accordance with AWWA C-600 and shall conform to AWWA Standard C-111. Mechanical joints shall be of the stuffing box type and shall conform to ANSI A21.11 for four (4) inch pipe through 12-inch pipe. Push on joints, rubber gaskets and lubricant shall conform to ANSI A21.11. Fittings and specials shall be ductile iron and shall be manufactured in accordance with AWWA Standard C-110 (ANSI A21.11).

Compact fittings shall be mechanically restrained, ductile iron in accordance with ANSI A 21.53 (AWWA C-153) for four (4) inch through 12-inch sizes only. Where thrust blocking is utilized, fittings shall be full body ductile iron in accordance with ANSI A 21.53 (AWWA C110). Pressure rating shall be not less than 200 psi unless otherwise specified. All ductile iron interior surfaces shall be lined with two (2) coats of ceramic epoxy to produce a total minimum dry film thickness of 40 mils (Protecto401 or approved equal). The exterior pipe surfaces shall be protected with asphaltic coating as specified in AWWA C151 and C110. Specifications for the ceramic epoxy can be found in Specification Section 09802.

All pipe joints within an encasement shall be furnished with manufactured restrained joints, and as specified in the standard Public Works Commission detail for encasements.

For aerial crossings which are four (4) inches through 12 inches in diameter, manufactured restrained joint ductile iron pipe Class 53, or Class 53 flanged ductile iron pipe shall be utilized in accordance with the standard Public Works Commission detail for aerial crossings. Mega-lugs, field-lok, and gripper rings are not an allowable means of restraint for aerial crossings. For aerial crossings larger than 12 inches, or

as noted specifically on the plans, flange joint ductile iron pipe, Class 53, shall be utilized in accordance with the standard Public Works Commission details. The location of flanges shall be specifically designed for each application. The flange pipe shall be in accordance with ANSI/AWWA C-115/A21.15. Threads for threaded flange pipe shall be in accordance with ANSI B2.1, shop fabricated as outlined by AWWA 115 with serrated faces furnished on the pipe, completely factory installed. Welding of flanges to the body of the pipe will not be acceptable. Ductile iron fittings and flanges shall be in accordance with ANSI/AWWA C-110/A21.10 with a minimum working pressure of 250 psi. Gaskets shall be full faced SBR rubber per ANSI/AWWA C-111/A21.11 with a minimum 1/8" thickness. Linings and coatings shall be as outlined for ductile iron pipe.

If the Public Works Commission determines that an expansion coupling is required, it shall be installed as indicated on the drawings. The expansion coupling shall not be buried.

For subsurface water crossings (i.e., streams, wetlands), restrained joint ductile iron pipe shall be utilized. No mechanical restraint systems (e.g., mega-lugs, field-lok gaskets, etc.) shall be utilized. The pipe shall be installed in a casing, in accordance with the approved Public Works Commission detail, unless otherwise specifically approved by the Public Works Commission.

Transition between ductile iron pipe and HDPE shall be accomplished utilizing mechanical restraints as approved by PWC.

HDPE PIPE

All high density polyethylene (HDPE) pipe and fittings shall be in accordance with PWC Standard Specification Section 02736, most recent edition.

COMBINATION AIR RELIEF AND VACUUM VALVE ASSEMBLIES

All sewer force mains shall have automatic air release valves installed as indicated on the plans, and in accordance with Public Works Commission requirements. The automatic air release valve shall be a combination air release valve. Combination air release valves shall be heavy duty "universal" style, single body units, incorporating the functions of an air and vacuum valve within a single housing.

The tap size shall be a minimum of two (2) inches, however if a larger tap is needed it shall be sized accordingly. The valve body, cover flange, and all internal parts shall be 316 stainless steel. The air release orifice shall be as specified by the Design Engineer. The air release valve shall have a maximum working pressure of 200 psi.

All air and vacuum combination release valves shall be Crispin Model UX20, ARI D-020, H-Tec Model 986, or approved equal. All air release valves shall be installed in accordance with the manufacturer's recommendations.

Air relief and vacuum valve manholes shall be 60 inch diameter precast concrete units conforming to ASTM C-478. The combination air relief vacuum valve manhole shall be cast with an anti-microbial

admixture, in accordance with manufacturer's instructions. The manholes and valves shall be installed in accordance with the standard PWC detail. The force main shall consist of one full joint of PVC C-900 (DR18) pipe centered at the air relief valve and a minimum of four (4) feet deep.

Combination air relief and vacuum valves shall be installed using stainless steel double strap service saddles, a two (2) inch ball valve, and a two (2) inch x one (1) inch brass tee with a quick connect attachment as shown in the PWC standard detail.

Service saddles for two (2) inch taps on four (4) inch and larger size iron pipe shall be ductile iron with stainless steel double straps, bolts, nuts and washers

Ball valves shall be all bronze construction, with a handle operator. Ball valves shall be manufactured and tested in accordance with AWWA/ANSI C800. The valve shall be equipped with packing nut, gland, and packing material. Ball valves shall be of an approved type made from approved materials conforming to ASTM specifications and shall also meet the approval of PWC. The turn required to travel from fully closed to fully open on a ball valve shall be 90 degrees.

AIR RELEASE VALVE MANHOLE RING AND COVER

Cast iron manhole frames and covers shall conform to the drawings in all essentials of design with vent holes. The frames and covers shall have a combined weight of not less than 310 pounds and shall conform to ASTM A-48, Class 30 frame and Class 35 cover. Lettering on the cover shall conform to the City of Fayetteville Public Works Commission standards and shall be stamped or cast into all covers so as to be plainly visible. Unless otherwise shown on the drawings, the frames and covers shall be so set that the top of the cover will be flush with finished grade or as directed by PWC.

BY-PASS PUMPING ASSEMBLIES

By-pass pumping assemblies shall be installed in accordance with PWC standard detail S.21. The bypass pumping assembly shall be constructed of ductile iron pipe which meets the requirements of this specification.

INSTALLATION

Pipe installation shall be in strict accordance with Specification Section 02222 – Excavation and Backfilling for Utilities Systems, and as outlined herein.

PIPE LAYING

Pipe installation shall be in accordance with the manufacturer's instructions. Proper equipment shall be utilized to perform the work in a manner satisfactory to PWC. All pipes and fittings shall be carefully lowered into the trench in such a manner to prevent damage to the protective coatings and linings. Under no circumstances shall pipe materials be dropped or dumped into the trench. Pipe shall be carried into position and not dragged.

All dust, dirt, oil, tar (other than standard coating), or other foreign matter shall be cleaned from the jointing surfaces, and the gasket, bell, and spigot shall be lubricated with lubricant recommended by the manufacturer.

Mechanical equipment should not be used to assemble the pipe. Pipe shall be assembled in accordance with the pipe manufacturer's instructions. Any damage resulting from the use of mechanical equipment shall be replaced as directed by PWC.

Adjustments in grade by exerting force on the barrel of the pipe with excavating equipment shall not be allowed. The Contractor shall verify line and grade after assembling each joint.

At any time when pipe laying is not in progress, the open ends of the pipe shall be closed by a water tight plug or other means approved by the PWC Project Coordinator. If water is in the trench, the plug shall remain in place until the trench is pumped completely dry. No pipe shall be laid in water or where in the PWC Project Engineer's and/or PWC Project Coordinator's opinion trench conditions are unsuitable. Every precaution shall be taken to prevent material from entering the pipe while it is being installed.

ALIGNMENT AND GRADE

All pipe shall be installed to the required lines and grades. Structures shall be installed at the required locations. The lines and grades of the pipe will generally be indicated by stakes parallel to the line of the pipe. The Contractor shall be responsible for installing the pipe to proper line and grade.

Threaded PVC and cemented joints will not be permitted. The ends of push on joints shall be beveled to facilitate assembly. Pipe shall be marked to indicate when the pipe is fully seated and the gasket lubricated to prevent displacement. Care shall be exercised to insure that the gasket remains in proper position in the bell or coupling while marking the joint.

All pipe installations shall be properly restrained, utilizing either thrust blocks or approved restraint systems. The thrust blocking shall be in accordance with PWC standards, and as designed by the Engineer. The approved restraint system shall be installed in accordance with the manufacturer's instructions.

For the purpose of identification of buried pipes during future trenching or location, a continuous "detectable" identification wire shall be installed as well as green, "Sanitary Sewer Force Main" marking tape. The wire shall be a minimum 12 gauge single strand, coated copper wire or copper clad steel wire that is suitable for underground use. The wire shall be buried continuously along the pipe. The wire shall be "stubbed" into marker posts and air release valve manholes and secured such that a "direct"/conductive metal detector may be used to trace the pipe location.

The marker posts shall be Rhino TriView TracerPeds which are green with a "Sewer Force Main" warning decal (GD-5314K) and have internal terminals. The marker posts shall utilize the TriGrip Anchor system for direct bury installations. The identification wire shall be attached to the marker posts

in accordance with PWC standards. Tracing wire marker posts shall be located no more than 500 feet apart.

When the force main is located in unpaved areas such as easements the marker posts shall be installed along the centerline of the force main. When the force main is located in paved areas the marker posts may be offset from the centerline of the force main in a uniform manner. The wire shall be installed with all non-metallic pipelines.

The "Sanitary Sewer Force Main" marking tape shall be green and labeled to warn of the presence of the sewer main. The tape shall be manufactured for durability and resistance to the elements. The marking tape shall be installed with both PVC and ductile iron force mains.

CONNECTION TO EXISTING MANHOLES

Where new mains are to be connected to existing active sanitary sewers, the active sewers shall remain in service by the Contractor. Unless otherwise indicated, where new lines are connected into existing manholes, all or such portion of the manhole invert as is necessary in the opinion of the PWC Project Coordinator shall be removed and a new invert shall be constructed to accommodate both new and existing effluent pipes and flows. Where force mains enter manholes, pipe and fittings shall be restrained as indicated on the plans with the force main outlet directed toward invert out.

All work shall conform to the applicable requirements specified for new manholes including all necessary concrete works, brick work, cutting, shaping and pipe fitting. Existing manhole walls, inverts, and shelves shall be coated with cement mixed with an anti-microbial additive in accordance with Specification Section 09801. New manholes that contain a force main discharge shall be cast with an anti-microbial admixture, in accordance with Specification Section 09801. The Contractor shall coordinate and cooperate with the Public Works Commission Project Coordinator on all connections. Connections to any manhole shall be made using the core and boot method. If necessary, drop or slide structures shall be installed, in accordance with PWC standards.

HYDROSTATIC TESTS

After the pipe has been laid, the valves installed, the taps made and the system has been partially backfilled as specified, all newly laid pipe shall be subjected to a hydrostatic pressure test. Where any section of a force main is provided with concrete thrust blocking for fittings, the hydrostatic test shall not be made until at least five (5) days after installation of the blocking unless otherwise approved. The Contractor will furnish all labor and material, including test pumps, taps, and corporations, for making hydrostatic tests. Cost for said tests shall be included in the Proposal. A PWC Project Coordinator shall be present for all testing. The Contractor shall coordinate with the PWC Project Coordinator for disposing of the test water from the system.

The duration of the pressure test shall be at least one hour or longer, as directed by the PWC Project Coordinator. The hydrostatic pressure shall be 200 psi. The pipe shall be slowly filled with water and the specified test pressure based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in

a manner satisfactory to the PWC Project Coordinator. Before applying the specified test pressure, all air shall be expelled from the pipe. If blow offs are not available at the high places, taps shall be made to provide blow offs.

The results of the pressure test shall be satisfactory as specified. All replacement, repair or retesting shall be accomplished by the Contractor at no additional cost to PWC. All materials and methods used to make repairs shall be approved by PWC. The PWC Project Coordinator shall be present while all repair work is taking place.

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DIVISION 2
SITE WORK

02831 CHAIN LINK FENCING

GENERAL

Where shown on the plans there shall be installed a "chain link" fence with all necessary posts, braces, top rail, gates, fabric, extension arms, and three strand barbed wire.

The erected fence shall meet the following requirements:

> The enclosing fence shall have an overall fabric height of six feet (6') and an additional one foot (1') of three strand barbed wire, for a total height of seven (7'). The gates shall be seven feet (7') in overall height.

MATERIALS

Fabric: Fencing shall be chain link #9 gauge aluminized continuously woven wire 2" uniform square mesh without knots or ties, except for knuckling and barbing. Both the top and bottom edges of the fabric shall be barbed unless otherwise shown on the plans. The Contractor shall not piece together a number of short pieces of fence fabric.

Tensile Strength Test: Wire pickets of which this fabric is made to stand a tensile strength test of approximately 70,000 pounds per square inch based on the cross-sectional area of the galvanized wire.

Framework: All posts and other appurtenances used in construction shall be hot-dipped, galvanized with a minimum of 1.8 oz. per square foot surface.

Line Posts: Hot dip galvanized "H" column (2" x 2 1/4") weight 4.1 pounds per linear foot, minimum carbon content 0.355. No used or open seam material will be permitted in posts or rails. (Alternate 2 1/2" O.D. galvanized pipe weight 3.65 pounds per linear foot or C-section line posts of the same dimension as H-post, 0.120 in wall thickness and fabricated from steel conforming to ASTM A-570, Grade E.) Intermediate posts shall be evenly spaced no more than 10 feet apart on center.

Top Rail: Hot dip galvanized pipe 1 5/8" O.D., weight 2.27 pounds per linear foot protected with outside sleeve type couplings at least 7 inches long. No used or open seam material will be permitted.

Terminal Posts: End, corner and pull posts hot dip galvanized pipe 3" O.D. - 5.79 pounds per linear foot. Gate posts hot dip galvanized pipe of "H" construction as specified.
Tension Wire: A bottom tension wire 7 gauge, alzd. (0.4 oz./s.f.), 6 inches above grade. Wire shall be fastened to fabric with aluminum rings at 24" on center and to each intermediate post.

Extension Arms: Hot dip galvanized. Line post arms of pressed steel malleable base; end, and corner post arms of malleable iron; gate posts to have ornamental top. Each extension arm to carry three strands of barbed wire approximately 12 inches out from fence line. Barbed wires to be securely fastened in by means of self-locking grooves. The barbed wire shall support a minimum of 400 lbs. vertical dead load from tip of arm. The barbed wire shall be 4-point pattern composed of two strands of No. 12 1/2-gauge galvanized wire.

Gates: Frame to be galvanized pipe 2.0 inches O.D. weighing 2.27 pounds per foot. Each frame to be equipped with 3/8-inch diameter adjustable truss rods. Gateposts and corner posts shall be 3 inches O.D. weighing 5.11 pounds per foot. Gates are to be manufactured using 2" aluminum tubing in lieu of the specified Schedule 40 steel pipe. Gateposts and corner posts shall be 6 5/8" O.D. for swing gates (greater than 20 feet in length and 4" O.D. for slide gates, weighing minimum of 5.11 pounds per foot. Corner fittings to be heavy pressed steel or malleable castings. Fabric to be same as in fence. Gates to be completed with malleable ball and socket hinges, catch, stops and rest. Hinges to permit gate to swing back against fence, 180 degrees if required. Latches shall be arranged for padlocking so that the padlock will be accessible from both sides of the gate regardless of the latching arrangement.

Braces: Brace material to be hot dip galvanized and same as top rail, to be spaced midway between top rail and ground, and to extend from terminal post to first adjacent line post. Braces to be securely fastened to post by suitable connections, and then trussed from line post back to terminal post with 3/8-inch round rod equipped with a turnbuckle for adjusting.

Fittings: Hot dip galvanized. All fittings to be malleable, cast iron or pressed steel.

Fabric-Bands: Fabric to be fastened to line post with (9 gauge) fabric bands spaced approximately 18 inches apart, and to top rail with wires (9 gauge) spaces approximately 24 inches apart.

Locks: Locks will be provided by the Owner.

INSTALLATION

General: Installation shall be made in a workmanlike manner by skilled workers experienced in the erection of this type of fence and in accordance with the manufacturer's recommendations. The fence shall be erected on a previously prepared surface to the lines and grades indicated on the plans.

Post Setting: All posts shall be set plumb and in alignment into a 36-inch 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 strength shall be 3000 psi (ASTM C-94) and the foundations a minimum of 9 inches in diameter for line post and 12 inches for terminal post. Concrete shall be thoroughly compacted so as to be free of voids and finished in a dome. Straight runs shall not exceed 500 feet between brace posts. Concrete shall cure a minimum of 72 hours before any further work is done on the posts.

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. The bottom of the fabric shall be held as uniformly as is practicable to the finished grade.

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 Public Works Commission 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 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 Public Works Commission. 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 and/or damage

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 within 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 Public Works Commission to finish grade, or typical cross section. The sod bed shall be excavated 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 inclement or impending inclement 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 Public Works Commission providing a minimum four (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 Public Works Commission. 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 Public Works Commission. 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 Public Works Commission. 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 Public Works Commission. 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 32oF.

Tamp and roll completed sod installation 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 Public Works Commission 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 Public Works Commission, make whatever arrangements necessary to 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 Public Works Commission. Limit watering to early morning or late afternoon to enable to soil the 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 ensure 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 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 Public Works Commission. 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 Public Works Commission for an inspection and provisional acceptance of the sod. Failure to notify the Public Works Commission 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 Public Works Commission 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 Public Works Commission 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 (most recent edition). 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 Public Works Commission.

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 Public Works Commission.

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 of the installed forms and will call such to the attention of the Public Works Commission promptly. The Contractor is cautioned that he shall be responsible for any damage to utility lines caused by his negligence. The Public Works Commission or his representative shall then inspect the forms and if approved, pouring operations may begin. Where unstable material exists, the Contractor shall remove such material to a depth required to provide a stable subgrade at no additional cost to the Public Works Commission.

FORM WORK

Metal forms shall be used throughout the work except for short, odd length sections and in accordance with ACI 301 and ACI 347 (most recent editions). 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 ensure 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 Design Engineer 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 being inspected and approved by the Design Engineer. Placing of concrete is to be in accordance with ACI 304 (most recent edition). Water shall be removed from the excavation before placing concrete and water shall be diverted to prevent washing over freshly deposited concrete.

Concrete shall be placed 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 concrete pouring operations. Any concrete showing misalignment due to form movement shall be removed and replaced at no additional cost to the Public Works Commission.

All concrete shall be consolidated in accordance with ACI 309 (most recent edition). 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 Design Engineer shall determine if the honeycomb is of a minor nature, the voids may be filled with mortar as approved by the Design Engineer.

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 Design Engineer is provided.

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

Cold weather concreting shall be in accordance with ACI 306 (most recent edition) and hot weather concreting shall be in accordance with ACI 305 (most recent edition). Concreting shall be done when weather conditions are favorable unless otherwise directed by the Design

Engineer. 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 Design Engineer. 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 Design Engineer and/or the Public Works Commission at the Contractor's expense.

Forms shall not be removed from the concrete for a minimum of 7 days, unless approved by the Design Engineer. 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 14 days by the 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 Design Engineer and/or Public Works Commission.

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 (most recent edition) 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 Public Works Commission, 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 Design Engineer. Cylinders shall be made and stored in accordance with ASTM C-13. Cylinders shall be for each day concrete is poured in excess of 10 cubic yards of each different type of concrete, as determined by the Design Engineer. 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 Fayetteville Public Works Commission (PWC), at no expense to the Fayetteville 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 Fayetteville 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, ConBlock, or approved equal. The ConShield liquid anti-microbial admixture can be obtained from ConShield Technologies, Inc. or an approved precast facility. TheConBlock liquid anti-microbial admixture can be obtained from ConSeal Concrete Sealants, 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 Fayetteville 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 77degrees 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 Public Works Commission, 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 Public Works Commission 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 degrees 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.

DIVISION 2
SITE WORK

09804 SPECIAL COATINGS – EPOXY LINING DUCTILE IRON PIPE AND FITTINGS

GENERAL

The interior surfaces of all ductile iron pipe and fittings in sanitary sewer service shall be fully coated with a ceramic epoxy lining. The lining system shall be a two component, amine cured novalac epoxy. 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. Any defects in the lining shall result in the pipe or fitting being replaced, at no additional cost to the Public Works Commission.

RELATED SECTIONS

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

REFERENCES

A. ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus
B. ASTM C 413 – Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
C. ASTM C 868 – Standard Test Method for Chemical Resistance of Protective Linings
D. ASTM D 714 – Standard Test Method for Evaluating Degree of Blistering of Paints
E. ASTM D 870 – Standard Practice for Testing Water Resistance of Coatings Using Water Immersion
F. ASTM D 1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
G. ASTM D 1653 – Standard Test Methods for Water Vapor Transmission of Organic Coatings
H. ASTM D 2240 – Standard Test Method for Rubber Property – Durometer Hardness
I. ASTM D 2370 – Standard Test Method for Tensile Properties of Organic Coatings
J. ASTM D 2583 – Standard Test Method ofr Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
K. ASTM D 2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
L. ASTM D 4060 – Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
M. ASTM D 4400 – Standard Test Method for Sag Resistance of Paints Using a Multinotch Applicator
N. ASTM D 4541 – Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

O. ASTM G 8 – Standard Test Methods for Cathodic Disbonding of Pipeline Coatings
P. ASTM G 95 – Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings
Q. ASTM G154 – Standard Practice for Operating Fluorescent Ultraviolet Lamp Apparatus for Exposure of Nonmetallic Materials

Unless otherwise specified, references to documents shall mean the documents in effect at the time of bid. If the referenced document(s) have been discontinued by the issuing organization, references to those documents shall mean the replacement documents or the last version of the document before it was discontinued.

Where conflicts exist between the standards and this specification, the more stringent shall apply.

MATERIALS

All ductile iron pipe and fittings shall be in accordance with the Public Works Commission standard specification 02730 – Sanitary Sewer Systems, Public Works Commission standard specification 02732 – Sewage Force Mains, and these Contract Documents.

The lining material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment (no silica fume, fly ash, or alumina dust). The lining shall be both coal tar (polycyclic aromatic hydrocarbons) free and hazardous air polluting solvents (HAPS) free. The lining system shall be 100% solids by volume.

The ceramic epoxy lining system shall be the Perma-Shield PL Series 431 as manufactured by Tnemec Company, Inc., Permox-CTF as manufactured by Permite Corporation, or approved equal.

The ceramic epoxy lining system shall meet the following minimum performance requirements:

A. Abrasion (ASTM D 4060, CS-17 wheel, 1,000 grams) – 76 mg loss
B. Adhesion (ASTM D 4541) – not less than 1,860 psi
C. Severe Wastewater Analysis Test (150oF, 500 ppm H2S, 4,000 ppm NaCl, 10% sulfuric acid, EIS Permeation Analysis) – Initial impedance of 11.2 (log-z). No blistering, cracking, checking, or loss of adhesion. Reduction in electrical impedance of 0.5 after 28 days of exposure.
D. Cathodic Disbondment (ASTM G 8, 1.5 V, Classification Group A) – no more than 0.000 inch disbanded equivalent circle diameter.
E. Dielectric Strength (ASTM D 149) – greater than 600 V per mil
F. Hardness (ASTM D 2240) – Shore D hardness of 79
G. Impact (ASTM D2794) – No visible cracking or delamination after 160 inch-pounds direct impact.
H. Chemical resistance by immersion testing, in accordance with ASTM D 714, as outlined in the following table:

20% Sulfuric Acid at 77° F	2 years, no effect
25% Sodium Hydroxide at 140° F	2 years, no effect
5% Sodium Chloride at 77° F	2 years, no effect
Distilled Water at 160° F	2 years, no effect

I. Salt Spray (ASTM B 117) – No blistering, cracking, rusting, or delamination of film. No rust creepage at scribe after 1,000 hours.
J. Sag Resistance (ASTM D 4400) – Not less than 90 mills wet film thickness.
K. Water Absorption (ASTM C 413) – 0.0 percent water absorption
L. Water Vapor Transmission (ASTM D 1653, Method B, Wet Cup, Condition C) – 1.25 g/m2 per 24 hour water vapor transmission and 0.09 perms water vapor permeance.

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 Public Works Commission upon written request and certified by the Supplier.

QUALITY ASSURANCE

The manufacturer of the specified coating system shall have a minimum of 10 years' experience in manufacturing high performance epoxy coating systems. The epoxy coating material shall be from a single manufacturer.

Application of the ceramic epoxy lining system shall be in accordance with the manufacturer's requirements. Preparation of the ductile iron pipe to be lined shall be completed by an installer approved by the lining system manufacturer.

SUBMITTALS

In accordance with these Contract Documents, the Contractor shall submit the following:

1. Manufacturer's certification that the coatings comply with the specified requirements and are suitable for the intended application.
2. Product data sheet.
3. Material Safety Data Sheet.
4. Copies of test data for all the physical, chemical, and permeation properties listed within this specification.

WARRANTY

The ceramic epoxy lining manufacturer shall warranty its products as free from material defects for a period of five (5) years. The Public Works Commission will solely determine whether the pipe should be replaced if any defects are discovered in the lining within the warranty period.

All costs to replace the pipe or fitting, including but not limited to, bypass pumping, excavation, and traffic control shall be the manufacturer's responsibility.

APPLICATION OF LININGS

Application of the ceramic lining system shall be completed by an installer approved by the manufacturer of the lining system.

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 ceramic epoxy lining shall be applied by a competent firm with a ten (10) 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 Public Works Commission 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^{o}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 by the lining manufacturer prior to shipment, 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. All ceramic epoxy lined pipe and fittings shall be visually inspected for any defects, including runs, sags, or debris within the lining. All repairs shall be performed by the manufacturer prior to shipment.

Markings: Each joint, manhole unit, or fitting 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 damaged pipe or fitting shall be replaced at no cost to the Public Works Commission.

INSTALLATION

Cutting Pipe: The Contractor shall cut the pipe without damaging the pipe or interior ceramic epoxy coating. All cuts shall be at right angles to the pipe axis. All cut ends shall be dressed with a power grinder to remove all sharp edges. The cut ends of push-on joint pipe shall be beveled in accordance with the pipe manufacturer's instructions. All field cuts shall be coated and sealed prior to installation. Application of the lining shall be done in accordance with the ceramic epoxy lining manufacturer's recommendations.

Handling: All ceramic epoxy lined pipe and fittings shall be handled only from the outside. No forks, chains, straps, hooks, cables, or other equipment shall be placed inside the pipe and fittings for lifting, positioning, or installation. The pipe and fittings shall not be dropped or unloaded by rolling. The pipe and fittings shall not strike sharp objects while moving or unloaded. Ductile iron pipe shall not be placed on grade utilizing hydraulic pressure from machinery or hammers. The use of nylon straps or other similar lifting devices are to be used.

Pipe Installation: All pipe and fittings shall be installed in accordance with PWC standard specifications 02222 – Excavation, Trenching, and Backfilling for Utility Systems, 02730 – Sanitary Sewer Systems, 02732 – Sewage Force Mains, and these Contract Documents.

APPENDIX A-AQUA WATER SPECIFICATION

Specifications for Water Systems

June 2019 Update

202 MacKenan Court
Cary, North Carolina 27511
919-467-8712

4163 Sinclair Street
Denver, North Carolina 28037
704-489-9404

6902 Sandridge Dr.
Fayetteville, North Carolina 28314
910-867-1239

152-B Furlong Industrial Dr.
Kernersville, North Carolina, 27284
336-889-6318

105 Hampstead Village, Bldg 24-I
Hampstead, North Carolina 28443
910-791-4404

AQUA NORTH CAROLINA

Community Water System Specifications and Construction Standards
Table of Contents

INTRODUCTION

Jurisdiction

This MANUAL shall apply to all proposed water systems and assets to be owned, operated or maintained by AQUA NORTH CAROLINA.

Purpose

These standards and specifications are adopted to establish minimum acceptable standards for the design and construction of water distribution/transmission facilities that are to be dedicated to AQUA NORTH CAROLINA or facilities that interconnect to other utilities. Such facilities include water supply, distribution, and miscellaneous related appurtenances associated with such systems. These standards and specifications apply only to approval by AQUA NORTH CAROLINA and not by any state or local authorities.

It is the responsibility of the design ENGINEER to ensure that this specification and/or his amendments (as approved by AQUA NORTH CAROLINA) meet all applicable building codes and governing laws.

Approval by AQUA NORTH CAROLINA does not relieve the ENGINEER from obtaining approval from state or local authorities.

Scope

This document is grouped into five divisions:

Division 1: General Requirements, presents general requirements governing review and approval of plans and construction inspection and acceptance.

Division 2: Design Standards contains all the criteria required for the acceptable design of water mains.

Division 3: Construction Specifications, contains detailed technical specifications governing the construction of water facilities.

Division 4: Standard Details, consists of drawings showing typical installation/construction of water facilities.

Division 5: List of Materials and Approved Manufacturers consists of approved equipment for construction per region.

DIVISION 1
GENERAL REQUIREMENTS

Division 1

Section 1

Definitions

1.1 Definitions

Except where specific definitions are used within a specific section, the following terms, phrases, words and their derivations shall have the meaning given herein when consistent with the context. Words used in the present tense include the future tense, words in the plural number include the singular number and words in the singular number include the plural number. The word "shall" is mandatory, and the word "may" is permissive.

AASHTO - American Association of State Highway and Transportation Officials. Any reference to AASHTO standards shall be taken to mean the most recently published revision unless otherwise specified.

ANSI - American National Standards Institute. Any reference to ANSI standards shall be taken to mean the most recently published revision unless otherwise specified.

ASTM - American Society for Testing Materials. Any reference to ASTM standards shall be taken to mean the most recently published revision unless otherwise specified.

AWWA - American Water Works Association. Any reference to AWWA Standards shall be taken to mean the most recently published revision unless otherwise specified.

CONTRACTOR - the person, firm, or corporation with whom the contract for work has been made by the Owner, the Developer or AQUA NORTH CAROLINA.

COUNTY - the applicable county and/or its designated representative(s).

DEVELOPER - the person, firm or corporation engaged in developing or improving real estate for use or occupancy.

DEVELOPER'S ENGINEER - an engineer or engineering firm registered with the State of North Carolina Board of Examiners for Engineers & Surveyors, retained by the DEVELOPER to provide professional engineering services for a project.

DIPRA - Ductile Iron Pipe Research Association. Any reference to DIPRA standards shall be taken to mean the most recently published revision unless otherwise specified

DRAWINGS - engineering drawings prepared by an ENGINEER to show the proposed construction.

ENGINEER - an engineer or engineering firm registered with the North Carolina Board of Examiners for Engineers & Surveyors.

FM - Factory Mutual. Any reference to FM standards shall be taken to mean the most recently published revision unless otherwise specified

GEOTECHNICAL/SOILS ENGINEER - a Registered North Carolina Engineer who provides services related to terrain evaluation and site selection, subsurface exploration and sampling, determination of soil and rock properties, foundation engineering, settlement and seepage analysis, design of earth and earth retaining structures, the design of subsurface drainage systems and the improvement of soil properties and foundation conditions and testing and evaluation of construction materials.

MANUAL - these Specifications for Water Construction.

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES - the United States Department of Transportation Manual on Traffic Control Devices, latest edition.

NCBELS – The North Carolina Board of Examiners for Engineers and Surveyors

NCDEQ – the North Carolina Department of Environmental Quality

NCDOT - the North Carolina Department of Transportation

NEMA - National Electrical Manufacturers Association. Any reference to NEMA Standards shall be taken to mean the most recently published revision unless otherwise specified.

NSF - National Sanitation Test Laboratory Foundation. Any reference to NSF Standards shall be taken to mean the most recently published revision unless otherwise specified.

OSHA - the Federal Occupational Safety and Health Administration.

OWNER - the person, firm, corporation, or governmental unit holding right of possession of the real estate upon which construction is to take place.

PLANS - DRAWINGS as defined herein above.

PWS – NCDENR Public Water Supply Section

RULES GOVERNING PUBLIC WATER SYSTEMS: North Carolina Administrative Code, Title 15a, Department of Environment and Natural Resources, Subchapter 18C – Water Supplies – Sections .0100 through .2200, latest edition.

SPECIFICATIONS - the specifications contained in Division 3 of this MANUAL.

STANDARDS - the minimum design standards contained in Division 2 of this MANUAL.

STANDARD DETAILS - the detailed drawings in Division 4 of this MANUAL related to water materials and installation of same.

SURVEYOR - a surveyor or surveying firm registered with the North Carolina Board of Examiners for Engineers & Surveyors.

UL - Underwriters Laboratory.

UTILITY – AQUA NORTH CAROLINA, INC.

WATER MAINS - water transmission mains, distribution mains, pipe, fittings, valves, hydrants, services, meters and miscellaneous related appurtenances.

WORK - the labor, materials, equipment, supplies, services and other items necessary for the execution, completion and fulfillment of the contract.

Division 1

Section 2

Plan Review, Approval, Construction, and Acceptance of Water Improvements

2.1 Plans, Specifications, and Models

2.1.1 General: All submitted plans should be a standard size sheet (24" x 36") with title block. Graphic scale(s) shall be provided on each sheet and all lettering shall be 1/8" or larger to permit photographic reproduction. All PLAN sheets and the title page of submitted SPECIFICATIONS, Engineer's Report & calculations must be signed, sealed and dated by the DEVELOPER'S ENGINEER in accordance with the rules and regulations of the NCBELS. All submitted plans, specifications, calculations, reports and any other associated documents will be submitted in hard copy and electronic copy. Electronic copies will be in a standard format of PDF and ACAD (DWG.). Any deviations in format must be preapproved by the UTILITY.

2.1.2 Master Plan: The entire water system shall be shown on a single Master Plan. For systems where the UTILITY is the owner and operator of both the water and wastewater systems, the entire water and wastewater systems will be shown on a single Master Plan. The Master Plan shall indicate the general locations of all mains, manholes, valves, hydrants, services and service laterals with respect to the proposed development improvements and the existing water and wastewater systems. Main sizes shall be indicated on the Master Plan.

2.1.3 Plan and Profile: All water mains shall be drawn in plan and profile. Any occurrence of phased construction should be clearly represented on the plan sheets upon submission to UTILITY for review.

Whenever possible, on-site water and wastewater systems shall be shown on the same PLAN sheet. As a minimum, the plan and profile drawings shall include the following information:

1. General information such as north arrow, names of designer and engineer, revision block with dates, graphic scale(s) and sheet number.

2. Profile with elevations at 10-foot interval, or more frequently if required by good design practice.

3. Development layout with horizontal and vertical controls.

4. All conflicts with other utility and drainage systems, including clearances.

5. Pipe data including size, lengths, class, and material.

6. Size, type, and locations of fittings, valves, hydrants, air release/vacuum relief valves and other related appurtenances.

7. Limits of pipe deflection.

8. Limits of special exterior coatings.

9. Limits of special bedding requirements.

10. Pipe restraint requirements.

11. Details of connection to existing systems.

12. Construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.

2.1.4 Details: The PLANS shall include all applicable STANDARD DETAILS as shown in Division 4 of this MANUAL. Special details shall be prepared by the DEVELOPER'S ENGINEER for aerial and underwater crossings of rivers, streams, canals and ditches. Other special details shall be prepared by the DEVELOPER'S ENGINEER as required.

2.1.5 Scale: The master plan shall be prepared at a scale not to exceed 1" to 200'. Plan and profile sheets shall not exceed a scale of 1" to 50'. Special details shall be of sufficiently large scale to show pertinent construction information. On especially large systems, a larger scale can be used with the permission of UTILITY, or an overall plan of a greater scale can be used as long as smaller scale plans are also provided.

2.1.6 Hydraulic Modeling: A hydraulic model utilizing WaterCAD or WaterGEMS may be required for all new systems planning to provide irrigation, containing 2 wells or more or for any system connecting to a master system. On single well system, the Utility reserves the right to require modeling to verify pressure and flows. If the proposed system is to be connected to an existing system, the entire interconnected system shall be modeled. Contact UTILITY's engineer to determine if the model will be required. If a system provides fire flow, additional modeling may be requested.

2.1.6.1 If a hydraulic model already exists for the system being connected to, the DESIGNER, with the permission of the UTILITY, may provide a hydraulic model of the proposed system to be placed in the existing model. In this case, UTILITY shall provide pressure and flow data for the system being connected to.

2.1.7 General Notes: All drawings will have these notes somewhere in the set:

- Aqua North Carolina shall be notified 72 hours before construction is to begin.

- Aqua North Carolina shall be notified 72 hours before any construction is buried.

- Aqua North Carolina shall be notified 48 to 72 hours before any testing is conducted

2.1.8 Project Summary: A summary of the project will be included with the submittal. The submittal will include the following information, at a minimum. This summary can be combined with the Engineer's Report.

- Project name and location.
- Water system name and PWSID (if connecting to existing system).
- A brief description of the project.
- The number of proposed connections.
- All proposed wells/water sources with capacity and proposed storage (if applicable).

2.2 Subdivision Related Water Improvements

2.2.1 General: This section covers all water improvements that are dedicated to UTILITY.

2.2.2 Design and Plan Review: Design of water improvements associated with UTILITY approved projects shall be in compliance with the DESIGN STANDARDS in Division 2, and the SPECIFICATIONS outlined in Division 3 of this MANUAL. PLANS will be reviewed and approved by UTILITY as part of the project review and approval process. Any occurrence of phased construction should be clearly represented on the plan sheets upon submission to UTILITY for review.

2.2.3 Preconstruction Meeting: A preconstruction meeting will be required before work begins on any project. The meeting will consist of, at minimum, the DEVELOPER'S ENGINEER, the CONTRACTOR, and a representative of UTILITY. Other attendees can be required by UTILITY as needed, including any subcontractors and regulators. It shall be the CONTRACTOR's responsibility to contact any local and state regulators to see if their presence is required at the preconstruction meeting.

2.2.4 Construction Inspection: DEVELOPER's ENGINEER shall periodically inspect all construction subject to these STANDARDS and SPECIFICATIONS.

After all required improvements have been installed; the DEVELOPER'S ENGINEER shall submit certification to UTILITY that the improvements have been constructed substantially in accordance with approved PLANS and SPECIFICATIONS. A walkthrough of the improvements by the DEVEOPER'S ENGINEER and a representative of UTILITY to ensure compliance with the PLANS and SPECIFICATIONS will be required before closing. Non-compliance with approved PLANS or SPECIFICATIONS or evidence of faulty materials or workmanship shall be recorded by the DEVELOPER or DEVELOPER'S ENGINEER and if not corrected in an expeditious manner, all work on the project will be suspended and service withheld. **DEVELOPER'S ENGINEER is responsible for all inspections and certifications**.

2.3 Compliance with other Regulatory Requirements

2.3.1 It shall be the responsibility of the DEVELOPER to obtain and comply with all applicable Federal, State and Local regulatory requirements.

2.3.1.1 **SPECIFICALLY HIGHLIGHTED**:

15A NCAC 18C .1537 DRINKING WATER TREATMENT CHEMICALS AND SYSTEM COMPONENTS

(a) The standards established by the American National Standards Institute/NSF International, codified as ANSI/NSF Standard 60 and ANSI/NSF Standard 61, are incorporated by reference including subsequent amendments and editions. ANSI/NSF Standard 60 applies to drinking water treatment chemicals. ANSI/NSF Standard 61 applies to drinking water system components. Copies may be obtained for public inspection as set forth in Rule .0503 of this Subchapter.

(b) A water supply product used in a public water system shall meet the standards incorporated by reference in Paragraph (a) of this Rule. A product certified by an organization having a third-party certification program accredited by the American National Standards Institute to test and certify such products may be used in a public water system.

(c) A supplier of water shall maintain a list of all water supply products used in a public water system for inspection by the Department. Prior to using a product not previously listed, a supplier of water shall either determine the product is certified as required by Paragraph (b) of this Rule or notify the Department of the type, name, and manufacturer of a product.

(d) A supplier of water shall not introduce or permit the introduction of a water supply product into a public water system that does not meet the requirements of this Rule.

2.3.2 Acceptance of the PLANS by the UTILITY does not imply acceptance of the PLANS by any state or local authorities. It is the responsibility of the ENGINEER to submit the PLANS to all required agencies and to obtain any approvals necessary before construction is to begin.

2.4 Guidelines for the Acceptance of New Water Mains from Contractors

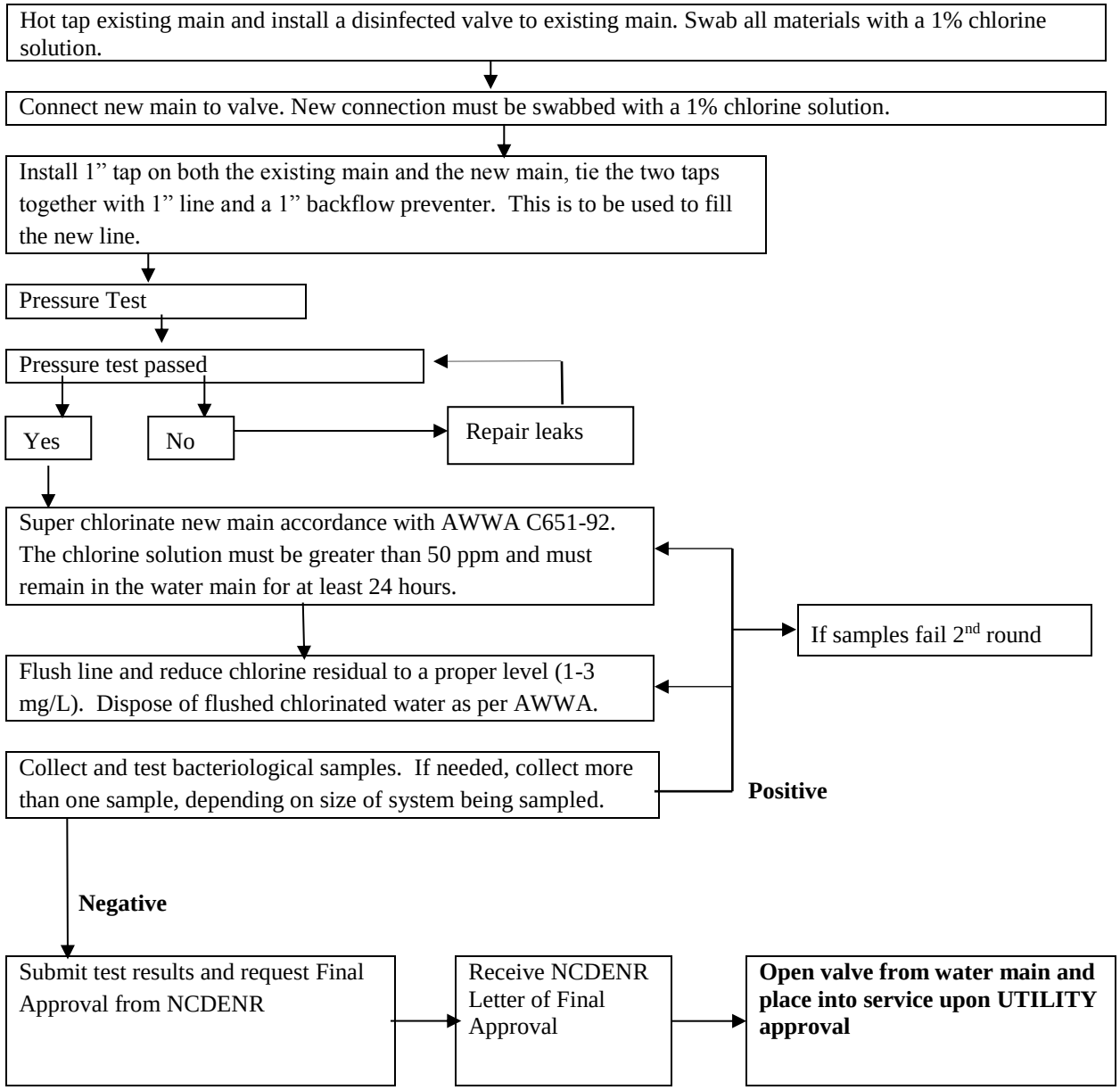
General: UTILITY as a purveyor of clean and high-quality water is responsible to prevent or minimize the exposure of its customers to any possible risk of chemical or microbiological contaminants that may result in illness to the community.

This document, which is in a flow chart format, is based on AWWA standard policies, practices, and procedures for accepting new water mains and is addressed to both internal operation personnel and outside contractors. The purpose of these guidelines is to provide a step by step procedure delineating the construction and final clearance of water main extensions.

It applies to all UTILITY facilities. All contract or operations employees are responsible and required to follow these procedures. Construction inspectors and supervisory employees will be responsible for ensuring compliance.

Incorporated Reference: ANSI/AWWA C651-92

GUIDELINES FOR THE ACCEPTANCE OF NEW WATER MAINS FROM CONTRACTORS



2.5 Engineering Design Requirements

2.5.1 NCDENR Application for Approval: NCDENR Application for Approval on Engineering Plans and Specifications shall name UTILITY as applicant.

2.5.2 Easements: PLANS shall clearly show and label all access and utility easements for any portion of the water system not within publicly dedicated rights of way, including any construction easements needed for the project.

2.5.3 NCDENR Submittal Documents: All applicable documents listed in the table below shall be provided by the project's ENGINEER for UTILITY's review prior to applying for NCDENR approval for Authorization to Construct.

Table 2.5.4

1	1 hard copy and 1 '.pdf' set of Design Drawings.
2	1 copy and 1 PDF of the NCDENR Checklist for New Well Construction, sealed by the ENGINEER (see attached, this section).
3	1 hard copy and 1 '.pdf' copy of Engineer's Report, completed in the format approved by NCDENR pursuant to the RULES GOVERNING PUBLIC WATER SYSTEMS, sealed by the ENGINEER.
4	1 copy and 1 'pdf' copy of the Project Summary.
5	1 copy and 1 '.pdf' set of all water system design calculations, sealed by the ENGINEER.
6	1 copy and 1 '.pdf' set of all well construction reports and testing reports for each well in the water system, if any.
7	1 copy and 1 '.pdf' set of all project specification sheets and MSDS sheets
8	1 copy and 1 PDF of the NCDENR Application for Approval of Engineering Plans and Specifications for Water Supply Systems.
9	1 copy and 1 '.pdf' set of the well lot survey for each well lot in the water system showing the well head location, the 100; radius from the center of the well head and the 20' access and utility easement to each well lot that does not front upon publicly dedicated rights of way, sealed by the SURVEYOR, if any.

2.6 Project Completion and Acceptance

UNDER NO CIRCUMSTANCES SHALL AQUA SUPPLY WATER UNLESS ALL OF THE FOLLOWING ITEMS ARE COMPLETED:
A – The Engineering Certificate is completed and submitted
B – All appropriate information is supplied so that an Applicant's Certificate can be executed, is executed and submitted
C – Aqua receives appropriate Final Approval from all applicable regulatory agencies
D – All appropriate documents are supplied for the Closing Documents and the documents executed

2.6.1 Project Documentation: All applicable documents shall be provided prior to project's acceptance by UTILITY and prior to placing the water system in service. The format for these document submissions will be 1 hard copy and 1 PDF and 1 DWG (for drawings)

2.6.2 Backflow Prevention Inspection Report and Testing: CONTRACTOR is responsible for providing all reports and testing results per most current PWS rules and regulations.

2.6.3 As-Built Inspection: ENGINEER is responsible for scheduling field inspection/site visits by UTILITY prior to UTILITY's acceptance of the project.

2.6.4 ENGINEER's Final Completion Package: Documents listed in the table below shall be provided by the ENGINEER.

Table 2.6.5

1	Water system pressure and leakage test results and bacteriological analysis results.
2	ENGINEER's Electronic Record Drawings for the project, which shall include the longitude and latitude of each valve, fire hydrant, meter, etc, in '.dwg' format, AutoCAD Release 14 minimum, 2000, or 2000i
3	1 copy and 1 '.pdf' set of ENGINEER's signed and sealed Record Drawings for project

4	ENGINEER's Letter of Certification of Completion (signed, sealed, and dated) for the project. The original to be sent by the ENGINEER to NCDEQ.

2.6.6 Record Drawings: The DEVELOPER's ENGINEER shall submit a certified set of Record Drawings sealed by the Engineer prepared in conjunction with a North Carolina Licensed Professional Land Surveyor to ensure proper locations and coordinates of built and installed devices/facilities to UTILITY prior to acceptance of the project. The DEVELOPER's ENGINEER shall be responsible for recording information on the approved PLANS concurrently with construction progress. Record Drawings submitted to UTILITY, as part of the project acceptance shall comply with the following requirements:

- Record Drawings shall be legibly marked to record actual construction.
- Record Drawings shall show actual location of all underground and aboveground water and wastewater piping and related appurtenances (Plan and profile). For systems where UTILITY is the owner and operator of both the water and wastewater systems, the entire water and wastewater systems Record Drawings shall show all underground and aboveground water and sewer piping and related appurtenances. All changes to piping location including horizontal and vertical locations of utilities and appurtenances shall be clearly shown and referenced to permanent surface improvements. DRAWINGS shall also show actual installed pipe material, class, etc.
- Record Drawings shall clearly show all field changes of dimension and detail, including changes made by field order or by change order.
- Record Drawings shall clearly show all details not on original contract drawings but constructed in the field. All equipment and piping relocation shall be clearly shown.
- Location of all hydrants, meters, meter boxes, valves, and valve boxes shall be shown. A benchmark shall be shown on the plan referencing the state plane coordinate system.
- Record Drawing format shall be georeferenced .DWG file and .PDF.

Each sheet of the PLANS shall be signed, sealed and dated by the DEVELOPER'S ENGINEER as being "Record Drawings." Construction PLANS simply stamped "As-Builts" or "Record Drawings" and lacking in the above requirements will not be accepted and will be returned to the DEVELOPER'S ENGINEER. The NCDENR "Applicant Certification" for Final Approval will not be released until correct "Record Drawings" have been submitted.

AQUA **CHECKLIST for NEW WELL CONSTRUCTION** Date:_____

Name of Public Water System: _____

Public Water System Identification number (PWSID) if known: _____

County: _____ Well name or number: _____

Engineer: _____

Well Driller's name: _____ Driller's Cert. number: _____

Casing: Length installed: _____ Type of Casing installed: _____
(should be 50 ft. minimum below grade)

Casing should be grouted full length. Length of Casing Grouted: _____

Grouting Method Used:
Pressure Method: _____ Pumping Method: _____ Other: _____

Well Site Deed(s) enclosed? (Y / N) Recorded Plat(s) enclosed? (Y / N)

Drive shoe used on bottom of well casing? (Y / N)

Signed well driller's log with driller's certification number (Y / N)

Monitoring: Bacteriological Analysis (Y / N) VOC Results (Y / N)

"New Well" Inorganic Results (Y / N) SOC Results (Y / N)

Radiological (if required) (Y / N) Asbestos (if required) (Y / N)

Nitrate/Nitrite (if not included in Inorganic Analysis) (Y / N)

Signed 24-hour well yield and drawdown report enclosed? (Y / N)

Engineer's well construction verification statement sealed and signed? (Y / N)

Total dynamic head design calculations? (Y / N)

Selected pump data and performance curves? (Y / N)

3 sets of "Application for Approval"? (Y / N)

Well site approval letter? (Y / N)

By signing and sealing the below, the Engineer certifies that he/she or someone under his/her direct control was present for the drilling of the subject well. If not he/she certifies and provides a video investigation record/log of the new well submitted with these documents.

Engineer's Seal & Signature:

DIVISION 2
DESIGN STANDARDS

Design Standards

Division 2

Section 1

Aqua North Carolina Daily Flows

1.1 Design Demand

1.1.1 DEVELOPER'S ENGINEER must confirm demands per RULES GOVERNING PUBLIC WATER SYSTEMS, latest edition. Demand calculations must be done according to these standards, Division 2, Section 5.3.2, or in accordance with the demand listed in the Developer's Agreement with UTILITY, whichever is more stringent.

Division 2

Section 2

Well Sites

2.1 Location

2.1.0 **Stormwater credits and/or allowances**: For each individual well, whether multiple wells are located on the same lot or not, the developer shall place into Aqua's name/for Aqua's future use/ at Aqua's disposal adequate stormwater credits/permissions to construct up to a minimum net 7,850 square feet of impervious surface.

2.1.1 For approval, NCDENR and/or UTILITY rules require that **minimum** horizontal separation between public water supply wells and known potential sources of pollution be maintained as follows:

A. 100 feet from:

- Any sanitary sewage disposal system or sewer pipe;
- Any subsurface disposal area, disposal tank, leach field or filter backwash;
- Buildings, storage facilities, permanent structures, animal lots, or cultivated areas where chemicals are applied;
- Surface water;
- Chemical or petroleum fuel underground storage tanks with secondary containment;
- Any roads other than the well access road;
- Any other potential sources of pollution such as power transformers.

Well sites down grade from individual septic tanks, near the 100' radius, are usually not accepted by NCDENR.

B. 200 feet from:

- A subsurface sanitary sewage treatment and disposal system designed for 3000 gpd or more.

C. 300 feet from:

- A cemetery or burial ground

D. 500 feet from:

- A septage disposal site;
- Chemical or petroleum fuel underground storage tanks without secondary containment; including underground pipelines for transmission of petroleum products (cross-country).

- A boundary of a groundwater contamination area;
- A sanitary landfill or non-permitted non-hazardous solid waste disposal site.

E. 1000 feet from:

- A hazardous waste disposal site.

2.1.1.1 The well shall not be located in an area generally subject to flooding.

2.1.1.2 Note that NCDENR may require greater separation distances or impose other protective measures when necessary to protect the well from pollution (see RULES GOVERNING PUBLIC WATER SYSTEMS, section .0203, Public Well Water Supplies for more detail).

2.1.2 Well sites with drainage ditches or low spots capable of holding water within the 100' radius will not be accepted by the UTILITY.

2.1.3 Well site shall be approved by NCDEQ and a UTILITY Representative prior to drilling. Final approval of well site shall be dependent upon satisfactory completion of any NCDEQ and UTILITY provisos.

2.1.4 A certified survey of the well lot shall be provided prior to submittal for NCDEQ plan approval. The survey shall include topographic information. The coordinates of the well and county pin number shall be provided for each well drilled.

2.1.5 The well lot must be owned or controlled by the UTILITY. Developer shall provide Utility with an appropriate recorded deed of easement and/or general warranty deed which shall include well protective non-contamination provisions acceptable to UTILITY to ensure the required 100' radius is pollution-free. Said deed must be in the UTILITY's name and shall be recorded at the county's register of deed office prior to submittal for NCDENR plan approval and UTILITY accepting the well. A 20' utility and access easement shall also be granted to UTILITY.

Division 2

Section 3

Design Criteria for Pumps & Motors

3.1 Submersible Motors

3.1.1 Motors shall be manufactured by Franklin or Centri-pro and of the highest psi thrust bearing available. Any other manufacturer must be approved by UTILITY.

3.1.2 Three-phase power is required for sites. DEVELOPER and ENGINEER shall investigate the possibility of making three-phase power available before specifying a single-phase motor.

3.1.2.1 On anything less than 10 hp, UTILITY may allow single-phase power.

3.1.3 Three phase motors 15 hp – 25 hp shall have a No. 8 pig tail or motor connector. The size pig tail or motor connector for larger motors shall be determined by the manufacturer.

3.1.4 All motors shall be new; remanufactured motors shall not be accepted.

3.1.5 The ENGINEER shall design the proper size drop wire in accordance with the latest Franklin or Century installation guide or the one provided with an equivalent motor used.

3.1.6 After motor is set in place, an insulation test shall be performed to ensure there are no shorts or grounds in the drop wire or motor. If grounds or shorts are found, the contractor will replace the drop wire and/or motor at no cost to the owner.

3.1.7 There shall be at least 20’ of drop cable left out of well.

3.1.8 The appropriate 3-phase motor protection shall be provided as specified by UTILITY for the area served.

3.1.9

3.2 Submersible Pumps

3.2.1 Pumps shall be manufactured by Goulds or Grundfos (see Division 5, Section 1.2.2) unless otherwise designated by UTILITY.

3.2.2 The pump size and type shall be designed by the ENGINEER and approved by the UTILITY.

3.2.3 All pumps shall be set on galvanized pipe or approved equal, of the size approved by UTILITY, unless weight will not allow it. When galvanized drop pipe is not feasible Shur-Align PVC drop pipe shall be allowed upon engineering approval.

3.2.4 An inline spring check valve shall be installed at the pump. A pump set 300' or more shall have a second check valve of the same type, installed halfway up the drop pipe.

3.2.5 A ¼", polyethylene line of sufficient psi rating to overcome the static pressure shall be installed with pump. One end shall be just above the pump and the other end left out of well at least 30'. The tube shall be continuous with no couplings or cuts.

3.2.6 A galvanized "tee" shall hold the pump on the well seal.

3.2.7 A well seal of the proper size shall be used complete with an approved well vent of the steel type.

3.2.8 If the drop pipe is 2 1/2" or larger, the well seal shall be steel and made with a solid top.

3.2.9 The pump setting depth shall be based on fracture locations and stabilized pumping level and is to be reviewed by a Professional Geologist or ENGINEER.

3.2.10 Install a 1" (minimum) PVC pipe from the top of the well down to the level of the pump for determining water drawdown depth by acoustic or manual sounding.

3.3 Booster Pumps and Motors

3.3.1 Booster pumps shall be manufactured by Goulds or Grundfos (see Division 5, Section 1.2.3) unless otherwise designated by UTILITY. The pump size and type shall be designed and/or approved by UTILITY. It shall be designed to pump the specified amount of gallons per minute at the specified pressure.

3.3.2 Motors for the pumps shall be of the manufacturer, horsepower, voltage, phase and hertz as specified or approved by the UTILITY.

3.3.3 Dual pumps with alternating, lead-lag and all necessary controls shall be installed.

3.3.4 Pumps shall be mounted on concrete pedestals at least 4" in height, with 4" over hang from each side of the pump, out of 3000 psi concrete. Lag bolts of the proper size shall be inserted in the concrete to mount the pump with. An 8" rubber matting shall be installed between the concrete and the pump base.

3.3.5 To prevent air-logging, each pump shall be equipped with an air release valve mounted on the highest point in the pump chamber. This air release will also have sanitary vent attached to it.

3.3.6 Either a flange or union shall be used at both the inlet and discharge piping where it enters the pump.

3.3.7 Each pump shall be equipped with a swing check valve of the specified type in the discharge side piping.

3.3.8 A gate or ball valve shall be installed in both the inlet and outlet piping. Gate valves shall be a rising OS&Y valve.

3.3.9 A tee with a ¼ inch ball valve with WOG rating of 600 psi shall be installed on both the intake and discharge side of the pump.

Division 2

Section 4

Water Treatment

4.1 Chemical Equipment

4.1.1 A chemical pumping system complete with chemical pumps, solution tanks, tubing, injectors and shelf shall be provided at each treatment location.

4.1.2 Chemical pumps shall be 115 VAC of appropriate pressure and flow design requirements, or as specified by UTILITY, specified heads complete with foot valves and injectors or equivalent. Manufacturers' specific recommendations for components designed for the application of all chemicals shall be followed.

4.1.3 Solution tanks shall be specified by the UTILITY.

4.1.4 Three tees will be installed in valve bank after the check valve to accommodate chemical feed points with an 18" minimum separation between the phosphate and caustic feeds and 5 feet of separation between the phosphate and chlorine feeds. If specified, the phosphate feed point and caustic feed point should be placed immediately after the check valve and the chlorine feed point should be placed past the master meter for the best results.

4.1.5 To achieve optimum corrosion control, UTILITY may specify pH adjustment above the state minimum pH of 6.5. Required safety features for wells with caustic feeds include caustic relays wired into the starter and a flow switch installed along a straight section of valve bank at least 12" from an ell. A low flow - flow switch is required on wells producing less than 15 gpm and flow switch will be used on wells producing in excess of 15 gpm.

4.1.6 The chemical shelf shall be wall mounted, a minimum size of 2" x 12" x 4', and made of chemical-resistant material with two 10" x 12" shelf brackets and mounted 42" above finished floor to the top or as specified by UTILITY.

4.1.7 A Separate chemical feeder shall be used for each chemical applied.

4.1.8 Three separate duplex GFCI outlets with separate individual feed circuits/wiring from the electrical control panel shall be provided for the chemical feeders. For Clarification See standard details – specifically W-32A Typical Well House Wiring Diagram. Each duplex outlet will be a GFI/GFCI outlet.

4.2 Filtration Requirements

4.2.1 All filtration/contaminant removal and/or waste disposal systems shall be designed by a licensed Professional Engineer, in cooperation with representatives of the UTILITY. These systems will be the sole discretion of the Utilitiy and must be approved before

installation and implementation.

4.2.2 When the raw water quality from a new well exceeds the EPA, State Maximum Contaminant Levels (MCL's), or as otherwise discussed within these specifications, provision shall be made, in the well house and lot design and construction, for the addition of physical treatment and, potential waste disposal if approved by the UTILITY (see Division 2, Section 4.3).

4.2.3 All water filtration facilities will be equipped with radio controls/telemetry and programmed logic controls (PLC). Radio controls/telemetry shall be provided by UTILITY.

4.2.4 Water softening Treatment will only be allowed when there is a receiving sewer with a wastewater treatment plant approved to receive the Water Softening Treatment backwash.

When the receiving sewer is not owned or operated by the Utility (Aqua), a flow acceptance letter must be provided for the discharge

4.2.5 Waste Disposal Facilities: Recycle systems are required in accordance with all applicable laws including Federal, State and Local; but when not permittable: sewer, sub-surface, or stream discharge waste disposal methods are also acceptable, when permitted by the appropriate regulatory agencies. With the exception of onsite Recycle and Sludge disposal systems, all waste treatment facilities will be located outside of the well head protection radius and will be separated from the water treatment facilities by an air gap to prevent cross connection. Sub-surface disposal methods will require a repair area close enough to be dosed from the original waste treatment and disposal facilities.

4.2.5.1 When applicable, a flow equalization/settling tank will be installed prior to any sand bed filters. Tank capacity will be sufficient to contain, at least, two complete waste cycle discharge volumes. No "septic" type tanks set above surrounding grade will be allowed.

4.2.6 An Operation and Maintenance Manual for the water treatment facilities will be provided to the UTILITY. This Manual will document the basic operation and maintenance issues and procedures for each equipment item and provide schedules for completion of routine tasks.

4.2.7 Start-up, Testing, and Operation: Project reports for treatment facilities will be provided to the UTILITY and must include schedules and performance standards for start-up, testing, and (initial) operation. Schedules should include the anticipated start-up date and proposed testing duration. Performance standards should include reference to applicable regulations and specific equipment capabilities.

4.3 Water Quality Parameters

4.3.1 Iron (Fe): <u>For any concentration below 0.3 mg/L, a</u> sequestering agent shall be required. The polyphosphate required will be at Utility specification.

4.3.2 Manganese (Mn): <u>For any concentration below 0.05 mg/</u>L a sequestrant shall be required. The polyphosphate required will be at Utility specification. At concentrations

greater than 0.30 mg/L, Mn filtration or approved equivalent will be required.

4.3.3 If the Fe & Mn Combined Levels exceed 0.50 mg/L, or if the Mn levels are greater than .3 Mn filtration or approved equivalent for removal of iron and manganese will be required unless the Engineer submitting on behalf of the developer and/or Aqua can justify and explain how sequestering will be successful. At minimum, the explanation will include dosing and chemical feed calculations and show how the insoluble portion of Fe and Mn will be less than the current sMCL. . If the engineer of record provides an explanation it is required to receive approval from NCDEQ-PWS Plan Review Section. Failure to receive NCDEQ_PWS approval will require filter installation. Under no circumstances will the Fe & Mn combined levels exceed 1.0 ppm without installation of iron and manganese filters.

4.3.4 Separate samples will be required for both soluble and insoluble Fe and Mn when concentrations are detected.

4.3.5 Sulfates: At or greater than 250 mg/l will require treatment and backwash permitting.

4.3.6 Total Dissolved Solids (TDS): At 500 mg/L or greater treatment shall be required.

4.3.7 Radionuclides levels are at 75% of the maximum contaminant levels, Filtration is required. An Alternative is to resampling at a schedule of four (4) hours, eight (8) hours, and twelve (12) hours at the permitted pumping rate. If these results are less than 75% of the maximum contaminant level, treatment will not be required.

Division 2

Section 5

Water Mains and Appurtenances

5.1 General Considerations

5.1.1 Type of Water Mains: UTILITY will approve PLANS for water supply mains and extensions only when such mains are designed and constructed in accordance with the criteria set forth in this MANUAL.

5.1.2 Design Period: Water mains shall be designed for the estimated ultimate tributary population. Water systems shall be designed to satisfy the domestic water demand requirements for the area.

5.1.3 Location: Water mains shall be located in dedicated rights-of-way or utility easements. When installed in rights-of-way, water mains shall, in general, maintain a consistent alignment with respect to the centerline of the road. All water mains located outside of dedicated rights-of-way shall require a minimum 20-foot easement with a 5' on either side of the main clear of any other parallel utilities. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a water main is located adjacent to a road right-of-way, a minimum 10-foot easement shall be provided. Additional easement widths shall be provided, if the pipe size or depth-of-cover dictates. Water mains shall not be placed under retention ponds, tennis courts, or other structures. In addition, water mains shall not be located along side or rear lot lines.

5.1.4 Construction Easements: All construction easements must be shown on the PLANS.

5.2 Design Basis

5.2.1 Hydraulic Modeling: A hydraulic model utilizing WaterCAD or WaterGEMS will be required for all new systems containing 2 wells or more or for any system connecting to a master system. If the proposed system is to be connected to an existing system, the entire interconnected system shall be modeled.

5.2.1.1 If a hydraulic model already exists for the system being connected to, the DESIGNER, with the permission of the UTILITY, may provide a hydraulic model of the proposed system to be placed in the existing model. In this case, UTILITY shall provide pressure and flow data for the system being connected to.

5.2.2 Average Daily Flow and Peak Flows: Average daily water flow shall be calculated by referencing the Water-Table of Daily Flows for Various Occupancies (Section 1). Maximum daily water flow shall be calculated as two times the average daily water flow and the peak hourly water flow shall be calculated as four times the average daily water flow.

5.2.3 Engineer's Report and Design Calculations: DEVELOPER'S ENGINEER shall submit signed, sealed and dated Engineer's Report and design calculations with the PLANS for all water distribution projects. Calculation shall show the water mains will have sufficient hydraulic capacity to transport peak hourly flows while meeting the requirements of Part 1, Division 2, Section 5.3.1 (below). Head losses through meters and backflow devices shall also be included in calculations. The Engineer's Report shall comply with the forms and guidelines given in the RULES GOVERNING PUBLIC WATER SYSTEM (Section .0307, Engineer's Report, Water System Management Plan and Other Plans). Any Engineer's Report that does not follow these guidelines may be rejected by the UTILITY.

5.3 Details of Design and Construction

5.3.1 Pressure: All water mains shall be designed in accordance with Section 5. The system shall be designed to maintain a minimum pressure of 40 psi at all points in the distribution system under all conditions of flow. Higher pressures may be required at commercial, industrial and high-density residential areas. The minimal normal working pressure in the distribution system shall be approximately 55 psi, but in no case less than 40 psi on the customer side of a meter. For pressures greater than 90 psi special provisions may be required. Design Friction Loss calculations for water mains shall be submitted with plans. AWWA Diurnal and a hydraulic model will be required to prove these requirements are met.

5.3.2 Design of Wells: Residential well capacity shall be based on a minimum of 1.0 gpm per residential connection, unless stated otherwise in the developer's agreement. Well capacity within the Bayleaf Master Water System (NC0392373) shall be based on a minimum of 1.5 gpm per residential connection. If PWS requirements or if a greater amount is given in the Developer's Agreement, the more stringent amount shall be used instead.

5.3.3 Design of Hydropneumatic Storage: When calculating the required effective and total volume, the Tank size shall be based on the North Carolina Public Drinking Water Regulations.

5.3.4 Diameter: Four-inch through 54-inch diameter water mains shall be allowed. As a minimum, four (4) inch-looped systems shall be required in low-density, residential projects. Where looping of mains is not practical, minimum six (6) inch mains shall be required, unless detailed calculations are submitted to substantiate the sufficiency of a smaller main (four (4) inch mains are allowed on the last 400' of a dead-end line). In commercial, industrial, and high-density residential areas, minimum eight (8) inch looped mains shall be required.

5.3.5 Dead Ends: In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical, as determined by UTILITY.

Where dead end mains occur, they shall be provided with a hydrant or with an approved flushing hydrant or blow-off for flushing purposes. Flushing devices shall be sized to provide flows with a velocity of at least 3 feet per second in the water main being flushed. No flushing device shall be directly connected to any sewer or irrigation system. Calculations and a hydraulic model will be required to prove these requirements are met.

5.3.6 Valves: All Valves with be clock-wise closed and counter clock-wise open. Valves shall be provided on water mains so that sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500-foot intervals in commercial, industrial and high-density residential areas and at not more than 1,000-foot intervals in all other areas. Valving shall be placed at all areas where water mains intersect in such a way as to ensure effective isolation of water lines for repair, maintenance or future extension.

5.3.7 Separation of Water Mains and Sewers: Refer to Division 3 of these SPECIFICATIONS for applicable requirements. No water pipe shall pass through or come in contact with any part of a sewer system. Extreme caution should be exercised when locating water mains at or near certain sites such as sewage treatment plants or industrial complexes. Individual septic tanks must be located and avoided.

5.3.8 Surface Water Crossings: UTILITY shall review and approve the PLANS on a case-by-case basis. All aboveground pipes shall be painted as specified in Division 3 for water mains.

5.3.9 Air Release Valves: Within 500 feet of the water entry point from a well to the distribution system and at all high points in water mains where air can accumulate, provisions shall be made to remove the air by means of automatic air release valves. At a minimum, air release valves should be placed where there is a change of pipe grade of 2 foot or more and spacing shall at least be one air release valve every 1,500 feet. Automatic air release valves shall not be used in situations where flooding of the manhole or chamber may occur. See details in STANDARD DETAILS.

5.3.10 Chamber Drainage: Chambers, pits or manholes containing valves, blow-offs, meters, or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blow-offs or air relief valves be connected directly to any sewer.

5.3.11 Disinfection Following Repair or Replacement: Any part of UTILITY water system which has direct contact with finished water and has been out of service for repair, alteration, or replacement shall be disinfected as outlined in Division 3 of these SPECIFICATIONS.

5.4 Water Services and Connections

5.4.1 Water services and connections shall conform to the applicable provisions of Division 3 and the STANDARD DETAILS. Only ¾", 1", 1-1/2", 2", 4", 6", 8" and 12" services will be allowed. Where water services greater than 12" are required, dual services shall be provided. Water services and connections to existing UTILITY systems up to 2" will be made by UTILITY. Services and connections to new water systems and to existing systems larger than 2'' shall be made by the CONTRACTOR.

A UTILITY representative must be on site during any connections to existing UTILITY systems.

CONTRACTOR shall not provide water service to new systems/line extensions other than for flushing and testing until the NCDEQ has issued a "Letter of Final Approval." To comply with regulations, the new connection shall not be placed into service until the

"Letter of Final Approval" from NCDEQ has been obtained.

5.4.2 For multiple connections to UTILITY existing water systems, the CONTRACTOR shall make the final connection upon UTILITY receipt of the NCDEQ "Letter of Final Approval" in accordance with the applicable AWWA in accordance with the applicable AWWA standard for disinfection of new water systems/ line extensions.

5.5 Water Metering

5.5.1 General: All water service connections shall be metered and be directly in front of the property. In general, gang meters are not accepted. The method of metering shall follow the guidelines listed below. However, the DEVELOPER'S ENGINEER must obtain approval before finalizing the design of the metering system.

5.5.2 Single Family Duplex and Multi-Family Subdivisions with Public Rights-of-Way: Each unit shall be individually metered. Single and double services shall be installed at property lines as indicated by the STANDARD DETAILS.

5.5.3 Single Family and Duplex Subdivisions with Private Streets: Individual meters may be permitted in accordance with Division 2, Section 5.5.2 if the private streets are designed to the applicable county standards and easements are dedicated over the entire private street common areas. In addition, sufficient area must be available outside of paved areas to locate water mains, services, and meters. If the above criteria cannot be met, the subdivision shall be metered pursuant to Division 2, Section 5.5.5.

5.5.4 Commercial, Industrial and Institutional Projects without Private Standby Water Lines: In general, each building shall be individually metered. Meter(s) shall be located in the public rights-of-way at the property line. If this is not practical, then the meter shall be located no closer than 5’ from the front of the building.

5.5.5 Commercial, Industrial, Institutional, Multi-Family with Private Streets, Apartments and Condominium Projects with Private Standby Water Lines: In general, all such projects shall require installation of a RPZ check assembly on each dedicated standby water line. Where on-site standby water systems contain less than 75 feet of main, a dual system (separate domestic and standby water lines) may be considered. Dual systems shall require backflow prevention in accordance with UTILITY Backflow Prevention Policy, latest edition. Individual meters to each unit are required.

5.5.6 Shopping Centers: In general, shopping centers shall require installation of a RPZ check assembly on each dedicated standby water line. Individual meters to each unit are required.

5.5.7 Meter Installation: All meters greater than or equal to 2” in size shall be provided by and installed by the CONTRACTOR. Meters less than two inches in size will be installed by UTILITY after payment of applicable fees and charges. All meters less than two inches in size will be installed underground in an approved meter box. Meters two inch and larger shall be installed by the CONTRACTOR per UTILITY Comprehensive Meter Program and the STANDARD DETAILS. In general, meters larger than two inch shall be located in a meter easement located adjacent to the public right-of-way.

5.5.8 Meter Sizing: Size of all meters shall be approved by UTILITY. The DEVELOPER'S

ENGINEER shall provide sufficient information on estimated peak flows and low flows. The developer's ENGINEER shall include head losses through metering devices when designing the water system.

5.5.9 Irrigation Meters: During the installation of the water system for a new development, UTILITY will require one (1) 1-inch service line to be installed between the water main and each lot. In the event that the builder and/or homeowner chooses to install an in-ground irrigation system, the 1-inch line can be retrofitted to include a 1" x ¾" tee to accommodate both a ¾" domestic meter and ¾" irrigation meter.

5.5.9.1 A Reduced Pressure Zone (RPZ) backflow prevention device shall be installed behind the irrigation meter. The RPZ shall be one of the following models. With UTILITY permission, another manufacturer with equal specifications and workmanship may be used.

- Cla-Val – RP2
- Conbraco - 400
- Febco – 825Y (D)
- Watts – Series 009QT
- Wilkins – WK 975XL-075

5.5.9.2 Before installing an in-ground irrigation system, reference the "AQUA NORTH CAROLINA RESIDENTIAL IRRIGATION METER INSTALLATION" guidelines.

5.6 Material, Installation and Testing

Applicable provisions of Division 3 and Division 4 shall apply.

5.6.1 Meter Boxes

Meter Boxes for up to 1-inch meters will be NDS D1200 Standard Water Meter Boxes and lids. Alternatives only allowed if approved by the Utility Engineer in writing. The meter Box Body at a minimum will be tapered and have a minimum wall thickness of 0.25 inch, have a double wall at the top cover seat area with a minimum thickness of 0.187 inch. The cover seat area shall have 30 structural support ribs on the underside of the seat, each with a minimum thickness of 3/16 inch. The bottom body shall have a 1.0-inch flange. The meter box cover shall have a minimum thickness of 0.25 inch. Boxes and lids shall be injection molded of structural foam polypropylene with a melt index of 10-12. Meter Box Covers (lid) will be a drop-in type lid with a 2.0-inch remote reading hole port and a cast iron reader flap. Meter box and lids shall be manufactured by the same manufacturer and designed to fit as a unit.

Placement of any meter within traffic loading areas or pavement areas is not preferred. If such an installation is proposed, it must be approved by the Utility Engineer in writing.

Meters and Meter Boxes/vaults larger than 1.0-inch will be approved on a case by case basis by the utility Engineer.

5.7 Location and Identification

A means for locating and identifying all water mains and valves shall be provided in accordance with Division 3 and the STANDARD DETAILS.

5.8 Cross-Connection Control

5.8.1 Location and Installation: In general, all backflow prevention assemblies shall be located directly following the water meter on developer/owner's property. If no meter is present (such as a building dedicated fire line) the backflow device shall be located that the right-of-way, edge of easement or edge of property line, and Aqua shall have no responsibility for the installation, operation or maintenance of the backflow device. Backflow prevention assemblies shall be installed aboveground to facilitate maintenance and testing and shall be operated with appropriate heat tracing for freeze protection. UTILITY's Cross Connection Control Policy shall be followed. It shall be the developer/owner's responsibility to purchase, install and maintain all backflow prevention assemblies. All cross-connection controls shall be tested and inspected by a North Carolina Department of Environmental Quality (NCDEQ) certified backflow prevention tester in accordance with state rules and regulations prior to acceptance by Aqua. Testable backflow devices shall be tested in accordance with State, Federal, and Local laws on a prescribed frequency but at a minimum of annually by a certified backflow prevention tester. Results from these tests shall be provided to Aqua NC. Any devices that are found to be defective shall be repaired immediately and follow-up test results provided to the UTILITY. Testing and maintenance of the backflow devices shall be the sole responsibility of the property owner. Failure to submit testing results and/or maintaining the devices in proper operational order could result in enforcement up to severance of service.

DIVISION 3
CONSTRUCTION SPECIFICATIONS

General Construction Requirements

Division 3

Section 1

General

1.1 Grades, Survey Lines, and Protection of Monuments

1.1.1 Grade: Benchmarks and base line controlling points shall be established prior to beginning work. Reference marks for lines and grades as the work progresses will be located so as to cause as little inconvenience to the prosecution of the work as possible. The CONTRACTOR shall place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. CONTRACTOR shall remove any obstructions placed contrary to this provision.

1.1.2 Surveys: The CONTRACTOR shall furnish and maintain, at his own expense, stakes and other such materials, and give such assistance, including qualified helpers, for setting reference marks to the satisfaction of UTILITY and the ENGINEER. The CONTRACTOR shall check such reference marks by such means as he may deem necessary and, before using this, shall call UTILITY's attention to any inaccuracies. The CONTRACTOR shall, at his own expense, establish all working or construction lines and grades as required from the reference marks, and shall be solely responsible for the accuracy thereof. The CONTRACTOR shall, however, be subject to the check and review of UTILITY.

1.1.3 Monument Preservation: Property comers and survey monuments shall be preserved using care not to disturb or destroy them. If a property comer or survey monument is disturbed or destroyed during construction, whether by accident, careless work, or required to be disturbed or destroyed by the construction work, said property comer or survey monument shall be restored by a land surveyor registered in the State of North Carolina. All costs for this work shall be paid for by the CONTRACTOR.

1.2 Utility Coordination

1.2.1 Location of Utilities: Prior to proceeding with trench excavation the CONTRACTOR shall contact all utility companies in the area to aid in locating their underground services. It shall be the contractor's responsibility to contact utility companies at least three (3) normal working days before starting construction. The CONTRACTOR shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground utilities may be determined.

The CONTRACTOR shall take all reasonable precautions against damage to existing utilities. However, in the event of a break in an existing water main, gas main, sewer or underground cable, the CONTRACTOR shall immediately notify the responsible official of the organization operating the interrupted utility. The CONTRACTOR shall lend all possible assistance in restoring services and shall assume all cost, charges, or claims

connected with the interruption and repair of such services.

1.2.2 Deviations Occasioned by Structures or Utilities: Wherever obstructions are encountered during the progress of the WORK and interfere to such an extent that an alteration in the PLANS is required, the ENGINEER shall have the authority to order a deviation from the line and grade and the UTILITY shall have final approval authority. If a change in line or grade of a gravity sewer is necessary, UTILITY will require the addition of any manholes needed to maintain the integrity of the sewer system.

1.2.3 Test Pits: Test pits for the purpose of locating underground pipeline, utilities, or structures in advance of the construction shall be excavated and backfilled by the CONTRACTOR. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the applicable county and UTILITY. The costs for such test pits shall be borne by the CONTRACTOR.

1.2.4 Protection of Existing Facilities: Temporary support, adequate protection and maintenance of all underground and surface utility structures including sewers, manholes, hydrants, valves, valve covers, and miscellaneous other utility structures encountered in the progress of the WORK shall be furnished by the CONTRACTOR at his expense. Any such structures which may have been disturbed shall be restored upon completion of the WORK.

1.3 Construction in Easements and Rights-of-Way

1.3.1 Construction in Easements: In easements across private property, the CONTRACTOR shall confine all operations within the easement area and shall be responsible and liable for all damage outside of the easement area. Trees, fences, shrubbery or other type of surface improvements located in easements will require protection during construction. Precautions shall be taken by adequate sheeting or other approved method to prevent any cave-in or subsidence beyond the easement limits or damage to improvements within the easement. In general, the easement area is intended to provide reasonable access and working area for efficient operation by the CONTRACTOR. Where easement space for efficient operation is not provided, the CONTRACTOR shall be responsible for organizing his operations to perform within the restrictions shown on the PLANS.

1.3.2 Construction in NCDOT Right-of-Way: The CONTRACTOR shall conform to all requirements of the NCDOT where construction work is in a right-of-way under the jurisdiction of the State of North Carolina. CONTRACTOR is required to have a copy of the encroachment agreement on the site at all times.

1.3.3 Construction in County Right-of-Way: WORK shall be governed by the applicable county right-of-way utilization regulations.

1.4 Suspension of Work due to Weather

During inclement weather, all WORK which might be damaged or rendered inferior by such weather conditions shall be suspended. During suspension of the WORK from any cause, the WORK shall be suitably covered and protected so as to preserve it from injury by the weather or otherwise.

1.5 Cooperation with other Contractors and Forces

During construction progress, it may be necessary for persons employed by UTILITY to work in or about the site. UTILITY reserves the right to access to the construction site at such times as UTILITY deems proper. The CONTRACTOR shall not impede or interfere with and shall cooperate with UTILITY for proper execution of the WORK.

1.6 Subsurface Exploration

The CONTRACTOR shall conduct subsurface explorations as necessary to perform the WORK.

1.7 Salvage

Any existing UTILITY owned equipment or material including but not limited to pumps, motors, control panels, valves, pipes, fittings, couplings, etc. which are removed or replaced as a result of construction shall be designated as salvage by UTILITY. If considered as salvage, the material shall be carefully excavated if necessary and delivered to UTILITY at a location designated by UTILITY.

1.8 Shop Drawings and Samples

The CONTRACTOR shall submit one (1) hard copy and one electronic copy (PDF) of the shop drawings, signed by the DEVELOPER'S ENGINEER, to UTILITY for approval. The data shown on the shop drawings shall be complete with respect to dimensions, design criteria, materials of construction and the like to enable review of the information as required.

The CONTRACTOR shall, if requested by UTILITY, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified in this MANUAL.

1.9 Refurbished Materials

All materials for construction shall be new materials. Any refurbished materials shall be allowed at the judgment and upon approval of the UTILITY Construction Coordinator.

Division 3

Section 2

Well Site Preparation

2.1 General

This Section covers the clearing, grubbing, stripping, grading, and any other work needed to prepare the construction site. The CONTRACTOR shall clear and grub all of the areas within the limits of construction as shown on the PLANS and approved by the COUNTY prior to the beginning of any WORK. All site work shall conform to the applicable site clearing, landscaping and tree ordinances of the applicable COUNTY or local governing jurisdiction.

2.2 Clearing and Grubbing

2.2.1 Clearing: The surface of the ground for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. Protect trees, shrubs, vegetative growth and fencing which are not called out for removal. Clearing operations shall be conducted so as to prevent damage to existing structures, installations and to those under construction, so as to provide for the safety of employees and others.

2.2.2 Grubbing: Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground. All depressions excavated below the original ground surface for or by the removal of such objects shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

2.2.3 Stripping: In areas so designated, top soil shall be stripped and stockpiled. Topsoil stockpiled shall be protected and seeded to protect from erosion until it is placed as specified. Any topsoil remaining after all WORK is in place shall be disposed of by the CONTRACTOR unless directed otherwise by UTILITY.

2.3 Grading

2.3.1 Access & Site Grading

A. Well site shall be sufficiently graded to allow access and set up of drilling equipment.

B. Additional grading may be required for well testing equipment.

2.3.2 Finished Grading

A. Well site shall be graded so that finished ground level of the well is at least 12" above the surrounding area within a 30’ radius to ensure that surface water drains away from the well in all directions. A minimum of 20' of this radius shall be level within 3" for the construction of the house. No water shall be allowed to collect at any point within the 100’ radius. The entire site shall be graded to provide for positive drainage away from the wellhead and so any storm water that enters the 100’ radius shall drain to points outside the radius.

B. Only clean fill dirt shall be used to fill well sites. Fill dirt shall be compressed and compacted every 18” of fill. If UTILITY’s Representative is not satisfied with the compaction and the compaction is not sufficient to support the facility and storage tank, compaction tests may be required to be done by a qualified agency. If it is found that the site is not compacted properly, the CONTRACTOR shall pay to correct the problem.

C. No potential sources of contamination including fertilizers, chemical or petroleum substances shall be placed within the 100' radius of the well head.

D. All pushed up shrubs, trees, etc, shall be removed from well site during excavation and prior to the finish grading. No burying of shrubs & trees shall be acceptable. In addition, no dumping shall be allowed on to the well site.

E. Prior to acceptance by Utility, the Owner shall be responsible for removal of all debris or non-permitted substances on well lot.

F. Final grading of the well site shall be smooth and ready for grassing and/or graveling.

2.4 Grassing

2.4.1 Well site shall be grassed.

2.4.2 Grassing:

2.4.2.1 Grass seed shall be applied evenly. Hydroseeding is permitted so long as no unapproved materials are used (see 2.3.2.2, below). Refer to the materials list for approved grass types.

2.4.2.2 Straw shall be applied over grass seed. Jute or coconut matting will be required for steeper slopes as needed and in areas where excessive erosion is noted. No fertilizers, chemicals or petroleum products shall be placed on the well site.

2.4.2.3 The contractor shall ensure a good stand of grass

2.4.3

2.5 Roads

2.5.1 There shall be an all-weather access road of at least 10' in width constructed within the recorded 20’ easement to each well site with a 15’x25’ turn around area of at the well adequate to accommodate complete turnaround of service vehicles, unless otherwise specified by local ordinances.

2.5.2 Access roads shall be graded with a minimum of 6" center crown in the road. If determined by the Inspector, side ditches to allow water to run off will also be required. At UTILITY Representative's discretion, rip rap may also be required on steep inclines.

2.5.2.1 All drainage ditched shall be lined with excelsior rolled erosion product to protect from erosion.

2.5.3 Road and side ditches shall be so constructed as to not direct or allow water runoff to drain toward the wellhead.

2.5.4 The finished access road shall be adequately compacted and covered with at least 6" of crush and run gravel and extend from the street to the doors of the facility (including turn around area) and the slab surrounding the wellhead.

2.5.5 Culvert pipe shall be placed in all low areas of access road and sized to handle flow of 50-year flood.

2.5.6 Road shall be designed and constructed to allow access of large equipment and allow re-drilling of the well, if necessary.

2.5.7 Road shall not exceed 12% grade without written consent of UTILITY.

2.5.8 A controlled access acceptable to the UTILITY shall be provided at each well site and shall consist of a post and cable properly marked, a gate, or mallard. UTILITY's Representative shall determine which method shall be acceptable.

2.5.9 Graveling:

2.5.9.1 Well drive and turn around shall be graveled. The gravel shall be placed so as not to direct water towards the well and also not to block the access to the facility.

2.5.9.2 Gravel shall be 3/4" or smaller crush and run and shall be applied at least 6" thick. Alternatives may be considered (such as #57 or #67 stone or asphalt paving if approved by UTILITY) based on what is deemed suitable to the neighborhood and acceptable to the UTILITY.

2.5.9.3 Graveled areas shall include geotextile between gravel layer and compacted earth surface. Geotextile shall be designed for drainage and separation. Geotextile shall have a minimum grab tensile strength of 120 lbs or greater.

Division 3

Section 3

Wells

3.1 Grading

3.1.1 Access & Site Grading

3.1.1.1 Well site shall be sufficiently graded to allow access and set up of drilling equipment.

3.1.1.2 Additional grading may be required for well testing equipment.

3.2 General

3.2.1 An on-site meeting with a UTILITY Representative shall be held prior to drilling a well. UTILITY must be notified a 1 week in advance prior to beginning drilling, setting the casing and beginning grouting.

3.2.2 Well shall be drilled at the specified well stake put in the ground by the surveyor, as approved by NCDENR, and in accordance with these specifications (see Section 1).

3.2.2.1 If the well is not drilled in staked location designated by the surveyor or does not have a minimum 100' radius approved by the State, the UTILITY shall not accept the well.

3.2.3 The well drilling contractor and/or DEVELOPER shall obtain any and all required permits needed to drill a well. Penalties assessed for not obtaining the required permits shall be the sole responsibility of the CONTRACTOR and/or DEVELOPER. UTILITY shall not be liable if the required permits are not obtained.

3.2.4 Well Diameter

3.2.4.1 Rock Wells: All rock wells shall be drilled with a minimum 8" well casing . UTILITY requires that the well hole from the bottom of the casing be drilled with a minimum 8" diameter for the full length of the well unless otherwise specified by the UTILITY. Exceptions must be approved by the Utility in writing.

3.2.4.2 Sand Wells: All sand wells shall be drilled with a minimum 8" well casing unless otherwise specified by the UTILITY.

3.2.5 Only potable water shall be used in the process of well drilling. Tanks and vessels carrying water for drilling purposes must be chlorinated to a minimum 50 parts per

million each time they are filled. All chlorine products must be free of sun inhibitors or sun stabilizers. Water from sources, such as unapproved wells, lakes, ponds, rivers, streams, etc, shall not be used.

3.2.6 All other drilling fluids and additives used shall comply with recognized industry standards and practices and be applied and used as prescribed by the manufacturer. Toxic and/or unapproved substances shall not be added to drilling fluid.

3.2.7 Wells shall be drilled straight and plumb the entire depth of the well. Crooked wells will not be accepted. If Aqua determines the wells is not plumb, i.e unable to install a temporary pump or permanent pump, Aqua will require a new well to be drilled at others expense

3.2.7.1 Rock Wells: The well driller shall attempt to drill to a depth at least fifty (50) feet beyond the last water-bearing fracture.

3.2.7.2 Sand Wells: Casing shall extend at least one (1) foot into the top of the water-bearing formation and in no case be less than 55 feet below ground level.

3.2.8 The well shall be constructed in accordance with all State and County regulations, AWWA standards and UTILITY specifications.

3.2.9 The well shall be thoroughly cleaned of all drill cuttings prior to the removal of the drilling equipment.

3.2.10 At the completion of drilling, the well drilling contractor shall chlorinate the well with granular and tablet chlorine such as HTH or equivalent to a tested level of 100 ppm for 24-hours in accordance with AWWA rule C654 and section .1002 of *The Rules Governing Public Water Supply Systems* (NCAC Title 15A, Subchapter 18C, Section 1002). All chlorine products must be free of sun inhibitors or sun stabilizers.

3.2.11 A signed and complete copy of the State and/or County required well drilling record/log shall be submitted to UTILITY showing the name of the Subdivision, well number, coordinates of well, well drilling company, date drilled, depth of well, depth of casing, drive shoe, depth of the grouting and placement method used, static water level, depth and yield at each water zone (including those zones cut off by the installation of the casing), total yield, etc. Well records without the above data will not be accepted.

3.3 Well Casing

3.3.1 Drive shoe (Rock Wells only) - A drive shoe must be installed on the end of casing. The drive shoe shall be made of forged, high carbon, tempered seamless steel and shall have a beveled, hardened cutting edge. This shoe shall be firmly driven into the rock at least 5' into competent bedrock to make a seal with 10' being preferred. **This should be documented on the signed well construction report.**

3.3.2 Casing material - New casing which bears mill markings and which conforms to standard specifications – carbon steel or approved equivalent for water well pipe shall be used. Casing shall be 8" inch heavy weight (0.322" wall thickness), carbon steel or ASTM F480 galvanized or approved equivalent for water well pipe unless otherwise specified. Thermoplastic casing will not be accepted on rock wells.

3.3.3 Casing length (Rock Wells only) - Where firm bedrock is encountered shallower than 55 feet, a minimum casing length of 55 feet below ground level will be required. Unless otherwise specified by the on-site Utility Representative, the well must be drilled a minimum of 5' into competent bedrock where the drive shoe and casing must be secured.

3.3.4 Method of joining - Casing lengths shall be joined in alignment and water tight by a method appropriate to the material used so that the resulting joint shall have the same structural integrity and protection as the casing itself. Threaded and coupled joints shall be API or equivalent and made up tight. Welding is acceptable.

3.3.5 Sanitary protection of the well - The well site shall be protected at all times during the drilling. The casing shall be sealed with a suitable flanged, threaded, welded cap, or compression seal upon completion. The top of the outside casing shall extend at least 12" above concrete finished floor level/elevation.

3.3.6 There shall be no openings in the casing wall below its top except for water level measurement access ports, vents, or grout nipples. Such openings shall be sealed water tight prior to leaving the well site.

3.3.7 An identification plate shall be attached to each public well immediately after drilling is completed. The well drilling contractor shall furnish a completed well identification plate as outlined below prior to leaving the job site. The well will not be accepted without this tag.

3.3.7.1 The identification plate shall be constructed of a durable, weatherproof, rustproof metal or equivalent material.

3.3.7.2 The identification plate shall be securely attached to the well casing where it is readily visible.

3.3.7.3 The identification plate shall be stamped with permanent markings to show the following information:

- Drilling contractor and registration number.
- Date well completed.
- Total depth of well.
- Casing: Depth (feet), Inside Diameter (inches).
- Yield or specific capacity expressed in gallons per minute (gpm), or gallons per minute per foot of draw down (gpm/ft.dd).
- Static water level and date measured.
- Gravel and screen size (if applicable).

3.4 Well Grouting

3.4.1 Grouting materials - For all community wells, composition of grout must meet State requirements.

3.4.2 The entire length of the well casing shall be grouted completely before the driller leaves

the site, i.e., in one pour.

3.4.3 The UTILITY may specify pressure grouting a well from the inside of the end of the casing out into the annular space; however tremie grouting is the preferred method. Or the UTILITY may specify grouting to the end of the casing within the annular space using two tremie pipes to ensure good distribution around the casing.

3.4.3.1 (Rock Wells only) Contractor shall not pour concrete. Well shall be grouted using the following method: grouting to the end of the casing within the annular space using tremie pipes to ensure good distribution around the casing, or pressure grouting.

3.4.4 Below are the specifications for using these types of grouting methods.

3.4.4.1 Grout material shall be placed by tremie pumped or forced injection after water or other drilling fluid has been circulated in the annular space sufficiently to clear all obstructions including rock chips in Type I wells.

3.4.4.2 In accordance with State regulations, there must be a minimum annular space equal to either one-third of the outside diameter of the casing or at a minimum two inches.

3.4.4.3 When emplacing the grouting material, the tremie pipe shall be lowered to the bottom of the zone to be grouted and raised slowly as the grout material is introduced.

3.4.4.4 The tremie pipe shall be kept full continuously from start to finish of the grouting procedure, with the discharge end of the tremie pipe being continuously submerged in the grout until the zone to be grouted is completely filled.

3.4.4.5 The grout must be allowed to properly cure at least 24 hours before construction may be resumed.

3.4.7 (Rock Wells only) For sanitary protection, the well should be grouted from the bottom of the casing secured in firm bedrock. Special care must be taken to set casing and grout into Piedmont crystalline rock and not just too overlying isolated boulders or iron hardpan. Additional length of grout may be necessary in some cases to support the weight of the casing.

3.5 Well Screens (Sand Wells only)

3.5.1 The well shall be equipped with a screen that will adequately prevent the entrance of formation material into the well after the well has been developed and completed by the well contractor.

3.5.2 The well screen will be of a design to permit the optimum development of the aquifer with minimum head loss consistent with the intended use of the well. The openings shall be designed to prevent clogging and shall be free of rough edges, irregularities or other defects that may accelerate or contribute to corrosion or clogging. How this design is determined shall be included with the Engineer's submittal for approval. (i.e. were samples sent to the screen manufacturer to determine optimum screen size, etc.)

3.5.3 Multi-screen wells shall not connect aquifers or zones which have differences in water quality with would result in contamination of any aquifer or zone.

3.5.4 Under no circumstances will a well screen be set less than 55 feet below land surface.

3.6 Gravel and Sand Packed Wells (Sand Wells only)

3.6.1 In constructing a gravel or sand packed well:

3.6.1.1 The packing material shall be composed of quartz, granite, or similar rock material and shall be clean, of uniform size, water-washed and free from clay, silt, or other deleterious material.

3.6.1.2 The size of the packing material shall be determined from a grain size and of the formation material and shall be of a size sufficient to prohibit entrance of formation material into the well in concentrations above five (5) milliliters per liter of settleable solids and ten NTU's of turbidity as suspended solids as permitted under N.C.2C Rules.

3.6.1.3 The packing material shall be placed in the annular space around the screens casing by a fluid circulation method, preferable through a conductor pipe to insure accurate placement and avoid bridging.

3.6.1.4 The packing material shall be adequately disinfected.

3.6.1.5 Centering guides must be installed within five (5) feet of the top packing material to ensure even distribution of the packing material in the borehole.

3.6.2 The packing material shall not connect aquifers or zones which have differences in water quality that would result in deterioration of the water quality in any aquifer or zone.

3.7 Well Development

3.7.1 All water supply wells shall be properly developed by the well driller;

3.7.2 Development shall include removal of formation materials, mud, drilling fluids and additives such that the water contains no more than:

3.7.2.1 five (5) milliliters per liter of settleable solids; and

3.7.2.2 ten (10) NTUs of turbidity as suspended solids.

3.8 Testing

3.8.1 No well shall be accepted when the drawdown test results are less than 15 gallons per minute unless accepted and approved by the Utility in Writing. .

3.8.2 A UTILITY Representative shall be present at start and completion of the drawdown. UTILITY must be provided 1 week notice prior to start of drawdown testing.

3.8.3 Test pump shall be set at the depth specified by UTILITY and shall be of sufficient size to determine the true well yield.

3.8.4 Perform a step test at a maximum of one hour, minimum of thirty minutes, or between as the production stabilizes (Step test with a minimum steps of 30 to 60 minutes). The steps should be performed in the following order: 50% production, 75% production, 100% production, and 125% production. The water level should be checked every one (1) minute and will be considered stable after ten (10) stable representative reads. If the production stabilizes quickly at 125% a similar test should be performed at 150% production.

Water level measurements shall be collected by hand or by acoustic monitoring.

3.8.5 A 24-hour test with a two-hour recovery shall be run without interruption. If the test is interrupted for any reason, it shall be the contractor's responsibility to re-run a complete test at no extra charge to the owner. Wells that have not been placed in service within two years of the date the well was drilled will require a current 24-hour well drawdown test to be completed.

3.8.6 Wells in close proximity to other community wellsand/or private wells will be required to be tested simultaneously in accordance with State and Local Regulations.

3.8.7 This test shall be run in accordance to UTILITY's specifications, which are as follows:

3.8.7.1 GPM and Pumping Level –

- Check every 5 minutes for 1st hour
- Check every 10 minutes for 2nd hour
- Check every 15 minutes for 3rd hour
- Check every 30 minutes for 4th hour
- Check every hour for remainder of test

3.8.7.2 Field Water Quality Parameters - Field water quality parameters (iron, manganese, hardness and pH) shall be tested as follows:

- 1st hour then,
- Every 4 hours thereafter, then,
- At the end of the test
- Field samples should be pulled more often if parameters are not within limits.

***The drawdown/capacity test will NOT be accepted unless the field water quality parameters are collected and the results recorded on the 24 hour drawdown report**

3.8.7.3 New well analysis samples shall be collected between the 10^{th} to 12^{th} hour of the 24 hour draw-down test.

3.8.7.4 After the 24-hour test is run, shut off the pump and start the recovery test as stated below.

3.8.7.5 Recovery Static Level -

- Check every 1 minute for 1st 30 minutes

- Check every 10 minutes for 2nd 30 minutes
- Check every 15 minutes for 3rd 30 minutes
- Check every 30 minutes for 4th 30 minutes

3.8.8 Water sample results must meet all regulatory and/or UTILITY water quality standards. The following contaminants will be sampled from every new well: bacteriological, inorganic chemical, including gross alpha and beta particles, uranium, radium 226 and 228, volatile organic chemicals, synthetic organic chemicals, Asbestos (as applicable), and any other regulated or unregulated contaminants as deemed necessary by the UTILITY. At least one copy of these analyses shall be submitted to UTILITY.

3.8.9 After the test pump is removed, the contractor shall rechlorinate the well to at least 100 ppm for 24-hours as required by AWWA rule C654 and recap it.

3.8.10 At least one signed hard copy and one electronic (PDF) copy of the well drawdown test shall be submitted to UTILITY.

3.8.11 Test log shall include gallons per minute, static water level, pumping water level, above ground head, time, turbidity of water, depth of any noted cascading of water, and all field parameter testing results.

3.8.12 A videotape shall be made of the well and a copy presented to the UTILITY. Should the video indicate that well construction deficiencies exist, the owner of the well shall be responsible for all necessary construction modifications. Any additional drawdown tests or any water analyses required due to construction modifications will be at the well owner's expense.

3.8.13 The Available Yield of the well shall be considered to be 90 percent of the 24-hour draw down stabilized pumping rate. If the specific capacity of the well is greater than 1, then 100% of the pumping rate may be used. The 1 gallon per minute per connection will be based on the Available Yield of 90%. Unused Capacity available shall not exceed the 90% threshold and is subject to a new pump test at the time of the new request and at each request thereafter.

3.8.14 Resampling: When at the discretion of the UTILITY, sufficient cause exists to resample water quality parameters, then a modified draw down test shall be run for, at least 3 volumes of the well or for the length of time as determined by the UTILITY, at the stabilized draw down pumping rate. The water quality samples for laboratory analyses shall be drawn at the end of the modified draw down test. If field parameter testing during the original draw down test indicated significant changes in water quality during the 24-hour test, then the resampling draw down test will run through the time of the changing concentrations, but no less than 3 hours. During the modified draw down testing, all field parameters shall be sampled at the above frequencies.

3.8.15 When well modifications are made to significantly alter the hydrologic or water quality conditions (i.e. a packer, liner, or concrete fill), or the well has not been activated within 2 years, then a complete draw down test shall be conducted on the modified well. Water samples to be pulled at the end of the test to determine the new sample results.

3.9 Well Abandonment

3.9.1 In the event that a well is not accepted by the Utility, it shall be abandoned in accordance with the North Carolina Administrative Code, Subchapter 2c, Section .0113 and Section .0114 and in accordance with County rules and regulations. A representative of the UTILITY shall be notified of the well abandonment 24-hours prior to completing the abandonment for Inspection purposes.

3.9.2 An official Well Abandonment Record on latest official form provided by the Division of Water Quality (Groundwater Section) shall be completed. A copy of this completed form shall be sent to the County Health Department, NCDENR, and UTILITY.

3.9.3 **All unused wells must be abandoned to protect the integrity of the ground water supply**. It shall be at the discretion of the UTILITY to allow a well not being used for the community water system to be kept for irrigation or other purposes.

Division 3

Section 4

Plumbing

4.1 Valve Bank

4.1.1 A valve bank shall be installed and sized in accordance with the approved plans and UTILITY's specifications. The valve bank shall be designed so that the maximum water velocity shall be 8 ft/sec. All Valves with be clock-wise closed and counter clock-wise open. All water valves within the Well House (whether main well house or satellite) shall be ¼ turn ball valves.

4.1.2 Only ASTM approved pipe shall be used above ground level as specified on the parts list.

4.1.3 Acceptable piping for below ground installations can be found on the materials list.

4.1.4 A turbine meter shall be installed on wells yielding more than 30 gpm water production. The turbine meter shall be capable of producing a 4-20 ma signal and shall also have a visual indicator showing the gallons per minute and total gallons pumped. Said meter size and model shall be specified by UTILITY.

4.1.5 A positive displacement meter of 1" size shall be used on wells producing 30 gpm or less. The meter shall be capable of producing a 4-20 ma signal and shall also have visual indicator showing the gallons per minute and total gallons pumped

4.1.6 Each valve bank shall have a WYE strainer installed before the water enters the meter. The WYE strainer shall be equipped with a ball valve and be piped to discharge at least 40 feet from the building to a ditch or the lowest point on the well lot. This drain shall not be installed in such a manner to cause flooding or standing water on the well lot. An air gap shall be maintained at the discharge end of the pipe. A rodent screen and splash block shall also be provided at the discharge end of this pipe.

4.1.7 When the plumbing is complete, all inside pipes 1" or smaller shall be insulated with rubber tube insulation such as Rubatex. All outside pipes and appurtenances shall be heat traced and insulated with rubber insulating tape such as Rubatex tape to a minimum thickness of 7/8" and covered with PVC pipe sized as follows:

- 2" or Smaller Pipe - 2" Rubatex & 4" Sch. 40 PVC
- 4" or Smaller Pipe - 4" Rubatex & 6" Sch. 40 PVC

4.1.8 A ¼ inch ball valve with WOG rating of 600 psi shall be installed on all gauges.

4.1.9 Gauges of proper pressure rating as determined by UTILITY shall be oil filled.

4.1.10 Swing check valves, spring check valves, ball valves, and short stem gate valves shall meet a minimum of 200% of the operating systems pressure or the ASTM approved rating, whichever is greater.

4.1.11 A pressure switch shall be installed complete with 1/4" shut off, 1/4" drain and oil-filled gauge of the proper pressure.

4.1.12 One threaded hose bib equipped with a vacuum breaker shall be installed in the chemical feed equipment. An unthreaded sample tap shall be provided at the well head. One unthreaded sample tap shall be provided on the system side of the valve bank.

4.1.13 All blow off pipes shall be installed so that the water will drain to a ditch or the lowest area of the well lot. This drain shall not be installed in such a manner as to cause flooding or standing water on the well lot. An air gap and rodent screen shall be maintained at the discharge end of the pipe.

4.1.14 In compliance with *OSHA 29 CFR 1910.151(c), emergency dual head eye wash units piped to the valve bank on the system side of the check valve will be located within the well house near the chemical equipment and near the entrance to the building. Drench hoses shall remain in operable condition at all times. The emergency eye wash heads will be located between 4 and 5 feet above the floor and attached to the wall per manufacturer specifications.

4.1.15 Coatings and Linings: Where ductile iron pipe and fittings are installed below grade or installed in a casing pipe, a bituminous coating approximately 1.0 mil thick shall be applied in accordance with ANSI/AWWA A21.51/C151. Where ductile iron pipe and fittings are to be installed aboveground, pipe, fittings and valves shall be thoroughly cleaned and given one field coat (minimum 1.5 mils dry thickness) of rust inhibitor primer. Intermediate and finished field coats of Alkyd shall also be applied by the CONTRACTOR (minimum 1.5 mils dry thickness each coat). Primer and field coats shall be compatible and shall be applied in accordance with the manufacturer's recommendations. Final field coat shall be olive green for raw water and dark blue for finished water.

All ductile iron pipe and fittings shall have an interior protective lining of cement-mortar with a seal coat of asphaltic material in accordance with ANSI/AWWA A21.4/C104

4.1.16 Distribution Pressure Relief Valve (PRV): On all systems containing hydropneumatic tanks as the storage and pressure regulating structure - A pressure relief valve shall be located within the well house and mounted on the piping such that it is exposed to the pressures as experienced by the distribution system. This PRV will be piped so that when activated it will discharge to the blow-off piping listed above.
The PRV shall be factory set at 100 pounds per square inch and shall be a 2 inch flow model as manufactured by Kunkle with the capability of discharging water in a range from 19 gallons per minute (gpm) to 229 gallons per minute. The PRV shall be built as follows:

All Bronze with Pressure tight cap
Both inlet and outlet connections will be cast integral with body to permit easy inspection and servicing without disconnecting piping.
Beveled seats lapped for optimum performance.

Stainless Steel (SS) spring for optimum corrosion resistance
Working pressure rated from 1 to 300 psig
Temperature rated from -60 to 406 degrees Fahrenheit

If the well pump or pumps within the system have an approved capacity to exceed 200 gpm, then multiple valves or larger valves must be evaluated. The discharge capacity of the valve(s) must meet the well pump(s) approved pumping capacity.

This valve will be installed behind a ¼ turn ball valve as shown in the details.

4.2 Hydropneumatic Tank

4.2.1 The contractor will plumb in the hydropneumatic tank, including but not limited to, the supply line, discharge line, air compressor piping, pressure relief, vacuum breakers, etc., (in accordance with the utility drawing.) and shall provide protection from freezing for these items.

4.2.2 The supply main will be of new ASTM approved pipe, complete with 90-degree ell, unions, etc. Where the tank is set on prefab saddles, a mechanical joint dresser coupling shall be provided ahead of tank connection to allow for settling.

4.2.3 One Well System - A 2" blow-off assembly complete with square nut cast valve and a cut off valve between the blow-off assembly and the tank shall be installed. A 2" galvanized or brass coupling shall be left within 3" of the top of the blow-off valve box for future connections (in accordance with the Utility drawing).

4.2.4 Multiple Tank Systems - A tank bypass of the proper size shall be installed on systems with more than one hydro-pneumatic tank and on potential elevated tank systems with hydro-pneumatic tank, complete with tank and main cutoff valves (in accordance with the Utility drawing).

4.2.5 The relief valve shall be a side discharge of pressure rating and size as per UTILITY specifications and shall be mounted on the top of the tank and will insulated to prevent freezing.

4.2.6 The vacuum breaker shall be a minimum 3/4" installed as shown in accordance to the utility drawing.

4.2.7 A ball valve with 600 WOG rating and a ball valve with a locking device shall be installed between the tank and the pressure relief valve and vacuum breaker (in accordance with the Utility drawing).

4.3 Air Compressor

4.3.1 An air compressor shall be installed complete with necessary piping and fittings.

4.3.2 Air compressor shall be of sufficient pressure to overcome the system cut-off pressure

while providing a minimum of .5cfm of free air. Controls shall be provided to start and stop the compressor due to water levels and pressures.

4.3.3 Probes used for air compressors shall be set at 6" above the center of the hydro-pneumatic tank. The air compressor safety cut off shall be set 2 psi above the system cut off pressure.

4.3.4 When used, the air volume control shall be placed so as to maximize the drawdown of the hydro-pneumatic tank during cycles.

4.3.5 All pipe in conjunction with air compressor shall be thoroughly cleaned to remove any cuttings or oil that might be left from cutting and threading of pipe.

4.4 Ground Storage Tanks

4.4.1 Inlet and outlet fittings shall be located, sized, and of the type specified by the UTILITY and designed to promote turnover in the tank.

4.5 Distribution

4.5.1 The distribution line shall be C900 DR 14 PVC or ductile iron as specified by the UTILITY, complete with mechanical joint fittings, ductile iron spools (inc. attached to the bottom flange of the tank), flange adapter, reducers, etc. A locating wire 30 mil HDPE jacket or larger, shall be attached to the locating wire left by the distribution system contractor and run with the pipe, the end terminating at the top of the valve box or under the tank. All underground pipes shall have a minimum cover of 3' with the first 18" of fill free of rocks and debris. Concrete blocking or approved restraint fittings shall be provided behind all ells and tees as per AWWA standards (in accordance with the utility drawing.)

Division 3
Section 5

Storage Tanks

5.1 Hydropneumatic Storage Tanks

5.1.1 Hydropneumatic tank shall be constructed and stamped in accordance with the American Society of Mechanical Engineers (ASME) Pressure Vessel Code stamped with the ASME "U" symbol stamp and registered with the National Board of Boiler and Pressure Vessel Inspectors. These tanks must be inspected by the Department of Labor, Boiler and Pressure Vessel Division after installation but prior to operation. Tank shall be manufactured to UTILITY's specifications and have a rated working pressure of at least 125 psi. Size of tank with number and size of outlets will be specified by the UTILITY. The minimum size tank accepted by UTILITY for a community water system shall be 5,400-gallons

5.1.2 The contractor shall set tank complete with pedestals as per plans.

5.1.3 Pedestals shall be excavated to solid compact ground (at least 36" below ground) and poured of 3,500 psi concrete (or 3,000 psi concrete with an additive) to form to the tank with a 12" dip at the center. Alternatively, steel saddles may be used to cradle the tank and shall sit firmly on top of the concrete pedestals. Pedestals shall be set on solid, compact ground with a minimum bearing capacity of 2500 psf. The first pedestal shall be no further than 10' from the house without UTILITY approval. The width shall be 2' with a length of 6' for 5,400-gallon tanks. The width shall be 30" with a length of 8' and a depth of 48" for 10,000-gallon tanks. Pedestals for other tank sizes shall be as specified by UTILITY. Forms shall be removed after 48 hours. Pedestal finish shall be smooth. The bottom of the tank shall be 18" above finish elevation of the ground beneath it.

5.1.4 Before setting the tank, the tank shall be painted with the appropriate finish and allowed to dry for 7 days. The two surfaces must be separated by a rubber or dense polypropylene material as specified by UTILITY. See Division 3 Section 7 for appropriate materials.

5.1.5 The tank shall be air cured for a minimum of 14 continuous days before filling.

5.1.6 The tank shall be thoroughly flushed to remove any sediment or foreign matter. A chlorine solution, in concentrations sufficient to produce a chlorine residual of at least 50-ppm, shall be introduced to overflow the tank. The chlorine solution shall remain in contact with the interior surfaces for a period of 24 hours. The tank then shall be thoroughly flushed with the free chlorine residual solution not to exceed 2 ppm after flushing. The tank shall not be placed into service until bacteriological test results are found to be satisfactory.

5.2 Ground Level Storage Tanks

5.2.1 Ground storage tank shall be installed in accordance with the design specifications completed by a licensed engineer in the State of North Carolina. Said design shall be approved by UTILITY and shall comply with all County, State, and Federal requirements. Ground Storage tanks shall be constructed in accordance with the American Society of Mechanical Engineers (ASME) Code. Tanks shall be manufactured to UTILITY specifications and size.

5.2.2 Design and its fabrication must comply with AWWA Standards D 100 of the American Water Works Association, Inc.. Foundations and support structures must comply with standard ACI 318. All accessory items installed shall be in full conformity with the current applicable OSHA safety regulations and the operating requirements of the structure. At a minimum if the tank is taller than 8 feet, a fixed ladder or form of access/egress must be installed in accordance with OSHA and AWWA standards and recommendations.

5.2.3 The Contractor shall provide working drawings and design calculations for the tank and the foundation. Drawings shall show the size and location of all structural components and reinforcement, the required strength and grade of all materials and the size and arrangement of principle piping and equipment. The drawings and calculations shall bear the certification of a professional Engineer licensed in the State of North Carolina.

5.2.4 A sanitary, screened vent and overflow of the proper size shall be installed on the top of the tank.

5.2.5 Probes of 316 stainless steel and all necessary controls for operation and monitoring of the water levels shall be installed in accordance with the UTILITY specifications and/or the approved plans. The number and settings for these probes shall be determined by the UTILITY and/or the approved plans.

5.2.6 The tank shall be all-welded construction of the most economical design. All members of structural steel shall be designed to safely withstand the maximum stresses to which they may be subjected during erection and operation.

Division 3

Section 6

Well House

6.1 Pad

6.1.1 The well house pad at minimum shall measure 10’ x 10’ by 6-inches thick. The footer and the slab shall be a continuous pour. The pad and foundations shall meet the international building code and all state and local regulations as it pertains to the appropriate building structure, at a minimum it shall be constructed as shown in the Standard Details.. The wellhead pad shall extend a minimum of 8’ 6” from well house pad and allow for a continuous bond concrete extending three feet horizontally around the outside of the well casing as per plans.

6.1.2.1 The well house pad shall be a minimum of 6” thick with 12” X 12” footings and a ½” slope to the drains. Concrete shall have a compressive strength of 3,000 psi.

6.1.2.2 The wellhead concrete pad shall be 8” thick with 12” x 12” footings and join with the well grout. Forms shall be level and square.

6.1.2 A 4” floor drain with pea-trap shall be installed in the center of the well house. The under-floor piping shall be Schedule 40 PVC. It shall be installed with a 0.5 % slope. The top of the pipe shall have a minimum of 12” of cover, and it shall extend a minimum of 20’ away from the well house or as directed by UTILITY. No standing water shall be allowed. Necessary measures including ditching and riprap may be required depending in site conditions.

6.1.3 Finished elevation of the pad shall be 3" to 4" above the surrounding ground and the site shall be graded so as not to allow runoff water to enter the building.

6.1.4 The edges of the pad shall be smooth.

6.1.5 Concrete shall be poured and installed in accordance with industry standards.

6.1.6 After the pad is poured and has set for at least 24 hours, forms shall be dismantled and removed from the site.

6.1.7 No slab penetrations shall be allowed except wellhead and drain. All additional piping shall be routed outside of building footprint prior to burying.

6.2 Block

6.2.1 A row of 6" block is required around the perimeter of the building complete with 3/8"

anchor bolts as per plans for wood framed well houses or in accordance with local permitting standards.

6.2.2 Blocks and mortar joints shall be level and free of cracks and shall be filled with concrete.

6.3 Wood Building

6.3.1 The contractor shall build house complete with a 36", single, aluminum, powder coated, exterior door as per Well House Framing Detail (See Drawing W-31).

6.3.2 Pressure treated 2" x 6" lumber shall be used as the seal plate and bolted to the anchor bolts or in accordance with County standards.

6.3.3 Joists shall be on 16" centers.

6.3.4 Ceiling joists shall be a minimum of 8' above finished floor.

6.3.5 Siding shall be 5 ¼" x 8" x 5/16" fiber cement board (or approved equal), installed per manufacturer's recommendations. Color to be selected by UTILITY (see Division 3 Section 7.2). Alternatives will be submitted to UTILITY for approval.

6.3.6 The well cover house shall be 24" above finished block to the top of the wall. Well cover size shall not exceed 36" wide and 7' long.

6.3.7 A gable vent or ridge vent shall be installed with a soffit vent for proper roof ventilation.

6.3.8 Two - 8" x 16" automatic foundation vents with wire security grating shall be installed 6" above the block on the back sides of the well house. Two 8" x 16" closing vents shall be installed in the front ceiling to allow heat to dissipate out through the roof in the summer.

6.3.9 Hasps shall be installed on well cover roof.

6.3.10 If building is to be built of any material other than wood, plans shall be approved by UTILITY in writing.

6.3.11 Interior Walls shall be backed with faced batt insulation and finished out with ½" plywood and painted white.

6.3.12 A well head protection sign (provided by UTILITY) shall be installed on each well house as well as a well identification number.

6.4 Roofs

6.4.1 A gable style roof shall be built with 4/12 pitch.

6.4.2 Covering shall be 1/2" OSB with 30# felt paper and (golden or autumn brown) architectural shingles with 20-year warranty.

6.4.3 Well cover roof shall be removable by sliding and flashed with 1.5" x 1.5" angle iron to

house.

6.4.4 All eaves shall be boxed in. Fascia shall be constructed of fiber cement board.

6.4.5 Metal drip edge material shall be installed at all exposed edges of the roof decking.

6.5 Insulation

6.5.1 All wood houses shall be constructed with R-15 faced batt insulation in the walls and R-30 fiberglass insulation in the ceilings. Construction in Alleghany, Ashe, Avery, Mitchell, and Yancey counties require R-19 fiberglass insulation in walls.

6.5.2 All block houses shall have insulation poured to the top of the block in each block cavity.

6.6 Commercial Size Well Houses

6.6.1 If structure is larger than 144 square feet, it shall comply with all local fire regulations (i.e. access road, address, fire extinguisher, etc.)

6.7 Satellite Well Houses

6.7.1 Installation of a satellite well house shall be at the discretion of the UTILITY.

6.7.2 Please refer to the Satellite Well House cut sheets attached to these specifications for complete construction details.

Division 3

Section 7

Painting

7.1 Paint Products

7.1.1 Materials specified are those that have been approved by the UTILITY. Products of the Sherwin Williams Company and the Tnemec Company are listed to establish a standard of quality. Equivalent materials of other manufacturers may be substituted on written approval of the UTILITY.

7.1.2 Requests for substitution shall include manufacturer's literature for each product giving the name, product number, generic type, descriptive information, solids by volume, recommended dry film thickness, and manufacturer's color charts.

7.1.3 Requests for substitution shall be submitted for approval at least 30 days prior to paint application.

7.2 Houses

7.2.1 Wood houses shall have at least two coats of Sherwin Williams A-100, latex flat exterior Plantation Brown paint applied to house and the trim.

7.2.2 Blockhouses shall be sealed and then have two coats of Sherwin Williams latex flat exterior A-100 Plantation Brown 90224.

7.3 New Hydro-pneumatic Tanks

7.3.1 Interior - Epoxy

7.3.1.1 Surface Preparation: Steel Structures Painting Council (SSPC) SP10, Near White Metal Blasting Cleaning. After surface preparation and prior to painting, all un-welded seams will be filled with Tnemec Series 63-1500 Filler and Surfacer.

7.3.1.2 1st Coat: Tnemec Series N140F-1255 Beige Pota-Pox primer at 4 dry mils per manufacturer's recommendation.

7.3.1.3 2nd Coat: Tnemec Series N140F-00 Tank White Pota-Pox finish at 5 dry mils per manufacturer's recommendation. After installation of final coat, interior shall be force cured for a minimum 24 hours with heated air.

7.3.1.4 A minimum of fourteen (14) days cure time shall be allowed before being placed into service.

7.3.1.5 Manufacturer approved thinners for specific Series and applications shall be used. Total dry film thickness shall be a minimum 9 dry mils per SSPC dry film thickness measuring standards.

7.3.2 Exterior - Epoxy / Polyurethane

7.3.2.1 Surface preparation: Steel Structures Painting Council (SPCC) SP10, Near White Metal Blast Cleaning.

7.3.2.2 1st Coat: Tnemec Series N14F-1255 Beige Pota-Pox Primer at 3.0 dry mils.

7.3.2.2 2nd Coat: Tnemec Series 1074 Endura-Shield (Color 84BR Weathered Bark) at 4.0 dry mils.

7.3.2.3 3rd Coat: Tnemec Series 1074U Endura-Shield (Color 84BR Weathered Bark) at 3.0 dry mils.

7.3.2.4 A minimum of seven (7) days cure time shall be allowed before placing into service.

7.3.2.5 Manufacturer approved thinners for specific Series and applications shall be used. Total dry film thickness of the new system shall be a minimum 10 dry mils.

7.3.3 Cathodic Separation protection

Cathodic Protection Material of ¾ inches minimum thickness shall be placed between the tank and the pedestals. This material will be wide enough and long enough to cover any areas that the tank and pedestals could possibly come into contact with each other.

7.3.4 Disinfection

All Hydro-pneumatic tanks shall be disinfected in accordance with North Carolina State Regulations and pass a bacteriological test.

A VOC sample may be collected by the UTILITY at its discretion.

Division 3

Section 8

Electrical

8.0 Maintenance Employee Safety is of the utmost importance. When devices are engineered and available that could limit incidents such as Arch-Flash, then equipment, panels, and boxes with design features built into them will be specified and used.

8.1 All electrical work shall be installed under a licensed electrician and shall pass all local and State inspection requirements.

8.2 Services

8.2.1 All new installations shall be equipped with power service.

8.2.2 Only copper conductors will be accepted for the service.

8.2.3 A grounding electrode of adequate size shall be connected to the well casing with two (2) driven electrode rods of 3/4" Minimum diameter. Driven grounding Rods shall be at least ten (10) feet apart. A ground test shall be performed and data presented to the UTILITY to insure adequate grounding is achieved.

8.2.4 All services shall have a minimum 200-amp meter base.

8.3 Panels

8.3.1 All control panels, transfer switches, meter, bases, branch circuit panels, electric boxes, motor control boxes, etc shall be NEMA rated as follows:

Located/mounted in the interior of a wellhouse/building shall be NEMA 4X

Located/mounted on the exterior of a wellhouse/building/remote well site (even if under a shed or building roof overhang) shall be NEMA 4X

8.3.2 Main well house panel shall be as specified by the UTILITY in Section 5, and shall be interior, surface mounted with a main breaker of specified size with a minimum of 16 circuits. Panels shall be a minimum of 200 Amp rated and include a NEMA 4X enclosure as specified above. Panels shall be ITE with copper busway.

Remote well house panels shall be identical to above in amp size, ITE with copper busway and minimum circuit rating. It shall be mounted in according to the Standard details and shall be NEMA Rated as listed above.

8.3.3 Each panel shall be provided with lightning arresters, Cutler Hammer CHS-A01 or equal.

8.3.4 When wiring is finished, the panel shall be labeled as to which breaker feeds what load.

8.3.5 Wiring loads shall be balanced in panels.

8.3.6 One 20 ample single pole breaker shall be installed as a spare in each panel.

8.3.7 All electrical outlets shall be protected by GFI breakers.

8.4 Magnetic Starters

8.4.1 As specified in Section 5, NEMD standard, with hand off/automatic (HOA) and an indicator light shall be used unless otherwise approved by the UTILITY. An Intermatic Model FF5M spring wound 5 minute timer switch shall be installed with a permanently marked cover to control the "auto-on" of the pump.

8.4.2 Each starter shall have two sets of normally open auxiliary contacts provided.

8.4.3 An adequate thermal overload shall be provided in each leg of the starter, as specified in the pump and motor manufacturer's specification book or attached chart.

8.4.4 Size of the starter will be determined by UTILITY.

8.4.5 Magnetic starts shall be Allen Bradley, NEMA 3R with 120 VAC coil.

8.5 Pressure Switches

If required, an Allen Bradley 835T-T253J (or UTILITY-approved equivalent) pressure switch will be installed.

8.6 Indicating Controls

An elapsed time meter and an impulse counter shall be mounted and wired by the contractor. Said elapsed time meter and impulse counter shall be selected from the attached materials list.

8.7 Telemetry/Radio Controls

8.7.1 If required , telemetry and/or radio controls will be designed and installed as approved by UTILITY at UTILITY's cost.

8.7.2 .UTILITY will pay for any SCADA equipment required.

8.8 Air Compressor

Where a hydro-pneumatic tank is installed, a compressor and controls shall be installed. Said compressor shall be selected from the attached parts list specified by UTILITY.

8.9 Chemical Receptacle

Three discrete circuit 115 VAC duplex GFI/GFCI receptacles shall be installed as shown in the Standard Details or as specified by the UTILITY. These receptacle outlets shall be permanently marked as "chemical".

8.10 Utility Receptacles

Two 115 VAC utility receptacle that are energized constantly and protected by a ground fault interrupter in addition to the breaker shall be installed. These receptacle outlets shall be permanently marked as "utility". One shall be located on the chemical panel side of house and one shall be located on the electrical panel side of house.

8.11 Lights

One LED vapor-tight ceiling mount fixture manufactured by LSI industries, model EG34SLEDHOCWUSEL, or equal, is required in each well house and shall be controlled from a wall switch at the entrance.

8.12 Heating

8.12.1 For a standard 10 X 10 well house, there shall be one four-foot 1,000-watt 240 volts AC baseboard heater mounted 6” above block on the interior wall. If the building is larger, then additional heating may be required.

8.12.2 The baseboard heater shall be controlled by a remote bulb thermostat. Thermostat shall be manufactured by White-Rodgers, Model #2B61-186.

8.12.3 If more than one baseboard heater is required baseboard heaters shall be substituted with one 3.3 kW unit heater.

8.13 Wire

8.13.1 All wire shall be copper of THW or THHN type and of adequate size.

8.14 Raceways

8.14.1 All raceways underground shall be minimum 2” schedule 40 PVC.

8.14.2 All exposed conduit shall be a sized according to conduit fill with exception of service masts which shall be of 2" rigid conduit.

8.14.3 Liquid tite flex or Carflex with the proper fittings shall be used from the well to the junction boxes, etc.

8.14.4 One hole or minerallic straps shall be used on all raceways in accordance with the N.E.C.

8.14.5 All building interior conduit shall be PVC

8.15 Fittings

8.15.1 PVC FS switch boxes shall be used for receptacles and switches.

8.15.2 Boxes and Fittings used with PVC pipe shall be of the PVC type.

8.16 Manual Transfer Switch

8.16.1 Equipment shall conform to the requirements of NFPA 70.

8.16.2 Products shall be listed and classified by UL or other North Carolina Recognized Third Party Testing Agency.

8.16.3 Equipment shall be NEMA ICS 10, manual transfer switch suitable for use as service equipment. Load side lugs shall be suitable for connection of two conductors per phase. The second set of conductors will be #6 AWG for connection to a surge protective device.

8.16.4 Ratings shall be for 480 volts, three phase, four wire, 60 Hz. 400A continuous rating or greater.

8.16.5 Enclosure shall be NEMA ICS 6, Type 3X.

8.16.6 Generator connections shall be installed in the base of the transfer switch. The connectors shall be Hubbell Single Pole Receptacles meeting the following:

400-amp panel mount
Mates with 300 or 400-amp plugs
Rated to 600 volts
Contact material shall be brass

Color sequence AND receptacle designations shall be as follows – Left to Right facing the transfer switch:

Single Phase installations:

Blue Male Receptacle, Black Male Receptacle, Green FEMALE Receptacle

Three Phase Installations:

Blue Male Receptacle, Orange Male Receptacle, Black Male Receptacle, Green FEMALE Receptacle

Division 3

Section 9

Excavation, Backfill, Compaction, Grading, & Restoration

9.1 General

This Section covers excavation, backfill, compaction, grading and restoration associated with utility trench and structural construction. All such WORK shall be performed by the CONTRACTOR concurrently with the WORK specified in these SPECIFICATIONS. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill, compaction, grading and slope protection required to complete the WORK shown on the DRAWINGS and specified herein. The WORK shall include, but not necessarily be limited to: pump stations, manholes, vaults, conduit, pipe, roadways and paving; all backfilling, fill and required borrow; grading; disposal of surplus and unsuitable materials; and all related WORK such as sheeting, bracing and water handling.

9.2 Soil Borings and Subsurface Investigations

Subsurface exploration and geotechnical engineering evaluation where provided is for the CONTRACTOR'S information only. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings.

The CONTRACTOR shall examine the site and undertake additional subsurface investigations including soil borings, if so desired, before commencing the WORK. UTILITY will not be responsible for presumed or existing soil conditions in the WORK area.

9.3 Existing Utilities

CONTRACTOR shall locate existing utilities in the areas of WORK. If utilities are to remain in place, the CONTRACTOR shall provide adequate means of protection during earthwork operations. Should uncharted or incorrectly charted piping or other utility conflicts encountered during excavation, the CONTRACTOR shall consult the owner of such piping or utility immediately for directions. Payment for damage and repair to such piping or utilities is the contractor's responsibility. Refer to Section 10.2 for utility coordination requirements.

UTILITY shall not be responsible for uncharted or incorrectly charted water and wastewater mains or other utilities. It is the contractor's responsibility to ensure that such facilities exist at the presumed point prior to commencing construction.

9.4 Materials

9.4.1 General: Materials for use as bedding and backfill, whether in-situ or borrow, shall be as described under this Section. The CONTRACTOR shall upon request by UTILITY, make an appropriate sample of this material available for testing by UTILITY or its

designated representative.

9.4.2 Structural Fill: Materials for structural fill shall be bedding rock or select common fill as specified herein or other suitable material as approved by UTILITY.

9.4.3 Common Fill: Common fill shall consist of material substantially free of organic material, loam, wood, trash and other objectionable material which may be compressible or which cannot be compacted properly. Common fill shall not contain stones larger than 4 inches in any dimension, asphalt, broken concrete, masonry, nibble or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Additionally, common fill shall be no more than 12 percent by weight finer than the No. 200 mesh sieve unless finer material is approved for use in a specific location by UTILITY.

9.4.4 Select Common Fill: Select common fill shall be as specified above from common fill, except that the material shall contain no stones larger than 1-1/2 inches in largest dimension, and shall be no more than 5 percent by weight finer than the No. 200 mesh sieve.

9.4.5 Bedding Rock: Bedding rock shall be 3/16 inch to 3/4 inch washed and graded stone (NCDOT #57). This stone shall be graded so that 90 to 100 percent will pass a 3/4 inch screen and 95 to 100 percent will be retained on a No. 8 screen. No stones larger than 1 inch in any dimension shall be accepted.

9.5 Dewatering, Drainage and Flotation

9.5.1 General: The CONTRACTOR shall excavate, construct and place all pipelines, concrete work, fill, and bedding rock, in-the-dry. In addition, the CONTRACTOR shall not install the final 24-inches of excavation until the water level is a minimum of one foot below the proposed bottom of excavation. For purposes of these SPECIFICATIONS, "in-the-dry" is defined to be within 2% of the optimum moisture content of the soil. UTILITY reserves the right to ask the CONTRACTOR to demonstrate that the water level is a minimum of one foot below proposed bottom of excavation before allowing the construction to proceed.

Discharge from dewatering shall be disposed of in such a manner that it will not interfere with the normal drainage of the area in which the WORK is being performed, create a public nuisance, or form ponding. No flooding of streets, driveways or private property will be permitted. The operations shall not cause injury to any portion of the WORK completed, or in progress, or to the surface of streets, or to private property. The dewatering operation shall comply with the requirements of appropriate regulatory agencies. Additionally, where private property will be involved, advance permission shall be obtained by the CONTRACTOR. Engines driving dewatering pumps shall be equipped with residential type mufflers. Where feasible, electrical "drops" shall be used in lieu of portable generators.

9.5.2 Additional Requirements: The CONTRACTOR shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations. The CONTRACTOR shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipelines to be built thereon have been completed.

Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at the proposed bottom of the excavation.

It is expected that wellpoints will be required for pre-drainage of the soils prior to final excavation for some of the deeper in-ground structures or piping and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline or fill will not be floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and negligible fines shall be removed by pumping.

The CONTRACTOR shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.

If required during backfilling and construction, water levels shall be measured in observation wells located as directed by UTILITY.

Continuous pumping will be required as long as necessary until completion of below grade activity.

9.6 Excavation

9.6.1 Excavation for Structures: All such excavations shall conform to the elevations and dimensions shown on the DRAWINGS within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removal of formwork, installation of services and other construction, inspection or as shown on the DRAWINGS. In excavating for footings and foundations, care shall be exercised not to disturb the bottom of the excavation. The bottom of excavations shall be rendered firm and dry before placing any structure or concrete.

9.6.2 Trench Excavation: Excavation for all trenches required for the installation of utility pipes shall be made to the depths indicated on the DRAWINGS and in such manner and to such widths as will give suitable room for installing the pipe within the trenches, for bracing and supporting and for pumping and drainage facilities.

The bottom of the excavations shall be firm and dry and in all respects acceptable to UTILITY.

Excavation shall not exceed normal trench width or depth as specified in the STANDARD DETAILS. Any excavation which exceeds the normal trench depth shall require special backfill requirements as determined by UTILITY.

Where pipes are to be installed on bedding rock, select common fill or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

Where pipes are to be installed directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being

excavated shall be done manually in such in a manner that will give a shaped bottom, true to grade, so that pipe can be evenly supported on undisturbed material, as specified in the STANDARD DETAILS. Bell holes shall be made as required.

9.7 Bedding and Backfill

9.7.1 General: Material placed in fill areas under and around structures and pipelines shall be deposited within the lines and to the grades shown on the DRAWINGS or as directed by UTILITY, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by UTILITY. If sufficient select common or common fill material is not available from excavation on site, the CONTRACTOR shall provide fill as may be required.

Fill shall be placed and spread in layers by a backhoe or other approved method, unless otherwise specified. Prior to the process of placing and spreading, all materials not meeting those specified under Division 3, Section 9.4 shall be removed from the fill areas. The CONTRACTOR shall assign a sufficient number of men to this WORK to insure satisfactory compliance with these requirements.

All fill materials shall be placed and compacted "in-the-dry." The CONTRACTOR shall dewater excavated areas as required to perform the work and in such manner as to preserve the undisturbed state of the natural inorganic soils.

Prior to filling, the ground surface shall be prepared by removing vegetation, debris, unsatisfactory soil materials, obstructions and deleterious materials. CONTRACTOR shall plow strip or break up sloped surfaces steeper than one vertical to four horizontal so that fill material will bond with the existing surface. When existing ground surface has a density less than that specified under Division 3, Section 12.9 for the particular area classification, CONTRACTOR shall break up the ground surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.

Before compaction, material shall be moistened or aerated as necessary to provide the optimum moisture content. Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits. If added moisture is required, water shall be applied by sprinkler trucks or other sprinkler systems, which will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued. The CONTRACTOR shall supply all hose, piping, valves, sprinklers, pumps, sprinkler trucks, hauling equipment and all other materials and equipment necessary to place water on the fill in the manner specified. CONTRACTOR shall compact each layer to required percentage of maximum dry density or relative dry density in accordance with Division 3, Section 9.9. Backfill or fill material shall not be placed on surfaces that are muddy, frozen or contain frost or ice.

9.7.2 Bedding and Backfill for Structures: Bedding rock shall be used for bedding under all structures as indicated on the STANDARD DETAILS. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed. Structural fill shall be used as backfill against the exterior walls of the structures. Fill shall be compacted sufficiently in accordance

with Division 3, Section 9.9.2 of these SPECIFICATIONS. If compaction is by rolling or ramming, material shall be wet down as required.

Backfilling shall be carried up evenly on all walls of an individual structure. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength.

In locations where pipes pass through building walls, the CONTRACTOR shall take precautions to consolidate the fill up to an elevation of at least one (1) foot above the bottom of the pipes. Structural fill in such areas shall be placed for a distance of not less than three (3) feet either side of the center line of the pipe in level layers not exceeding eight (8) inches in depth.

The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the DRAWINGS. No soft spots or uncompacted areas will be allowed in the WORK.

Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

9.7.3 Bedding and Backfill for Pipes: Bedding for pipe shall be as shown on the PLANS and detailed on the STANDARD DETAILS. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.

Backfilling over and around pipes shall begin as soon as practicable after the pipe has been installed, jointed and inspected. All backfilling shall be prosecuted expeditiously and as detailed on the STANDARD DETAILS.

Any space remaining between the pipe and sides of the trench shall be carefully backfilled and spread by hand or approved mechanical device and thoroughly compacted with a tamper as fast as placed, up to a level of one (1) foot above the top of the pipe. The filling shall be carried up evenly on both sides. Compaction shall be in accordance with the STANDARD DETAILS and Division 3, Section 9.9.

The remainder of the trench above the compacted backfill (as just described above) shall be filled and thoroughly compacted in uniform layers. Compaction shall be in accordance with the STANDARD DETAILS and Division 3, Section 9.9.

9.8 Compaction

9.8.1 General: The CONTRACTOR shall control soil compaction during construction to provide the percentage of maximum density specified. The CONTRACTOR shall provide UTILITY copies of all soils testing reports prepared by a GEOTECHNICAL/SOILS ENGINEER, demonstrating compliance with these SPECIFICATIONS.

When existing trench bottom has a density less than that specified under Division 3, Section 9.9.2, the CONTRACTOR shall break up the trench bottom surface, pulverize,

moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.

9.8.2 Percentage of Maximum Density Requirements: Fill or undisturbed soil from the bottom of the pipe trench to 1 foot above the pipe shall be compacted to a minimum density of 95% of the maximum dry density as determined by AASHTO T-180.

Non-Paved Areas: Backfill from 1 foot above utility pipe to grade shall be compacted to a minimum density of 95% of the maximum dry density as determined by AASHTO T-180.

Paved Areas: Backfill from 1 foot above utility pipe to bottom of subgrade shall be compacted to a minimum density of 98% of the maximum dry density as determined by AASHTO T-180.

Fill under and around structures, and to the extent of the excavation shall be compacted to a minimum density of 95% of the maximum dry density as determined by AASHTO T-180.

9.8.3 Compaction Tests: If the UTILITY deems it necessary, compaction tests can be required. The locations of compaction tests within the trench shall be in conformance with the following schedule, as determined by the UTILITY:

- One test at the spring line of the pipe.
- At least one test for each 12" layer of backfill within the pipe bedding zone for pipes 24 inches and larger.
- One test at an elevation of one foot above the top of the pipe.
- One test for each two feet of backfill placed from one foot above the top of the pipe to finished grade elevation.

If based on GEOTECHNICAL/SOILS ENGINEER testing reports and inspection, fill which has been placed is below specified density, CONTRACTOR shall provide additional compaction and testing prior to commencing further construction.

9.9 Topsoil

9.9.1 Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by Resident Engineer. Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 1/2 cubic foot in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work shall not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed.

9.9.2 Topsoil shall be uniformly redistributed in a 4-8-inch layer and lightly compacted to a minimum thickness of 4 inches. Any irregularities in the surface resulting from topsoiling or other operations shall be corrected in order to prevent formation of depressions or

water pockets. Topsoil shall not be placed while in frozen or muddy condition, when subsoil is excessively wet or in and condition detrimental to proper grading.

9.9.3 Erosion and sedimentation controls must be maintained when applying topsoil.

9.10 Grading

All areas within the limits of construction, including transition areas, shall be uniformly graded to produce a smooth uniform surface. Areas adjacent to structures or paved surfaces shall be graded to drain away from structures and pavement. Ponding shall be prevented. After grading, the area shall be compacted to the specified depth and percentage of maximum density.

No grading shall be done in areas where there are existing pipelines that may be uncovered or damaged, until such lines have been relocated.

9.11 Maintenance

CONTRACTOR shall protect newly graded areas from traffic and erosion and keep them free of trash and debris. CONTRACTOR shall repair and reestablish grades in settled, eroded and rutted areas.

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, CONTRACTOR shall scarify surface, reshape and compact to required density prior to further construction.

9.12 Inspection and Quality Assurance

9.12.1 Inspection: CONTRACTOR shall examine the areas and conditions under which excavating, filling and grading are to be performed, and not proceed with the WORK until unsatisfactory conditions have been corrected.

CONTRACTOR shall examine existing grade prior to commencement of WORK and report to UTILITY if elevations of existing grade vary from elevations shown on DRAWINGS.

9.12.2 Quality Assurance: All work shall be performed in compliance with applicable requirements of governing authorities having jurisdiction.

The CONTRACTOR, at his expense, shall engage soil testing and inspection services for quality control testing during earthwork operations. The testing and inspection service shall be subject to the approval of UTILITY.

Quality control testing shall be performed during construction to ensure compliance with these SPECIFICATIONS. CONTRACTOR shall allow the testing service to inspect and approve fill materials and fill layers before further construction is performed. The CONTRACTOR shall give copies of all test results in a report form to UTILITY to demonstrate compliance with compaction requirements stipulated in this MANUAL.

Division 3

Section 10

Boring and Jacking

10.1 General

The installation of a casing pipe by the method of boring and jacking shall be covered by these SPECIFICATIONS. The overall work scope shall include, but not be limited to, boring and jacking pits and equipment, sheeting, steel casing pipe, spacers, coatings, location signs as required, miscellaneous appurtenances to complete the entire WORK as shown on the STANDARD DETAILS, and restoration. Applicable provisions of Division 3 shall apply concurrently with these SPECIFICATIONS. Boring and jacking operations shall be performed within the right-of-way and/or easements shown on the DRAWINGS.

10.2 Pipe Material

10.2.1 Steel Casing: Steel casings shall conform to the requirements of ASTM Designation A 139 (straight seam pipe only) Grade "B" with minimum yield strength of 35,000 psi. The casing pipes shall have the minimum nominal diameter and wall thickness as shown on the following table:

Carrier Pipe Nominal Diameter	Casing Outside Diameter	Casing Wall Thickness (Hwy)	Casing Wall Thickness (RR)
4"	14"	.250"	.250"
6"	16"	.250"	.250"
8"	18"	.250"	.312"
10"	22"	.250"	.375"
12"	24"	.250"	.375"
14", 16"	30"	.312"	.500"
18", 20"	36"	.375"	.563”
24"	48"	.500"	.625"

The inside diameter of the casing pipe shall be a minimum of 3 inches greater than the outside diameter of the carrier pipe bell or coupling.

Field and shop welds of the casing pipes shall conform to the American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference

of the pipe and shall not increase the outside pipe diameter by more than 3/4 inch.

Casings shall extend a minimum of 5 feet beyond paved areas.

10.2.2 Carrier Pipe: The carrier pipe shall be minimum class 50 ductile iron pipes with restrained joints. Ductile iron pipe shall comply with the specification outlined in Division 3, Section 1 of these SPECIFICATIONS.

10.2.3 Inspection: All casing pipe to be installed may be inspected at the site of manufacture for compliance with these SPECIFICATIONS by an independent laboratory selected and paid for by UTILITY. The manufacturer's cooperation shall be required in these inspections.

All casing pipe shall be subjected to a careful inspection prior to being installed. If the pipe fails to meet the specifications, it shall be removed and replaced with a satisfactory replacement at no additional expense to UTILITY.

10.3 Pipe Handling

Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe shall not be dropped. All pipes shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe or coatings shall be repaired to the satisfaction of UTILITY.

10.4 Construction Requirements

10.4.1 Work Coordination: It shall be the contractor's responsibility to perform the boring and jacking work in strict conformance with the requirements of the agency in whose right-of-way or easement the work is being performed. Any special requirements of the agency such as insurance, flagmen, etc., shall be strictly adhered to during the performance of WORK. The special requirements shall be performed by the CONTRACTOR at no additional cost to UTILITY.

10.4.2 Dewatering: Dewatering through the casing during construction shall not be permitted. All dewatering methods shall be approved by UTILITY before construction work begins.

10.4.3 Carrier Pipe Support: The carrier pipes shall be supported within the casing pipes so that the pipe bells do not rest directly on the casing. The load of the carrier pipes shall be distributed along the casing by casing spacers. Casing spacers shall be bolt on style split shell metal spiders with bituminous coating or approved equal. All nuts and bolts shall be stainless steel. Runners shall be made of a high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction.

10.4.4 Jacking Pits: Excavation adjacent to the roads shall be performed in a manner to adequately support the roads. Bracing, shoring, sheeting or other supports shall be installed as needed. CONTRACTOR shall install suitable reaction blocks for the jacks as required. Jacking operations shall be continuous and precautions shall be taken to avoid interruptions which might cause the casing to "freeze" in place. Upon completion of jacking operations, the reaction blocks, braces, and all other associated construction materials shall be completely removed from the site.

10.4.5 MISCELLANEOUS REQUIREMENTS: Correct line and grade shall be carefully maintained. Earth within the casing shall not be removed too close to the cutting edge in order to prevent the formation of voids outside the casing. If voids are formed, they shall be satisfactorily filled with grout by pumping.

The sections of steel casing shall be field welded in accordance with the applicable portions of AWWA C206 and AWS D7.0 for field welded pipe joints. CONTRACTOR shall wire brush the welded joints and paint with Inertol Quick-Drying Primer 626 by Koppers Company or approved equal. After completion of jacking, CONTRACTOR shall clean the interior of the casing of all excess material.

The annular space between the carrier pipe and casing shall be filled with clean sand, if required in the Bore and Jack permit. Masonry plugs shall be installed at each open end of the casing. Plugs shall be 12" thick and suitable for restraining the earth load while allowing drainage of the casing.

Division 3

Section 11

Pressure Pipe Restraint

11.1 General

Pressure pipe fittings and other items requiring restraint shall be braced with restraining assemblies as specified in this Section.

11.2 Restrained Joint Construction

Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained "Locked-type" joints manufactured by the pipe and fitting manufacturer and the joints shall be capable of holding against withdrawal for line pressures of a minimum 150 psi. Mechanical joint ductile iron pipe retainer glands shall not be permitted. Any restrained joints that allow for elongation upon pressurization will not be allowed in those locations where the pipe comes out of the ground.

Restrained pipe joints that achieve restraint by incorporating cut out sections in the wall of the pipe shall have a minimum wall thickness at the point of cut out that corresponds with the minimum specified wall thickness for the remainder of the pipe.

The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil.

The required lengths of restrained joint ductile iron pipe and PVC pipe shall be determined by the ENGINEER and shown in a tabular form as depicted on the "Restrained Joint Detail" in the STANDARD DETAILS.

Wherever 2-45° bends are used in place of a 90° bend and the minimum length of restrained pipe required from one 45° bend extends beyond the other 45° bend, the 2-45° bends will be considered as though a 90° bend were located midway between the 2-45° bends. No use of 90 degree bends is allowed unless approved by the UTILITY in writing.

11.3 Mechanical Restraining Devices

11.3.1 General: Mechanical Restraining Devices as specified herein may be substituted for the restrained "Locked-Type" joints. The length of pipe to be restrained shall be based on the "Restrained Joint Detail" in the STANDARD DETAILS.

11.3.2 Joint Restraint Device: Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure

increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A536. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A11.11 and ANSI/AWWA C153/A21.53. Twist-off nuts shall be used to insure proper actuating of the restraining devices.

The mechanical joint restraint device shall have a working pressure of at least 150 psi with a minimum safety factor of 2:1 (this will be shown on the PLANS).

Division 3

Section 12

Connections to Pressure Mains

12.1 General

Installations of pressure connections 2" and larger shall be made in accordance with this Section.

12.2 Tapping Sleeves

12.2.1 General: Tapping sleeves shall be mechanical joint sleeves or fabricated steel sleeves as specified below. All pressure connections to asbestos cement pipe and all "size on size" taps shall utilize mechanical joint sleeves.

12.2.2 Mechanical Joint Sleeves: Sleeves shall be cast of gray-iron or ductile-iron and have an outlet flange with the dimensions of the Class 125 flanges shown in ANSI B16.1, properly recessed for tapping valve. Glands shall be gray-iron or ductile iron. Gaskets shall be vulcanized natural or synthetic rubber. Bolts and nuts shall comply with ANSI/AWWA Cl 11/A21.11. Sleeves shall be capable of withstanding a 200-psi working pressure.

12.2.3 Steel Tapping Sleeves: Sleeves shall be fabricated of minimum 3/8" carbon steel meeting ASTM A285 Grade C. Outlet flange shall meet AWWA C-207, Class "D" ANSI 150 lb. drilling and be properly recessed for the tapping valve. Bolts and nuts shall be high strength low alloy steel to AWWA Clll (ANSI A21.11). Gasket shall be vulcanized natural or synthetic rubber. Sleeve shall have manufacturer-applied fusion bonded epoxy coating, minimum 12 mil thickness.

12.2.4 Tapping Valves: Tapping valves shall meet the requirements of Section 22.2 except that units shall be flange by mechanical joint ends. Valves shall be compatible with tapping sleeves as specified above and specifically designed for pressure connection operations.

12.3 NOTIFICATION AND CONNECTION TO EXISTING MAINS

TO AVOID THE POSSIBILITY OF ISOLATION VALVES BEING LEFT OPEN - All connections to existing mains shall be made by the CONTRACTOR only after the connection procedure and his work scheduling has been reviewed and approved by UTILITY. All connections to existing piping will be such that the connection is made through a wet tap with tapping valve or the connection is started with a gate valve. This is to ensure that the existing system's cleanliness and sanitation is maintained until the new piping system has satisfactorily passed all test and has been disinfected The CONTRACTOR shall submit a written request to UTILITY a minimum of one (1) week prior to scheduling said connections. In his request he shall outline the following:

1. Points of connection, fittings to be used, and method of flushing and disinfection if applicable.

2. Estimated construction time for said connections.

UTILITY shall review the submittal within one (1) week after receiving it and inform the CONTRACTOR regarding approval or denial of his request. If his request is rejected by UTILITY, the CONTRACTOR shall resubmit his request modifying it in a manner acceptable to UTILITY.

All connections shall only be made on the agreed upon date and time. If the CONTRACTOR does not initiate and complete the connection work in the agreed upon manner, he shall be required to reschedule the said connection by following the procedure outlined above.

The CONTRACTOR shall not operate any valves in the system.

12.4 Installation

12.4.1 Excavation, Backfill, Compaction and Grading: The applicable provisions of Division 3, Section 9 shall apply.

12.4.2 Construction Details: Sufficient length of main shall be exposed to allow for installation of the tapping sleeve and valve and the operation of the tapping machinery. The main shall be supported on concrete pedestals or bedding rock at sufficient intervals to properly carry its own weight, plus the weight of the tapping sleeve valve and machinery. Any damage to the main due to improper or insufficient supports shall be repaired at the contractor's expense.

The inside of the tapping sleeve and valve, the outside of the main, and the tapping machine shall be cleaned and swabbed or sprayed with 10% liquid chlorine prior to beginning installation for water system pressure connections.

After the tapping sleeve has been mounted on the main, the tapping valve shall be bolted to the outlet flange, making a pressure tight connection. Prior to beginning the tapping operation, the sleeve and valve shall be pressure tested at 150 psi to ensure that no leakage will occur.

For pressure connections 12" diameter or less, the minimum diameter cut shall be 1/2" less than the nominal diameter of the pipe to be attached. For 14" through 20" installations, the minimum diameter shall be 1 1/2" less; for larger taps, the allowable minimum diameter shall be 2" to 3" less than the nominal diameter of the pipe being attached. After the tapping procedure is complete, the CONTRACTOR shall submit the coupon to UTILITY.

Adequate restrained joint fittings shall be provided to prevent movement of the installation when test pressure is applied. Provisions of Division 3, Section 11 shall apply.

Division 3

Section 13

Pipe Material for Water Mains and Service Connections

13.1 General

These SPECIFICATIONS cover the pipe, fittings, and accessory items used for water distribution systems.

Pipe used in water distribution systems shall be either polyvinyl chloride (PVC), or ductile iron pipe (DIP).

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of substantial completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by UTILITY, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

All water main materials, including pipe and fittings, shall meet NSF/ANSI 61 standards per rule .0406 of the Rules Governing Water Systems.

13.2 PVC Pipe

13.2.1 PVC Pipe: All PVC pipe of nominal diameter three (3) through twelve (12) inches shall be manufactured in accordance with AWWA Standard C900, latest edition. The PVC pipe shall have a minimum working pressure rating of 200 psi and shall have a dimension ratio (DR) of 14. Pipe shall be the same O.D. as ductile iron pipe. PVC pipe smaller than three (3) inches shall be SDR 21 Class 200.

13.2.2 Joints: PVC pipe shall have integral bell push-on type joints conforming to ASTM D3139.

13.2.2 Fittings: Fittings used with C900 PVC pipe shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings four (4) through twenty-four (24) inches in accordance with ANSI/AWWA A21.53/C153.

Fittings used with 3" and smaller PVC pipe shall be manufactured from virgin rigid PVC (polyvinyl chloride) compounds with a Cell Class of 12454 as identified in ASTM D 1784. All fitting shall be threaded unions Bell and spigot with elastomer gaskets, or compression type – no glue joints are to be used.

13.3 Ductile Iron Pipe & Fittings

13.3.1 Ductile Iron Pipe: All ductile iron pipe of nominal diameter (3) through fifty-four (54) inches shall conform to ANSI/AWWA A21.50/C150 and ANSI/AWWA A21.51/C151. A minimum of Class 50 pipe shall be supplied for all sizes of pipe unless specifically called out in the DRAWINGS, or required by UTILITY.

13.3.2 Fittings: Any fittings required shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings three (3) through twenty-four (24) inches in accordance with ANSI/AWWA A21.53/C153.

13.3.3 Joints: Joints for ductile iron pipe and fitting joints shall be push-on or mechanical joints conforming to ANSI/AWWA A21.11/C111. Where called for in the plans, restrained or flanged joints shall be provided. Flanged joints shall conform to ANSI Standard B 16.1-125 LB. Restrained joints shall conform to Division 3, Section 1, 11.3.

13.3.4 Polyethylene Encasement: The pipe shall be polyethylene encased (8 mil) where shown on the DRAWINGS or required by UTILITY in accordance with ANSI/AWWA A21.51/C105.

13.4 Service Pipe, Stops, Fittings, and Service Saddles

13.4.1 Service Pipe: All service lines shall be 3/4", 1", 1-1/2" or 2" blue polyethylene tubing conforming to specifications in AWWA C800 and AWWA C901. One and one-half inch (1-1/2") and larger shall be sized in accordance with the Iron Pipe Sizing Standard (IPS);3/4 " and 1" shall be the Copper Tube Sizing Standard (CTS)

13.4.2 Stops: Corporation stops shall be ¾", 1", 1-1/2" or 2" brass, equipped with connections compatible with the polyethylene tubing and threaded in accordance with specifications in AWWA C800 and AWWA C901. Curb stops shall be sized to match the meter size and conform to the specifications in AWWA C800 and AWWA C901. There will be one corporation stop at the main tap and start of the service line. There will be a second corporation stop type of ball valve placed at the end of the service line and prior to the meter yoke so that the meter yoke can be isolated. The second ball corporate stop shall be accessible from inside of the meter box.

13.4.3 Fittings: Fittings shall be brass, cast and machined in accordance with specifications in AWWA C800 and AWWA C901, with compatible polyethylene tubing connections.

13.4.4 Service Saddles: A service saddle shall be used for all service line taps. Service saddles shall be double strap, anchored by a minimum four (4) bolt pattern on a ductile iron saddle body. Service saddles for PVC pipe shall have the double strap sized exactly to the pipe outside diameter. Sealing gaskets shall be BUNA-N rubber and straps shall be corrosion resistant alloy steel.

UTILITY may require a stainless-steel strap and fusion epoxy or nylon coated ductile iron body with stainless steel hardware in areas designated as corrosive.

13.4.5 All services shall be sleeved with 2" schedule 40 PVC or greater under paved areas.

Division 3

Section 14

Water Main Installation, Disinfection and Pressure Testing

14.1 General

Pipe shall be installed in accordance with the manufacturer's specifications and instructions for the type of pipe used and applicable AWWA standards, such as C600 and C603, unless otherwise stated in these SPECIFICATIONS.

14.2 Pipe Handling

All types of pipe shall be handled in such manner as will prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of UTILITY or be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on properly prepared ground, graded to eliminate all rock points and to provide uniform support along the full length. When being transported, the pipe shall be supported at all times in a manner which will not permit distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of UTILITY, is damaged beyond repair by the CONTRACTOR shall be removed from the site of the work and replaced with another unit.

Joint gaskets shall be stored in clean, dark, dry location until immediately before use.

Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and reinstalled. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by UTILITY to ensure absolute cleanliness inside the pipe.

14.3 Separation of Water Mains and Sewers

14.3.1 General: Water mains that are installed in the vicinity of pipe lines designated to carry raw wastewater or reclaimed water (wastewater effluent) shall meet the horizontal and vertical separations specified below.

14.3.2 Horizontal Separation: A minimum horizontal separation of ten feet, outside of pipe to outside of pipe, shall be maintained between potable water piping and domestic wastewater gravity piping or storm water piping.

A minimum horizontal separation of ten feet, outside of pipe to outside of pipe, shall be maintained between potable water piping and reclaimed water piping carrying unrestricted public access reuse water.

Where it is not possible to maintain the required horizontal separation, the potable water

main may be laid in a separate trench or on an undisturbed earth shelf located on one side of the wastewater gravity piping, storm water piping or reclaimed water piping and at such an elevation that the bottom of the water main is at least eighteen inches above the top of the other pipe.

If the minimum allowable ten feet of horizontal separation or eighteen inches vertical separation in a separate trench cannot be maintained, the water pipe shall be ductile iron if the other pipe is a storm water pipe that may not be possibly upgraded in material and joint type.

If the minimum allowable ten feet of horizontal separation or eighteen inches vertical separation in a separate trench cannot be maintained, the water pipe and sanitary sewer pipe shall be ductile iron.

If the other pipe is a reclaimed water pipe and the above separation requirements are not met, the reclaimed water pipe shall be ductile iron.

Deviations from these requirements and other alternatives may be considered on a case-by-case basis if supported by data from the design engineer and must receive specific approval by the Department prior to implementation.

There shall be at least a 10-foot horizontal separation between potable water piping and sanitary sewer force mains without exception. Field conditions not allowing the minimum separation being achieved shall be reported to the engineer. Specific solutions to separation problems as proposed by the engineer must be accepted by the Department prior to implementation.

No water main shall pass through or come in contact with any part of a sanitary sewer manhole or storm sewer structure.

14.3.3 Vertical Separation: A minimum vertical separation of eighteen inches, outside of pipe to outside of pipe, shall be maintained between potable water piping, wastewater gravity piping, storm water piping or reclaimed water piping.

When there is less than eighteen inches of net vertical clearance between the potable water pipe and storm water pipe, the water piping shall be ductile iron. One full length of pipe shall be centered at the point of crossing.

If the minimum allowable ten feet of horizontal separation or eighteen inches vertical separation in a separate trench cannot be maintained, the water pipe and sanitary sewer pipe shall be ductile iron.

If the other pipe is a reclaimed water pipe and the above vertical separation requirements are not met, the reclaimed water pipe shall be ductile iron.

Special structural support or concrete saddles may be necessary at the pipe crossing location.

It is preferable to install the potable water pipe above the domestic wastewater, storm water or reclaimed water pipe at crossings.

Deviations from the separation requirements and other alternatives may be considered on a case-by-case basis if supported by data from the design engineer and must receive specific approval from the UTILITY and PWS prior to implementation.

There shall be a minimum of eighteen inches of net vertical separation between water mains and sanitary sewer force mains without exception. Situations where it is not possible to maintain the required vertical separation shall be reported to the engineer. Specific solutions as proposed by the engineer must be accepted by the UTILITY and PWS prior to implementation.

14.3.4 Crossing a Water Main over a Sewer: Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least eighteen inches above the top of the sewer, unless local conditions or barriers prevent an eighteen inch vertical separation – in which case both the water main and sewer shall be constructed of ferrous materials and with joints that are equivalent to water main standards for a distance of ten feet on each side of crossing.

14.3.5 Crossing a Water Main under a Sewer: Whenever it is necessary for a water main to cross under a sewer, both the water main and the sewer shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of ten feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

14.4 Trench Preparation and Pipe Bending

14.4.1 Trench Preparation and Pipe Bedding: Applicable provisions of Division 3, Section 9 shall apply. Also refer to STANDARD DETAILS.

14.4.2 Pipe Preparation and Handling: All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken, or otherwise defective materials are being used. CONTRACTOR shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

CONTRACTOR shall use proper implements, tools, and facilities for the safe and proper protection of the WORK. CONTRACTOR shall lower pipe into the trench in such a manner as to avoid any physical damage to the pipe and shall remove all damaged pipe from the job site. Care shall be taken not to drop or dump pipe into trenches under any circumstances.

14.4.3 Trench Dewatering and Drainage Control: Specifications from Division 3, Section 9 shall apply. CONTRACTOR shall prevent water from entering the trench during excavation and pipe installation operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be installed in water.

14.4.4 Survey Line and Grade: Pipe shall be installed to the lines and grades shown on the PLANS. The CONTRACTOR shall provide line and grade stakes at a 1,000-foot maximum spacing and at all line and/or grade change locations. CONTRACTOR shall provide Temporary Bench Marks at maximum 1,000-foot intervals. The minimum pipe depth shall be three (3) feet below the finished grade surface or three (3) feet below the elevation of the edge of pavement of the road surface whichever is greater.

14.4.5 Pipe-laying in Trench: CONTRACTOR shall prevent foreign material from entering the pipe while it is being placed in the trench. CONTRACTOR shall remove all foreign material from the pipe or joint ring before the next pipe is placed. If the pipe-laying crew cannot put the pipe into the trench, and in place, without getting soil into the pipe, UTILITY may require that snugly-fitted, tightly-woven canvas bags be placed over each end before lowering the pipe. The bags shall be left in place until the connection is to be made to the adjacent pipe. During laying operations, CONTRACTOR shall keep debris, tools, clothing, or other materials out of the pipe.

14.4.6 Installing PVC Pipe: All PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL "Handbook of PVC Pipe Design and Construction" unless such standards conflict with this MANUAL in which case this MANUAL shall apply.

14.4.7 Installing Ductile Iron Pipe: All ductile-iron pipe shall be installed in accordance with AWWA C600 unless such standards conflicts with this MANUAL in which case this MANUAL shall apply. CONTRACTOR shall cut pipe only as necessary to comply with alignment shown on the PLANS. Flame cutting of pipe shall not be allowed.

CONTRACTOR shall provide special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes shall be permitted under any circumstances.

The pipe shall be polyethylene encased (8 mil) where shown on the DRAWINGS in accordance with ANSI/AWWA A21.51/C105.

14.4.8 Installing Pipes on Curves: Long radius curves, either horizontal or vertical, may be installed with standard pipe by deflections at the joints. Maximum deflections at pipe joints and laying radius for the various pipe lengths shall be as recommended by the pipe manufacturer.

14.4.9 Pipe Restraining: Requirements specified in Division 3, Section 11 shall apply.

14.4.10 Bedding and Backfill for Pipes: Requirements specified in Division 3, Section 9 shall apply.

14.5 Hydrostatic Tests

14.5.1 General: Hydrostatic tests shall consist of pressure test and leakage test. Hydrostatic tests shall be conducted on all newly installed pressure pipes, joints and valves including all service lines to the curb stops. Air testing of pressure pipes will not be permitted under any circumstance. Tests may be made on sections not exceeding 2,000 feet, when this procedure is acceptable to UTILITY. CONTRACTOR shall furnish all necessary equipment and material, make all taps, and furnish all closure pieces in the pipe as required. Equipment to be furnished by the CONTRACTOR shall include graduated containers, pressure gauges, hydraulic force pumps, and suitable hoses and piping. UTILITY will monitor and approve a satisfactory test.

When filling and/or flushing a new water line extension that is connected to an existing system, the valve between the two shall always stay closed. Filling and/or flushing shall

be accomplished through and adequately sized "jumper". The jumper shall consist of a tap onto the existing water line, a valve, a Reduced Pressure Zone (RPZ) backflow preventer, a valve, and a tap into the new extension. Filling and flushing of the new water line shall be accomplished through this tap. At no time shall the RPZ be removed until written authorization has been received from the UTILITY. The operation of the valves shall be coordinated with the UTILITY.

ONCE THE NEW WATER LINE EXTENSION IS ACCEPTED BY THE UTILITY, ALL TEMPORARY TAPS, PIPING AND RPZs SHALL BE REMOVED 9TAPS CAN BE ABANDONED IN PLACE.

The CONTRACTOR may conduct hydrostatic tests after the trench has been partially backfilled with the joints left exposed for inspection for his informational purposes only. The hydrostatic tests for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified. Where any section of pipe is provided with concrete thrust blocking, pressure test will not be made until at least five days have elapsed after the thrust blocking is installed.

The CONTRACTOR is to provide UTILITY 48 hour notice before any pressure testing is to begin.

14.5.2 Testing Criteria: All pipe sections to be pressure tested shall be subjected to a hydrostatic pressure of 150 psi. The duration of each pressure test shall be for a period of 2 hours. If during the test, the integrity of the tested line is in question, UTILITY may require a 6-hour pressure test. The basic provisions of AWWA C-600 and C-605/M23 shall be applicable.

14.5.3 Procedure for Pressure Test: Each section of pipe to be tested, as determined by UTILITY, shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, and appropriate valves installed to ensure bleeding of all air from the main. If defective pipes, fittings, valves, or hydrants are discovered in consequence of this pressure test, all such items shall be removed and replaced by the CONTRACTOR with sound material and the test shall be repeated until satisfactory results are obtained. Provisions of AWWA C600 and C605/M23, where applicable, shall apply.

14.5.4 Procedure for Leakage Test: After completion of the pressure test, a leakage test shall be conducted to determine the quantity of water lost by leakage under the specified test pressure. Applicable provisions of AWWA C600 and C605/M23 shall apply.

Allowable leakage in gallons per hour for pipeline shall not be greater than that determined by the formula:

$$L = \frac{SD(P)^{1/2}}{148{,}000}.$$

L = Allowable leakage in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of the pipe in inches.
P = Average test pressure during leakage test in pounds per square inch gauge.

Leakage is defined as the quantity of water to be supplied in the newly installed pipe or any valve section under test which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. Should any test of pipe installed disclose leakage greater than that allowed, CONTRACTOR shall locate and replace or repair the defective joints, pipe or valve until the leakage from subsequent testing is within the specified allowance.

In accordance with Division 1 Section 2, the engineer of record shall submit a certifying statement/report on the results of the testing with the Final Certification Package.

14.6 Disinfection of Water Mains

14.6.1 General: Before being placed in service, all new water mains shall be chlorinated in accordance with the specifications below and the procedures outlined in AWWA C651 "Standard Procedure for Disinfecting Water Mains." , section 4.4.3, the Continuous Feed Method, and section .1003 of *The Rules Governing Public Water Supply Systems*.

14.6.2 Flushing: Sections of pipe to be disinfected shall first be directionally flushed (full diameter) to remove any solids or contaminated material that may have become lodged in the pipe. If no hydrant is installed at the end of the main, then a blow-off valve shall be provided large enough to develop a velocity of at least 2.5 feet per second in the main.

A Disinfection plan must be presented to the UTILTY prior to disinfection/flushing. If additional valves and/or blow-offs/hydrants are required to achieve a directional flushing, they will be provided by the Contractor as part of the construction.

All taps required for chlorination or flushing purpose or for temporary or permanent release of air shall be provided for by the CONTRACTOR as a part of the construction of water mains. After the disinfection, all such taps shall be sealed to the satisfaction of UTILITY.

14.6.3 Disinfection Criteria: Before being placed into service, all new mains and repaired portions of, or extensions to existing mains shall be chlorinated so that the initial chlorine residual is not less than 50 mg/1.

14.6.4 Form of Applied Chlorine: Chlorine may be applied as liquid chlorine (gas-water mixture), or a mixture of water and high-test calcium hypochlorite. CONTRACTOR shall assume responsibility for safe handling of chlorine and shall meet requirements of OSHA and other regulatory agencies for safe handling of chlorine.

14.6.5 Point of Application: The preferred point of application of the chlorinating agent is at the beginning of the pipe line extension or any valved section of it, and through a corporation stop inserted in the pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipe line extension. Alternate points of applications may be used when approved or directed by UTILITY.

14.6.6 Operation of Aqua North Carolina Valves: Valves shall be manipulated by UTILITY personnel so that the strong chlorine solution in the line being treated will not flow back

into the line supplying the water.

14.6.7 Retention Period: Treated water shall be retained in the pipe at least 24 hours.

14.6.8 Chlorinating Valves and Hydrants: In the process of chlorinating newly installed pipe, all valves or other appurtenances shall be operated while the pipe line is filled with the chlorinating agent and under normal operating pressure.

14.6.9 Final Flushing and Testing: Following chlorination, all treated water shall be thoroughly flushed from the newly installed pipe at its extremity until the replacement water throughout its lengths shows upon test, a free chlorine residual not in excess of 1 ppm after flushing.

After flushing; water samples, as directed by UTILITY, shall show acceptable bacteriological results. All bacteriological testing shall be performed by a private laboratory. All such bacteriological analysis must be performed by a laboratory certified by the State of North Carolina.

Proper chain of custody procedures must be followed and samples shall only be collected by certified laboratory personnel in the presence of UTILITY'S personnel.

Copies of testing results and all related correspondence with the NCDENR shall be submitted to UTILITY.

14.6.10 Repetition of Flushing and Testing: Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the CONTRACTOR until satisfactory results are obtained. The water lines shall not be placed into service until bacteriological test results are found to be satisfactory by a state-approved laboratory.

14.7 Notification and Connection to Existing Mains

Requirements specified in Division 3, Section 12.3 shall apply.

14.8 Cross-Connection Control

14.8.1 Inspection and Testing: Backflow prevention assemblies shall be tested by a certified cross-connection control technician in the presence of a UTILITY representative.

All backflow prevention assemblies shall be inspected and approved by UTILITY prior to project acceptance and service being provided.

14.9 Water Service Piping and Connection

Water service piping and connection shall be installed as indicated in the STANDARD DETAILS. The location of all service lines shall be as shown on the DRAWINGS and shall be either single or dual service. On curbed streets, the exact location for each installed service shall be marked by etching or cutting a "W" in the concrete curb. Where no curb exists, locations shall be adequately marked by a method approved by UTILITY.

14.10 Location and Identification

All PVC water mains shall be a solid blue color. All water mains shall have an "Early Warning" protection tape installed continuously along the alignment. The protection tape shall be installed during backfilling 8 to 12 inches below finished grade directly over the pipe and be continuously marked "Caution, Water Main Buried Below." The tape shall have a metallic detectable strip included and be blue in color. All protection tape shall be as Terra-Tape or equal. See STANDARD DETAILS. In addition to the warning tape there shall be installed a 12 gage THNN location wire. Concurrent Ends of this location wire shall be physically connected utilizing a protective corrosion resistant connector as approved by the UTILITY.

All ductile iron water mains shall either be marked with a continuous 2-inch wide blue stripe located within the top 90 degrees of the pipe or wrapped in blue polyethylene bags. Backfill shall not be placed for 30 minutes following paint application.

Division 3

Section 15

Valves, Hydrants & Accessories

15.1 General

All valves and appurtenances shall be products of well established firms who are fully experienced and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these SPECIFICATIONS as applicable.

15.2 Resilient Seat Gate Valves

15.2.1 General: All gate valves twenty-four (24) inches and smaller shall be resilient seat gate valves. All Valves with be clock-wise closed and counter clock-wise open Such valves shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509, latest revision, and in accordance with the following SPECIFICATIONS. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the pipe

15.2.2 Material: The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class B. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating. A 2" wrench nut shall be provided for operating the valve in a buried installation. All valves shall be tested in strict accordance with AWWA C509. All valves are to open counterclockwise.

15.2.3 Miscellaneous Requirements: The valves shall be right hand open, non-rising stem with the stem made of cast, forged, or rolled bronze as specified in AWWA C509. Two stem seals shall be provided and shall be of the o-ring type. The stem nut must be independent of the gate.

The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

15.3 Butterfly Valves

15.3.1 General: All shut-off valves sixteen (16) inches and larger shall be butterfly valves. Butterfly valves and operators shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, except as hereinafter specified. Valves, except as specified hereinafter, shall be Class 150A or B. All Valves with be clock-wise closed and counter clock-wise open

15.3.2 Material: The valve body shall be constructed of close grain cast iron per ASTM A126, Class B or equivalent material. All retaining segments and adjusting devices shall be of

corrosion resistant material. Valve seats shall be a natural rubber or synthetic rubber compound. Valve seats 30 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material. Valves 24 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C504.

15.3.3 Face-to-Face Dimension: The face-to-face dimensions of valves shall be in accordance with above mentioned AWWA Specification for short-body valve.

15.3.4 Valve Shaft: The valve shaft shall be turned, ground, polished and constructed of 18-8 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one-piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design.

15.3.5 Valve Operator: In general, the butterfly valve operators shall conform to the requirements of AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable

15.4 Valve Installation

All valves shall be inspected upon delivery in the field to insure proper working order before installation. They shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connection ends furnished. All valves and appurtenances shall be installed true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of UTILITY before they are installed.

Valves shall be installed in a vertical position and be provided with a standard valve box so arranged that no shock will be transmitted to the valve. The box shall be vertically centered over the operating nut, and the cast iron box cover shall be set flush with the road bed or finished surface.

After installation, all valves shall be subjected to the field test for piping as outlined in Division 3, Section 14 of these SPECIFICATIONS. Should any defects in materials or workmanship appear during these tests, the CONTRACTOR shall correct such defects to the satisfaction of UTILITY.

Flanged joints shall be made with hot dipped galvanized bolts, nuts and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe. All buried bolts and nuts shall be heavily coated with two (2) coats of bituminous paint

15.5 Valve Boxes

All buried valves shall have cast-iron three-piece valve boxes Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at the finished grade surface as directed by UTILITY. The barrel shall be two-piece, sliding type, having 5-1/4 inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with cast iron covers. Covers shall have "WATER" cast into the top for all water mains. The actuating nuts for deeper valves shall be extended to come up to 4-foot depth below finished grade.

Care shall be taken while constructing valve boxes to ensure that valve stems are vertical and the cast iron box has been placed over the stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. CONTRACTOR shall remove any sand or undesirable fill from valve box prior to final inspection.

All valve boxes shall be equipped with concrete collar.

15.6 Air Release Valves

The air release valves for use in water mains shall be installed as shown on the STANDARD DETAILS. Valves used for 6 inch water lines and larger shall have a cast-iron body or bronze body, cover and baffle, stainless steel float, bronze water diffuser, Buna-N or Viton seat and stainless-steel trim. Vales used on water lines smaller than six inches shall have a cast iron body with a stainless-steel float and trim, Buna-N valve with a stainless steel seat. Valves shall be provided with a vacuum check to prevent air from re-entering the line. The fittings shall be threaded (NPT).

15.7 Hydrants

15.7.1 Material: Hydrants shall have a 5-1/4 inch valve opening and shall comply with AWWA Standard C502 for hydrants for water works service, unless in conflict with MANUAL, in which case this MANUAL shall apply. Each hydrant shall have 6-inch mechanical joint ends with harnessing lugs ("dog ears") and shall open by turning to the left (counter-clockwise). Hydrant shall be of ample length for 3-1/2 foot depth of bury. It shall be provided with two 2-1/2 inch hose nozzles and one 5 1/4 inch pumper nozzle, all having National Standard hose threads. Nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard (pentagonal, measuring 1-1/2 inch point to flat). Hydrants shall be equipped with "O-Ring" packing.

15.7.2 Painting: All iron parts of the hydrant both inside and outside shall be painted, in accordance with AWWA C502. All inside surfaces and the outside surfaces below the ground line shall be coated with asphalt varnish. They shall be covered with the two coats, the first having dried thoroughly before the second is applied

The outside of the hydrant above the furnished ground line shall be thoroughly cleaned and thereafter painted with one coat of paint of a durable composition.

15.7.3 Construction Details: Hydrants shall be plumb and shall be set so that the lowest hose connection is, at least, eighteen (18) inches above the surrounding finished grade. All hydrants shall be inspected in the field upon delivery to the job to insure proper operation before installation. The resetting of existing hydrants and moving and reconnecting of existing hydrants shall be handled in a manner similar to a new-installation. Hydrant shall be constructed in accordance with the STANDARD DETAILS.

15.7.4 Location: Hydrants shall be located in the general location as shown on the DRAWINGS. All hydrants shall be located no less than five (5) and no more than ten (10) feet from the edge of pavement of the adjacent roadway and no less than five (5) feet from any physical feature which may obstruct access or view of any hydrant, unless otherwise approved by the applicable county and UTILITY

DIVISION 4
STANDARD DETAILS

Figure No.	**Title**
1	Bore & Jack Detail Casing
2	Pavement Crossing
3	Standard Roadway Open-Cut Detail
4	Utility Separation Details
5	Typical Conflict Resolution by Deflection or Fittings
6	Restrained Joint Detail
7	Service Connection
7A	Typical 1.5 to 2 Inch Water Service
7B	Standard Meter Box and lid – 1 inch meter and smaller
8	Tapping Sleeve (1 of 2)
9	Tapping Sleeve (2 of 2)
10	Gate Valve and Extension
11	Hydrant Detail
12	Blow-off Detail for Hydropneumatic Tanks
12A	Standard Automatic Flushing Device
13	Air Release Valve Detail
14	Trench Detail
15	Guard Post Detail
16	Typical Thrust Block Detail
17	Reduce Pressure Backflow Preventer
18	Reduced Pressure Backflow Device Detail, 2 inch Services and Smaller
19	Service Connections for Compound Meters and Backflow Preventer Assembly 3”, 4”, 5”, 8” and 10”
20	Typical Water System Layout With Gravity Sewer in the Cul-de-sac
20A	Typical Water System Layout Without Gravity Sewer in the Cul-de-sac
21	8” Well Detail
22	Well House Foundation
23	Well Piping Details
23A	Satellite Well Piping details
24	Chemical Details
25	Well w/ Tank Piping Details
26	Air Piping & Tank Piping Detail – McDonnell & Miller Layout
26A	Air Piping & Tank Piping Detail – Whitewater Layout
27	Hydropneumatic Tank
28	Hydropneumatic Tank Details for Standard Replacement
29	Hydropneumatic Tank Details for Standard Replacement 2
30	Well House Framing Details
31	Well House Exterior Details
32	Well House Electrical Layout
32A	Typical Well House Wiring Diagram
33	Three Phase Panel Layout
34	Single Phase Panel Layout
35	Typical Satellite Well Electrical Panel
36	Typical Satellite Well Electrical Panel Cover

DIVISION 5
LIST OF MATERIALS AND APPROVED MANUFACTURERS

Division 5

Section 1

North Carolina

1.1 Well Sites

1.1 Grassing: Centipede grass seed mixed with "Contractus".

1.2 Graveling: 4" thick, compacted, crush and run gravel.

1.2 Pumps and Motors

1.2.1 Submersible Motors: Motors shall be manufactured by Franklin or Centri-pro and of the highest psi thrust bearing available. Any other manufacturer must be approved by UTILITY.

1.2.2 Submersible Pumps

1.2.2.1 Goulds or Grundfos are acceptable; design shall be for the most efficiency.

1.2.2.2 1.5", 2" & 3" sizes acceptable, larger sizes may be approved as required (Drop Pipe).

1.2.2.3 Strataflo, series 300, full port, NPT, spring check valve. Two (2) are required if setting is 300 plus feet deep.

1.2.3 Booster Pumps and Motors

1.2.3.1 Booster pumps shall be designed by, or approved, by Utility to meet 12hr demand with submersible pumping and storage capacity. The pumps and the tank(s) shall also meet Peak demand. All pumps shall be approved by Utility.

1.2.3.2 Booster Pumps of the series specified and shall be manufactured by either:

- Goulds
  Low pressure up to 60psi, Centrifugal, Series "S", "LH", "M" or "L" close coupled, 230VAC, single or 3 phase, depending on circumstances.
  High pressure over 60psi, Multi-stage, Series "SSV", configuration SVB, SVD, or SVC, vertical , 230VAC, single or 3 phase, depending on circumstances.
  In certain instances, as specified by the Utility, Variable speed pumps may be used and would be of the "Aquavar" series.

- Grundfos

Low pressure up to 60psi, Centrifugal, Series "SR" or SF, close coupled, 230VAC, single or 3 phase, depending on circumstances.
High pressure over 60psi, Multi-stage, Series "CR", "CRI" or CRN with a flanged inlet and outlet configuration, 230VAC, single or 3 phase, depending on circum-stances.
In certain instances, as specified by the Utility, Variable speed pumps may be used and would be of the "BoosterpaQ" system.

1.2.4 Control: Only dual pumps with alternating, lead-lag, bypass and step interlock and all necessary controls shall be installed.

1.2.5 Air release shall be Watts, 1/4" bronze model FV -4M1(Dayton 4A821).

1.2.6 Swing check valve (horizontal piping only): Nibco, Bronze, Industrial, NPT, WOG minimum 200psi.
Spring check valve (vertical piping only): Strataflo, series 300 spring.

1.2.7 Gate valve: Nibco, Bronze, Industrial, short stem, NPT, WOG 300psi, series T-133.

1.2.8 Ball valve (1/4"): Apollo, Bronze, NPT, series 70-100, WOG 600psi.
Gauge: liquid filled 100psi w ¼" NPT stem - Campbell PG11T-1.
liquid filled 200psi w ¼" NPT stem – Campbell PG13T-L

1.3 Plumbing

1.3.1 Valve Bank

1.3.1.1 Above ground pipe: galvanized steel, cast Brass or Stainless.

1.3.1.2 Below ground pipe: PVC, , Ductile Iron, Brass or Stainless.

1.3.1.3 Water Meter: Sensus Omni or Hersey MVR Pulsar Flow provided by UITLITY.

1.3.1.4 Wye Strainer: Watts, bronze, series 777 or 77s, WOG 400psi
Ball valve (1" up): Apollo series 77-100, Bronze, threaded , Full Port with WOG of 600psi.
Pipe (above ground): galvanized, brass or stainless steel with braided poly pipe to Strainer.

1.3.1.5 Rubatex insulation only.

1.3.1.6 ¼" ball valve: Apollo, bronze, series 70-100, WOG 600psi.

1.3.1.7 Gauges: liquid filled 100psi w ¼" NPT stem - Campbell PG11T-1.
liquid filled 200psi w ¼" NPT stem – Campbell PG13T-L.

1.3.1.8 Swing check valves (1" up): Nibco, Lead Free bronze, threaded with WOG 200psi.
Ball valves (1" up): Apollo series 77-100, Bronze, threaded , Full Port with

WOG of 600psi.
Gate valves: Nibco, Lead Free Bronze, non-rising stem, Series T-113 with WOG 300 psi

1.3.1.9 Pressure Switch: Allen Bradley, Model 836T-T253J.
Ball Valves: Apollo, bronze, series 70-100, WOG 600psi.

1.3.1.10 Hose bib:
Threaded: Nibco, Lead Free, bronze, NPT with WOG 200psi.
Non-threaded: Nibco, industrial, bronze, NPT with WOG 200psi.

1.3.1.11 Eyewash: Guardian, model G5026.

1.3.1.12 Distribution Pressure Relief Valve – 2 inch Kunkle Model 0020-H01-MG
Factory set at 100 psig – all bronze

1.3.2 Hydro Pneumatic tank

1.3.2.1 Dresser sleeve shall be MJ, cast type such as manufactured by UFCO or equal.

1.3.2.2 MJ valve: valves shall comply with AWWA C-500 and be iron body, parallel seat type, bronze fitted with resilient rubber coated wedge. Model # Kennedy 15TIX, Mueller A2360 or equivalent.
Valve Box: cast iron, adjustable screw type Part #.
Valve Box Ring: Brooks 24" valve collar.

1.3.2.3 MJ valve: valves shall comply with AWWA C-500 and be iron body, parallel seat type, bronze fitted with resilient rubber coated wedge. Model # Kennedy 15TIX, Mueller A2360 or equivalent.

1.3.2.4 Valve Box: cast iron, adjustable screw type, such as manufactured by UFCO or equal.
Valve Box Ring: Brooks 24" valve collar.

1.3.3 Distribution line:

1.3.3.1 SDR 21, Class 200 PVC, acceptable within subdivision up to 2" unless otherwise directed by UTILITY.

1.3.3.2 DR 18, C900 PVC, acceptable within subdivision, state, county or federal roads, under culverts and under creeks (when cased).

1.3.3.3 Class 50, Ductile Iron, minimum pressure rating 200psi, acceptable within subdivision, state, county or federal roads, under culverts and under creeks (when cased).

1.3.3.4 HDPE pipe of the specified size and pressure rating of not less than 200psi, shall be used under wetlands or stream crossings. Proper size and type fittings shall be installed. Once the pipe is installed, if direct bored, it shall have a waiting period of 7days, to allow for shrinkage before tying on to other pipe.

1.3.4 Restraint Fittings

1.3.4.1 MJ fittings, where the restraining system is built in, such as AquaGrip, shall be acceptable on all types of pipe without further blocking.

1.3.4.2 Megalug restraint collars systems shall not be allowed on SDR 21, Class 200 PVC. Types with minimum of 6 lugs, are acceptable on all other pipes listed under (5) above.

1.3.5 Relief Valve: bronze, NPT, ASTM and Boiler rated, steam rated, valve, set at the tested or approved tank pressure, Kunkle Valve, Model 6010eem01-km0(xxx) (psi).

1.3.6 Vacuum Breaker: Strataflo, series 300, inverted spring check valve with mushroom vent.

1.3.7 Locking Ball Valve: Apollo ball valve, model 75 -105 with 600 WOG rating and a four position locking device. All Valves with be clock-wise closed and counter clock-wise open

1.3.8 Air Compressor

1.3.8.1 Whitewater, Model 1/6hp, 120VAC.

1.3.8.2 Probes and pressure switch Included with (1).

1.3.9 Chemical Barrels: Pulsafeeder chemical barrel (55 gal).

1.4 Distribution mains

1.4.1 Mains

1.4.1.1 same as Distribution Line.

1.4.1.2 same as Restraint Fittings.

1.4.1.3 Other Fittings: Tees, bend, etc. MJ cast (Mueller or equal) or compression (as made by "One Bolt, Inc.").

1.4.1.4 MJ Gate Valves (Square nut): Kennedy 15TIX, Mueller A-2360 or equivalent.

1.4.1.5 Valve Box: cast iron, adjustable screw type, such as manufactured by UFCO or equal.

1.4.1.6 Valve Box Ring: Brooks 24" valve collar.

1.4.1.7 Air Relief Valve: automatic blow-off – For 6 inch and large water lines, the air relief valve shall be APCO #200, Crispin PL 20 (2inch) or equivalent. For water lines smaller than 6 inch the air relief valve shall be the Crispin AR10 (1 inch), APCO #50 (1 inch), or equivalent.

1.4.1.8 Mains: Last 400' on cul-de-sacs – minimum size 4".

1.4.2 Services

1.4.2.1 Meter Box: NDS D1200 meter box with hinge lid.

1.4.2.2 Meter setter: Ford Model VHH-72-7W or Mueller 1404-2 Yoke or

1.4.2.3 Strap Saddles: Bronze, double strap made by Mueller, Ford or Equal.

1.4.2.4 Compression Fittings: Mueller, Ford or equal.

1.4.2.5 Chaseways: schedule 40, PVC, electrical conduit or plumbing pipe.

1.4.2.6 Meters: Provided by UTILITY.

1.4.2.7 All service lines shall be ¾" 1", 1-1/2" or 2" blue polyethylene tubing conforming to specifications in AWWA C800 and AWWA . One and one-half inch (1-1/2") and larger shall be sized in accordance with the Iron Pipe Sizing Standard (IPS);3/4 " and 1" shall be the Copper Tube Sizing Standard (CTS)

1.4.3 Backflow and Cross Connection

1.4.3.1 Backflow Prevention Device:
Severe Hazard: Bronze RPZ – Cla-Val-RP2, Watts Series 009QT, Wilkins WK975XL-075, Febco 825Y (D), Conbraco 400, or approved equal
Moderate Hazard: Bronze, Double Check Valve Assembly, part # 40-104-997

1.4.4 Hydrants

1.4.4.1 Kennedy K81-D2 5 1/4", Mueller Centurion A421 5 1/4", or utility-approved equal.

1.5 Water Treatment

1.5.1 Chemical Equipment.

1.5.1.1 Chemical Pump: Pulsafeeder, model LE Series of appropriate pressure and flow design requirements, or as specified by UTILITY.
14gpd @ 100psi: LEK3SA-VHC-xxx
24gpd @ 100psi: LE14SA-VHC-xxx
6gpd @ 150psi: LE2SA-VHC-xxx
22gpd @ 150psi: LEK34SA-VHC-xxx

1.5.1.2 Chemical Vat: NSF Approved- Snyder or approved equivalent

1.5.1.3 Safety Components
Flow Switch, Low Flow (below 15gpm): ITT, McDonnell & Miller Model FS7-4.
Flow Switch, Full Flow (over 15gpm): ITT, McDonnell & Miller Model FS4-3.

1.6 Tanks

1.6.1 Hydro Pneumatic Tanks

1.6.1.1 Tank shall be National Board stamped ASME approved, as manufactured by RECO USA or Ramco Tank Manufacturers. Other tank manufacturers to submit plans for approval to UTILITY before construction on the tank begin.

1.6.1.2 Pedestals shall be poured with 12" dip for tank and a minimum of 3/8" thick rubber shall be installed between the tank and the pedestal.

1.6.2 Ground Storage Tanks

1.6.2.1 Probes shall be manufactured by WARRICK CONTROLS and of the configuration specified by Utility.

1.7 Well House

1.7.1 Building

1.7.1.1 Door: 36" minimum single door, steel of (min) 16 Gauge, painted with Epoxy Paint or a semi solid or solid fiberglass door.

1.7.1.2 Automatic Foundation Vents: 8"x16".
Closing Vents: 8"x 16", part #.

1.8 Electrical

1.8.1 Panels

1.8.1.1 Panel 230VAC, ITE, with copper busway.
Nema 4X Inside and Outside
Part Number Single Phase
Part Number Three Phase

1.8.2 Magnetic Starters

1.8.2.1 Starter: Allen Bradley, Nema 3R, , three pole with 120VAC coil.

1.8.2.2 Timer: Intermatic Model FF5M spring wound 5-minute timer (also works for hand switch).

1.8.2.3 Auxiliary Contacts: Two Normally open required

1.8.2.4 Thermal Overloads: Allen Bradley – series "J".

1.8.3 Pressure Switch: Allen Bradley – 835T-T253J or Square D

1.8.4 Indicating Controls

1.8.4.1 Elapsed Time Meter: Vender-Root 7795.

1.8.4.2 Impulse Counter: Durant 6-Y-41345.

1.8.5 Telemetry / Radio Controls

1.8.5.1 Telemetry: provided by UTILITY.

1.8.5.2 Radio Control: provided by UTILITY.

1.8.6 Air Compressor: Whitewater, Model 1/6hp, 120vac, Model # 1HAB-44-M100X 115 volt 1/6HP 0.12 KW 60 Hz, or McDonnell & Miller Tank Level Controller.

1.8.7 Heating

1.8.7.1 Base Board Heater:
4': 1,000-watt, 240 volts AC, part # Dayton 3UG84D.

1.8.7.2 Remote Thermostat: White-Rodgers, Model #2B61-186.

1.8.8 Auto-Off Timers: Intermatic FF Series, Commercial Series.

APPENDIX B-NCDOT ENCROACHMENT AGREEMENT AND APPROVAL WITH CONDITIONS

APPENDIX C-EROSION AND SEDIMENTATION CONTROL PLAN APPROVAL AND ATTACHMENTS

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
BRIAN WRENN
Director

NORTH CAROLINA
Environmental Quality

October 21, 2020

LETTER OF APPROVAL

Public Works Commission
Joseph Glass, P. E., Engineering Manager
Post Office Box 1089
Fayetteville, NC 28302

RE: Project Name: Annexation Phase V, Construction Proj. VIII, Areas 24B & 24C
Acres Approved: 16.67
Project ID: CUMBE-2021-037
County: Cumberland, City: Fayetteville
Address: Seaford Drive
River Basin: Cape Fear
Stream Classification: Other
Submitted by: Alex Adekoya
Date Received by LQS: September 30, 2020
Plan Type: Utility

Dear Mr. Glass:

This office has reviewed the subject erosion and sedimentation control plan. We find the plan to be acceptable and herebyissue this Letter of Approval. The enclosed Certificate of Approval must be posted at the job site. This plan 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.

As of April 1, 2019, all new construction activities are required to complete and submit an electronic Notice of Intent (NOI) form requesting a Certificate of Coverage (COC) under the NCG010000 Construction Stormwater General Permit. This form MUST be submitted and COC issued prior to the commencement of any land disturbing activity on the above-named project. The NOI form may be accessed at deq.nc.gov/NCG01. Please direct questions about the NOI form to Annette Lucas at Annette.lucas@ncdenr.gov or Paul Clark at Paul.clark@ncdenr.gov. After you submit a complete and correct NOI Form, a COC will be emailed to you within **three business days**. Initially, DEMLR will not charge a fee for coverage under the NCG01 permit. However, on or after June 1, 2019, a $100 fee will be charged annually. This fee is to be sent to the DEMLR Stormwater Central Office staff in Raleigh.

Title 15A NCAC 4B .0118(a) and the NCG01 permit require that the following documentation be kept on file at the job site:

1. The approved E&SC plan as well as any approved deviation.
2. The NCG01 permit and the COC, once it is received.
3. Records of inspections made during the previous 30 days.

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.

North Carolina's Sedimentation Pollution Control Act is performance-oriented, requiring protection of existing natural resources and adjoining properties. If, following the commencement of this project, the erosion and sedimentation control plan is inadequate to meet the requirements of the Sedimentation Pollution Control Act of 1973 (North Carolina General Statute 113A-51 through 66), this office may require revisions to the plan and implementation of the revisions to insure compliance with the Act.

Acceptance and approval of this plan is conditioned upon your compliance with Federal and State water quality laws, regulations, and rules. In addition, local city or county ordinances or rules may also apply to this land-disturbing activity. This approval does not supersede any other permit or approval.

Please note that this approval is based in part on the accuracy of the information provided in the Financial Responsibility Form, which you provided. You are requested to file an amended form if there is any change in the information included on the form. This permit allows for a land-disturbance, as called for on the application plan, not to exceed the approved acres. Exceeding the acreage will be a violation of this permit and would require a revised plan and additional application fee. Any addition in impervious surface, over that already noted on the approved plan, would also require a revised plan to verify the appropriateness of the erosion control measures and the stormwater retention measures. (GS 113A-54.1(b)). In addition, it would be helpful if you notify this office of the proposed starting date for this project. Please notify us if you plan to have a preconstruction conference.

Your cooperation is appreciated.

Sincerely,

Chris Baker

Chris Baker
Assistant Regional Engineer
DEMLR - Fayetteville Regional Office

Enclosures: Certificate of Approval

cc: Alex Adekoya, P. E., W. K. Dickson & Company, Inc. – electronic copy
Michael Bailey, City of Fayetteville Permit Office– electronic copy
Fayetteville Regional Office

APPENDIX D-EASEMENT SPECIAL CONDITIONS

Easement Special Conditions – Area 24 B/C Village Hills and Kings Mill

September 7, 2021

Property Owner	Parcel Number	Address	Special Conditions
Blake W & Lesa K Nelson	9487-02-9467	8885 Cliffdale Road	1. Six foot temporary fence to keep dogs from construction limits is needed; Owner permitted to remove trees before November 1, 2021 at his own expense.
Blake W & Lesa K Nelson	9487-12-0409-	8907 Cliffdale Road	1. Six foot temporary fence to keep dogs from construction limits is needed. Owner is responsible to remove contents from shed/leanto prior November 1, 2021. The shed/leanto is to be removed by PWC unless removed by owner prior to November 1, 2021. The Utility Contractor may need to coordinate the removal of the shed with the PWC Project Coordinator. Any trees owner wishes to cut himself need to be cut and removed from site by November 1, 2021.
Kimberly Spaulding Daniel	9487-02-4161-	8948 Cliffdale Road	1. PWC to install wood fence at PL (replacing existing chain link fence)
Kimberly Spaulding Daniel	9487-02-4276-	8938 Cliffdale Road	1. PWC to install wood fence at PL (replacing existing chain link fence). 2. PWC paid for the wood swing set, dog kennel, 6x6 shed, and brick pumphouse. The Contractor may have to remove these items if not removed by the time of construction.
Eva Gatlin	9487-02-5349-	8926 Cliffdale Road	1. Do not disturb shed or septic alarm within TCE. 2. Repair the septic drain fields or system if damaged. Pump-haul septic system as needed until repairs are made. 3. Abandon existing well.
Richard Wayne Capps	9487-02-5557-	6705 Seaford Drive	1. Temporary fence is needed for dog.

Property Owner	Parcel Number	Address	Special Conditions
Johnnie E & Valerie Willard	9477-92-8417	6994 Bostick Drive	1. Ensure the gates match existing fencing as closely as possible.
Lance Stuart Thellman	9477-92-6726-	6978 Bostick Drive	1. Sod the easement areas.
Christopher Facko	9477-92-5609-	605 Bangor Court	1. Temporary safety fence is needed.
Cynthia Sutton Banks	9477-92-2843-	608 Bangor Court	1. Wood fence should be replaced at chainlink fence line. Add gates to the wood fence and tie it into the location of the chain link fence.
George C Greer	9477-92-5819-	6970 Bostick Drive	1. Contractor may remove blocks as needed.
Timothy J Plitz	9477-93-1066-	6948 Bostick Drive	1. Temporary fence is needed for dogs.
Jose & Gladys Morales	9477-93-0069-	6944 Bostick Drive	1. Contractor may move natural rock border around tree planter area as needed. Prior to disposal, please coordinate with the property owner if the rock border can be reused.

Property Owner	Parcel Number	Address	Special Conditions
Katrina Rena Kilmartin-Baucom	9477-82-8949-	6720 Sexton Court	1. Temporary safety fence is needed.
Marissa N. Ortiz	9477-82-8949-	6716 Sexton Court	1. Six foot chain link fence is needed for aggressive dogs.
Tristan Trotter	9477-82-9917-	6712 Sexton Court	1. Temporary safety fence is needed. Chain link fence should be used for neighboring parcel with aggressive dogs.
Johnson M White	9477-92-1745-	6700 Sexton Court	1. Temporary fence is needed for dogs.
Daneshia S. Frazer	9477-82-7519-	6790 Seaford Drive	1. Do not disturb shed.
Russell Walter Errett, Jr.	9477-82-7598-	6786 Seafrod Drive	1. Do not disturb shed.
Daniel G. Barton	9477-82-8576-	6782 Seaford Drive	1. Temporary fence is needed for dogs and children.

Property Owner	Parcel Number	Address	Special Conditions
John R. O'Donoghue	9477-82-9545-	6778 Seaford Drive	1. Temporary fence is needed for dogs. Wood grapevine may be removed as needed.
R&R Material Assets, LLC.	9477-92-0524-	6774 Seaford Drive	1. Do not disturb dog pen in TCE. Temporary fence is needed for dog and children.
Phillip Brents Carter	9477-92-1513-	6770 Seaford Drive	1. Do not disburb shed in TCE. Temporary fence is needed for children.
Thomas Stephen Rozier	9477-92-1593-	6766 Seaford Drive	1. Do not disturb shed in TCE.
Roldan D. Rosas	9477-92-8135-	6735 Seaford Drive	1. If swing brace and pavers are in conflict, please coordinate with property owner prior to moving them.
Corey James Thomas	9477-92-6064-	5504 Hickory Knoll Road	1. Temporary fence is needed for dogs. Easement is not acquired, information may change.
Conroy Nicholas M. Meddar	9477-92-7043-	5450 Hickory Knoll Road	1. Easement is not acquired, information may change.

Property Owner	Parcel Number	Address	Special Conditions
Travonnie Holmes	9477-90-6776-	7723 Guinevere Court	1. If concrete driveway is damaged or disturbed, replace driveway to the first joint. Do not change the existing condition at the intersection of the driveway and roadway.
Robert Nathan Kelley	9477-90-8695-	7705 Bond Court	1. Remove pine and oak tree in the backyard on the edge of the TCE, two pine trees in the front yard near property line, and trees between chainlink and wood fences. The clothesline may be removed. Temporary fence is needed.
Michael Monge	9487-00-0628	7725 Scottsdale Drive	1. Temporary fence is needed. Easement is not acquired, information may change.
Hooper, Thomas H	9487-00-3265-	1138 Paddington Place	1. If concrete walkway is damaged or disturbed, replace the concrete walkway in kind. 2. Temporary fence is needed.
Jesse William Heikkinen	9487-00-2398-	7709 Scottsdale Drive	1. Temporary fence is needed.
John Hunt	9487-00-4174-	1142 Paddington Place	1. Temporary fence is needed for dogs.
Thellman, Lance Stuart & wife	9477-92-6726-	6978 Bostick Drive	1. An existing shed will be moved and stay within the TCE on this parcel. This is at approximately station 1+40 on the Bangor Court easement between MH B31 and MH B32.

Property Owner	Parcel Number	Address	Special Conditions
Banks, Cynthia Sutton	9477-92-2843-	608 Bangor Ct.	1. Contractor to coordinate with Handi-House to remove the contents out of the shed and then remove/dispose of the shed and concrete pad in accordance with State and Local requirements.

APPENDIX E-REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION

FROEHLING & ROBERTSON, INC.

Report of Subsurface Exploration and Geotechnical Engineering Evaluation

FAYETTEVILLE PWC – ANNEXATION AREA 24 SEWER LINE
(AREAS B and C)
Fayetteville, North Carolina
F&R Project No. 66X-0120

Prepared For:

WK DICKSON
community infrastructure consultants

720 Corporate Center Drive
Raleigh, North Carolina 27607

Prepared By:
Froehling & Robertson, Inc.
310 Hubert Street
Raleigh, North Carolina 27603

February 27, 2020

FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

310 Hubert Street
Raleigh, North Carolina 27603-2302
T 919.828.3441 | F 919.828.5751

NC Engineering License # F-0266

February 27, 2020

Mr. Monroe Huckaby, E.I.
WK Dickson & Co., Inc.
720 Corporate Center Drive
Raleigh, North Carolina 27607

Subject: Report of Subsurface Exploration
& Geotechnical Engineering Evaluation
Fayetteville PWC – Annexation AREA 24 Sewer Line (Areas B and C)
Fayetteville, North Carolina
F&R Project No. 66X-0120

Dear Mr. Huckaby:

Froehling & Robertson, Inc. (F&R) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the above-referenced project in Fayetteville, North Carolina. Our services were performed in general accordance with F&R's Proposal No. 1966-00482 Revision 2 dated August 22, 2019. The attached report presents our understanding of the project, reviews our exploration procedures, describes existing site and 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.

Feb 27 2020 8:11 AM

Michael S. Sabodish Jr.

DocuSign

NORTH CAROLINA PROFESSIONAL SEAL 046209 ENGINEER Mohammad Kayser

Mohammad Kayser, Ph.D., P.E.
Geotechnical Engineer

Michael S. Sabodish, Jr., Ph.D., P.E.
Geotechnical Services Manager

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APPENDICES

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 twenty nine (29) SPT borings (AB-1, AB-2, AB-4 to AB-8, AB-10 to AB-12, BB-1 to BB-3, BB-5, BB-8, BB-9, BB-11, BB-13, CB-1, CB-3, CB-4, CB-6 to CB-9 and HB-1 to HB-4) and eight hand auger borings with DCP testing (AB-9, AB-13, BB-4, BB-6, BB-7, BB-12, CB-2 and CB-5). As requested by WK Dickson, two separate geotechnical engineering reports have been prepared for this project. This report will cover 15 SPT borings (BB-1 to BB-3, BB-5, BB-8, BB-9, BB-11, BB-13, CB-1, CB-3, CB-4 and CB-6 to CB-9) and six hand auger borings (BB-4, BB-6, BB-7, BB-12, CB-2 and CB-5) located in the Areas B and C. A separate geotechnical engineering report will be issued covering Area A borings ;
- Preparation of typed boring logs, and development of subsurface profiles;
- Performing geotechnical laboratory testing and soil corrosivity 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

The project sites are primarily located in and generally west of Cliffdale Road in Fayetteville, North Carolina (see Figure No. 1 – Site Vicinity Map). Based on our review of the plans provided by WK Dickson to F&R dated April 1, 2019, the proposed Area B sewer line consists of 16 different sections: Yeoman Drive, Hickory Knoll Connector, Seaford Drive 1, 2 and 3, Bostic Drive, Area B Outfall 1 and 2, Bangor Court, Sexton Court Backyard 1 and 2, Bostic Upper Connector, Bostic Drive 1 and 2, Cliffdale Road Crossing and Seaford Outfall. The proposed area C sewer line consists of 11 different sections: Area C Outfall, Paddington Place, Bond Court, Scottsdale Drive 1 and 2, Guinevere Court, Guinevere Court outfall, Charring Cross Lane 1 and 2, Hickory Knoll and Scottsdale Drive Storm. The proposed sewer lines will consist of 8" diameter PVC pipe and 8" diameter ductile iron pipe. Based on our review of the plans, it appears that open-cut construction, and bore and jack techniques will be used to install the proposed sewer line. The storm line at Scottsdale in Area C will be installed via 15 and 18-inch diameter concrete pipes. The Area B and Area C sections of the proposed sewer line are discussed in detail in following sections.

AREA B:

Yeoman Drive section of the sewer line begins at the intersection of Yeoman Drive and Hickory Knoll Road (at proposed manhole MH B1) and extends north along Yeoman Drive for 336 feet. This section of the sewer line ends at the intersection of Yeoman Drive and Seaford Drive (at proposed manhole MH B2). The depth of the open-cut line at this section is anticipated to range from about 9 to 13 feet below the existing ground surface. A soil boring was not performed in this section.

Hickory Knoll Connector starts near the intersection of Hickory Knoll Road and Shady Knoll Lane (at proposed manhole MH B9). From the intersection, the connector extends north towards Seaford Drive through private properties for 375 feet (See Figure No. 2C in Appendix I). The connector ends at Seaford Drive (at proposed manhole MH B12) at a point approximately 250 feet west from the intersection of Seaford Drive and Bostic Court. The depth of the open-cut line at this section is anticipated to range from about 8 to 9 feet below the existing ground surface. Bore and jack techniques will be installed to cross the sewer line through private properties : i) between proposed manhole MH B9 approximately from station 0+00 and manhole MH B10 at station 1+51 and ii) approximately from station 2+10 to manhole MH B12 at station 3+75. The depth of the sewer line at the bore and jack pit locations range from approximately 9 to 12 feet. The dimensions of the proposed entry and receiving pits will be 20 feet by 40 feet and 10 feet by 10 feet, respectively. The bottoms of the pits are approximately 1 feet deeper than the proposed sewer line. Borings BB-5, BB-6, BB-7 and BB-8 were located along this section.

Seaford Drive 1 and 2 sections start from the end of **Hickory Knoll Connector** (at proposed manhole MH B12). **Seaford Drive 1** section extends east along Seaford Drive for 669 feet (ends at proposed manhole MH B17). **Seaford Drive 2** section extends west along Seaford Drive for 495 feet (ends at proposed manhole MH B14). **Seaford Drive 3** section starts from the end of Yeoman Drive section (at proposed manhole MH B2) and extends west along Seaford Drive for 1337 feet (ends at proposed manhole MH B8) (See Figure No. 2G in Appendix I). The depth of the open-cut line at these sections is anticipated to range from about 6 to 13 feet below the existing ground surface. Borings BB-5, BB-11 and BB-13 were located along this section.

Bostic Drive 1 section of the sewer line starts from the end of Bostic Drive (just south of the cul-de-sac) at a point approximately 300 feet south from its intersection with Seaford Drive, then extends northwest along Bostic Drive for 1031 feet (ends at proposed manhole MH B22) (see Figure No. 2E in Appendix I). The depth of the open-cut line at this section is anticipated to range from about 6.5 to 11.5 feet below the existing ground surface. Boring BB-11 was located along this section.

Area B Outfall-1 section starts at a point approximately 150 feet southwest from the intersection of Caribou Court and St. Julian Way (at proposed manhole MH B45), then extends southwest through wooded areas for 733 feet (ends at proposed manhole MH B50). **Area B Outfall-2** section starts at Seaford Drive at a point approximately 200 feet west from the intersection of Seaford

Drive and Bostic Drive (at proposed manhole MH B15), then extends northwest through private properties for 1,072 feet (ends at proposed manhole MH B28) (See Figure No. 2F in Appendix I). The depth of the open-cut line at these sections is anticipated to range from about 7 to 10 feet below the existing ground surface. Boring BB-12 was located along **Area B Outfall-2** section. A soil boring was not performed along the **Area B Outfall-1** section.

Bangor Court section of the sewer line starts at a private property at a point approximately 320 feet southeast from the cul-de-sac of Bangor Court (at proposed manhole MH B25) and then extends northwest towards Bangor Court. This section of the sewer line ends at a point approximately 150 feet northeast from the end of Bangor Court (ends at proposed manhole MH B35). The depth of the open-cut line at this section is anticipated to range from about 7 to 9 feet below the existing ground surface. Boring BB-12 was located along this section.

Sexton Court Backyard-1 section of the sewer line starts at a private property at a point approximately 200 feet southeast from the cul-de-sac of Sexton Court (at proposed manhole MH B27) and then extends west for 556 feet through the backyards of private properties between Sexton Court and Seaford Drive. This section of the sewer line ends at proposed manhole MH B39. **Sexton Court Backyard-2** section of the sewer line starts at a private property at a point approximately 150 feet northeast from the cul-de-sac of Sexton Court (at proposed manhole MH B28) and then extends west for 372 feet through the backyards of private properties between Sexton Court and Bostic Drive (See Figure No. 2D in Appendix I). This section of the sewer line ends at proposed manhole MH B30. The depth of the open-cut line at these sections is anticipated to range from about 4 to 11.5 feet below the existing ground surface. Boring BB-10 was proposed along **Sexton Court Backyard-2** section, however the boring was cancelled due to access related issues. A soil boring was performed along the **Sexton Court Backyard-1** section.

Bostic Upper Connector connects **Sexton Court Backyard-2** (at proposed manhole MH B29) and **Bostic Drive 3** (at proposed manhole MH B40). The connector starts approximately 200 feet south from the intersection of Seaford Drive and Forman Drive (at proposed manhole MH B29), then extends north towards Seaford Drive through private properties for 210 feet (See Figure No. 2D in Appendix I). The connector ends at the intersection of Seaford Drive and Forman Drive (at proposed manhole MH B40). The depth of the open-cut line at these sections is anticipated to range from about 11 to 11.5 feet below the existing ground surface. The section of the proposed sewer line from station 0+20 to manhole B40 station 2+10 will be installed via bore and jack techniques. The depth of the sewer line at the bore and jack pit locations ranges from approximately 8 to 12 feet. The dimensions of the proposed entry and receiving pits will be 20 feet by 40 feet and 10 feet by 10 feet, respectively. The bottoms of the pits are approximately 1 feet deeper than the proposed sewer line. Borings BB-9 and BB-10 were located along this section. Boring BB-10 was cancelled due to access related issues.

Bostic Drive 2 and 3 sections start from the end of **Bostic Upper Connector** (at proposed manhole MH B40). **Bostic Drive 2 section** extends east along Bostic Drive for 478 feet (ends at proposed manhole MH B44) and **Bostic Drive 3 section** extends west along Seaford Drive for 491 feet (ends at proposed manhole MH B42). The depth of the open-cut line at these sections is anticipated to range from about 6 to 9 feet below the existing ground surface. Boring BB-9 was performed along these sections.

Cliffdale Road Crossing section starts at a point approximately 150 feet east from the intersection of Cliffdale Road and Seaford Drive (at proposed manhole MH B49), then crosses Clifford Road by bore and jack and extends along Seaford Drive (See Figure No. 2B in Appendix I). This section of the sewer line is 519 feet long and ends at proposed manhole MH B54. The depth of the open-cut line at this section is anticipated to range from about 8 to 11 feet below the existing ground surface. The section of the proposed sewer line approximately from station 0+40 to manhole B51 station 2+49 will be installed via bore and jack techniques to cross Cliffdale Road. The depth of the sewer line at the bore and jack pit locations range from approximately 9 to 10 feet. The dimensions of the proposed entry and receiving pits are anticipated to be 20 feet by 40 feet and 10 feet by 10 feet, respectively. The bottoms of the pits are approximately 1 feet deeper than the proposed sewer line. Borings BB-1 and BB-2 were located along this section.

Seaford Outfall section of the sewer line starts at Seaford Drive at a point approximately 250 feet west from the intersection of Cliffdale Road and Seaford Drive (at proposed manhole MH B53) and then extends south for 654 feet through private properties (See Figure No. 2B in Appendix I). The depth of the open-cut line at this section is anticipated to range from about 8 to 13 feet below the existing ground surface. Borings BB-3 and BB-4 were located along this section.

AREA C:

Area C Outfall section of the sewer line begins (at proposed manhole MH C1) approximately 170 feet west from Cliffdale Road at a point approximately 400 feet south from the intersection of Cliffdale Road and Scottsdale Drive and extends northwest for 712 feet through wooded areas. This section of the sewer line ends at proposed manhole MH C6. The depth of the open-cut line at this section is anticipated to range from about 3 to 7 feet below the existing ground surface. Boring CB-3 was located along this section.

Paddington Place section starts approximately 150 feet south from the southern cul-de-sac of Paddington Place (at proposed manhole MH C3) and extends north through wooded areas and along Paddington place for 986 feet. This section of the sewer line ends at proposed manhole MH C13. The depth of the open-cut line at this section is anticipated to range from about 5 to 10 feet below the existing ground surface. The section of the proposed sewer line between manhole MH C3 approximately from station 0+00 and manhole MH C8 at station 1+62 will be installed via bore and jack techniques. The depth of the sewer line at the bore and jack pit locations range from approximately 5 to 11 feet. The dimensions of the proposed entry and receiving pits are anticipated to be 20 feet by 40 feet and 10 feet by 10 feet, respectively. The bottoms of the pits are

approximately 1 feet deeper than the proposed sewer line. Borings CB-1 and CB-2 were located along this section.

Bond Court starts at proposed manhole MH C14 at a point 200 feet south from the cul-de-sac of Bond Court and then extends north towards Bond Court. After reaching Bond Court the sewer line runs along the road (See Figure No. 2J in Appendix I). Length of this section of the sewer line is 313 feet and ends at proposed manhole MH C17. The depth of the open-cut line at this section is anticipated to range from about 3 to 13 feet below the existing ground surface. The section of the proposed sewer line between proposed manhole MH C15 and manhole MH C16 will be installed via bore and jack techniques. The depth of bore and jack pits is not known at the time of this report preparation. However, we anticipate the bottom of the entry and receiving pits will be approximately 1 feet deeper than the proposed sewer line invert elevation. As such, the depth of the entry and receiving pits are assumed to be 4 and 14 feet, respectively at this location. The dimensions of the proposed entry and receiving pits are anticipated to be 20 feet by 40 feet and 10 feet by 10 feet, respectively. Borings CB-4 and CB-5 were located along this section.

Scottsdale Drive 1 and 2 sections start from the end of **Bond Court** (at proposed manhole MH C17). **Scottsdale Drive 1** section extends southeast along Scottsdale Drive for 427 feet (ends at proposed manhole MH C21) and **Scottsdale Drive 2** section extends north along Scottsdale Drive for 615 feet to the intersection of Scottsdale Drive and Charring Cross Lane (ends at proposed manhole MH C24) (see Figure No. 2K in Appendix I). The depth of the open-cut line at these sections is anticipated to range from about 8 to 13 feet below the existing ground surface. Borings CB-6, CB-8 and CB-9 were located along this section.

Guinevere Court section starts from the intersection of Scottsdale Drive and Guinevere Court at proposed manhole MH C23 and then extends west along Guinevere Court for 151 feet (ends at proposed manhole MH C25). **Guinevere Court Outfall** section starts at proposed manhole MH C26 approximately 150 feet south from the cul-de-sac of Guinevere Court and extends north through wooded areas and along Guinevere Court for 446 feet (see Figure No. 2L in Appendix I). The depth of the open-cut line at these sections is anticipated to range from about 6 to 11.5 feet below the existing ground surface. Borings CB-7 and CB-8 were located along **Guinevere Court Outfall** and **Guinevere Court** sections, respectively.

Charring Cross Lane 1 and 2 sections start from the end of **Scottsdale Drive 2** (at proposed manhole MH C24). **Charring Cross Lane 1** section extends east along Charring Cross Lane for 414 feet (ends at proposed manhole MH C33) and **Charring Cross Lane 2** section extends west along Charring Cross Lane for 205 feet to the cul-de-sac of Charring Cross Lane (ends at proposed manhole MH C24) (see Figure No. 2K in Appendix I). The depth of the open-cut line at these sections is anticipated to range from about 8 to 14.5 feet below the existing ground surface. Boring CB-6 was located along these sections.

Hickory Knoll section starts approximately 80 feet east from the intersection of Amber Gate Path and Hickory Knoll Road at proposed manhole MH C34 and extends east for 84 feet through

private properties. The depth of the open-cut line at this section is anticipated to range from about 6.5 to 12 feet below the existing ground surface. A soil boring was not performed in this section.

Scottsdale Drive Storm starts approximately 150 feet south from the intersection of Scottsdale Drive and Bond Court and run north towards Charring Cross Lane for approximately 445 feet. The depth of the storm line ranges from approximately 6 to 11 feet. The storm line will be installed via 15 and 18 inch diameter concrete pipes. Borings CB-8 and CB-9 were located along this storm line.

3.0 EXPLORATION PROCEDURES

3.1 SUBSURFACE EXPLORATION

F&R advanced a total of 15 SPT borings (BB-1 to BB-3, BB-5, BB-8, BB-9, BB-11, BB-13, CB-1, CB-3, CB-4 and CB-6 to CB-9) and six hand auger borings with DCP testing (BB-4, BB-6, BB-7, BB-12, CB-2 and CB-5) as part of this exploration. Boring BB-10 was cancelled due to access related issues. The approximate boring locations are shown on the Boring Location Plans presented as Figure Nos. 2A to 2L in Appendix I. The borings were advanced to depths ranging from 6 to 20 feet. The boring locations were selected by W.K. Dickson and established in the field by F&R using a hand-held GPS unit. Ground surface elevations at the boring locations were interpolated from the provided preliminary plans. Given these methods of determination, the boring locations and ground surface elevations should only be considered approximate.

The SPT borings were advanced by a track-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 at a nominal interval of approximately 5 feet.

The hand auger borings were performed using a 3-inch diameter auger bucket. DCP testing was performed in general accordance with ASTM Special Technical Publication No. 399 (1966). The number of blows required to drive the 1.375-inch diameter steel cone three consecutive 1.75-inch increments is recorded and the blows of the last two 1.75-inch increments are averaged to obtain the DCP N_c-values, representing the penetration resistance of the soil. When properly evaluated, the DCP test results provide an index for estimating soil strength and relative density.

A representative portion of soil was obtained from each SPT and hand auger sample, sealed in a 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 and hand auger is presented in Appendix II.

Groundwater level measurements were attempted at the termination of drilling in all of the test borings and hand auger borings. Borings BB-2, BB-4, BB-8, BB-11, BB-12, CB-1, CB-6 and CB-8 were backfilled immediately after drilling completion due to their locations either in the road, residential yards, or driveways. Groundwater level measurements were attempted again after a stabilization period of approximately 24-hours had elapsed after the completion of drilling in the remaining borings. Temporary piezometers were installed in borings BB-1, BB-3, BB-13, CB-4, CB-7 and CB-9 in order to obtain stabilized groundwater measurements. The temporary piezometers consisted of 1-inch diameter, hand slotted PVC pipes installed into the completed borings.

3.2 LABORATORY TESTING

F&R selected representative soil samples and subjected them to geotechnical index testing consisting of natural moisture content, percent fines analysis, and 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. In addition to the geotechnical laboratory testing, 12 soil samples were subjected to pH, Chloride, Sulfide, Sulfate, Electrical Resistivity and Redox Potential testing to aid in assessing the corrosivity potential of the on-site soils. Soil corrisivity test results are presented in section 4.4 of this report.

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 the Middendorf Formation. The Middendorf Formation is described as sandy deposits that vary in color from gray to orange gray with discontinuous bedding with cross bedding common.

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 Figures 3 and 4 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 the surface in borings BB-1, BB-4, BB-6, BB-7, BB-12, CB-2, CB-3, CB-5 and CB-8 from the ground surface to depths of 2 to 6 inches (typically 2 to 4 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 in borings BB-2, BB-5, BB-8, BB-9, BB-11, BB-13, CB-1, CB-4, CB-6, CB-7 and CB-9 to depths ranging from 2 to 7 inches (typically 2 to 3 inches).

Surficial material was not encountered in boring BB-3.

4.2.3 SPT Borings Subsurface Conditions

Fill and Possible Fill Soils

Fill or material that F&R believes may be fill (referred to as "possible fill" on the attached boring logs) were encountered in borings BB-5, BB-8, BB-9, BB-11, BB-13 and CB-9 to depths ranging from approximately 2 to 7 feet. The presence of the fills is likely to be associated with the construction of roadways and utility installations. The fill soils were typically classified as loose to medium dense, silty and clayey sands (USCS – SM & SC) and stiff low to high plasticity sandy clays and clayey silts (CL, ML and MH). A highly plastic (MH) fill soil layer was encountered in boring BB-13 below the surficial organic soils to a depth of 2 feet.

Borings BB-9 and CB-9 encountered a very loose (SPT-N value of 4 or less) soil layer from a depth of 2 feet and extended to a depth 7 feet, respectively. Boring BB-8 encountered a dense silty sand soil layer from a depth of 2 to 7 feet. The remaining fill soils exhibited SPT N-values ranging from 9 to 17 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 not containing gravel or any hard material would generally be expected to exhibit N-values of 9 bpf or greater. In general, it appears that the fill varied from being poorly to well-compacted. The fill soils contained trace roots, asphalt and rock fragments.

Alluvial Soils

An alluvial soil layer was encountered in boring CB-3 below the surficial materials to a depth of approximately 2 feet. Alluvial soils are defined as soils that have been transported by water. Alluvial soils consisted of silty sand (USCS-SM). The relative density of the alluvial soils was very loose.

Coastal Plain Soils

Below the surficial materials or fill or alluvial soils the borings encountered Coastal Plain soils consisting of silty and clayey sand (USCS-SM & SC) and low to high plasticity sandy clays and silts (CL, CH, ML & MH). Highly plastic clayey silts and sandy clays (USCS-MH and CH) were encountered in borings BB-1, BB-3 and CB-3 from a depth of 2 to 7 feet. In borings BB-9, CB-4 and CB-8 highly plastic sandy clay (CH) soil layers encountered at a depth of approximately 12 feet and extended to depths of approximately 14.5 to 17 feet. Thickness of the highly plastic soil layers ranged from 2.5 to 5 feet with average layer thickness of 3.5 feet.

The consistency of the soils obtained from the SPT samples generally ranged from loose to dense relative density with SPT N-values ranging from 5 to 32 bpf for sands and firm to hard with SPT N-values ranging from 6 to 36 bpf for the clays and silts. Very loose or soft native soils were

encountered in borings BB-9 and CB-3 in the upper 2 to 7 feet of the soil profile. A deeper very loose soil layer was encountered in boring CB-4 from a depth of 17 to 20 feet.

4.2.4 Hand Auger Borings Subsurface Conditions

This section of the report provides a general discussion of subsurface conditions encountered at the hand auger borings (BB-4, BB-6, BB-7, BB-12, CB-2 and CB-5). Since the augering process disturbs the soils, and relatively undisturbed samples are not obtained as would otherwise be possible through SPT sampling, determination of the origin of the soils (*i.e.,* fill, residual, etc.) was not possible. In addition, since SPT sampling was not performed, the consistency of the soils (*i.e.,* medium dense, firm, etc.) was unable to be determined.

The hand auger borings encountered silty and clayey sands (SM & SC) and low to high plasticity sandy clays and silts (CL, CH & ML). Hand auger borings BB-6 and CB-2 encountered highly plastic sandy clay (CH) soil layers at depths of approximately 7 to 8 and 6 to 10 feet, respectively.

4.3 SOIL MOISTURE AND GROUNDWATER CONDITIONS

The borings encountered a mixture of moist and wet soils. A majority of the soil samples were in a moist conditions (i.e., within 3 to 5 percent of the estimated optimum moisture content). Wet soil conditions (5 to 6 percent or greater over the estimated optimum moisture content) were encountered in borings BB-1 to BB-5, BB-9, BB-12, BB-13, CB-1 to CB-3, CB-5 and CB-7 to CB-9 at depths ranging from the existing ground surface to 4 feet and extended to depths ranging from approximately 2 to 8 feet. In borings BB-3, BB-5, BB-9, CB-1 to CB-3, CB-8 and CB-9 wet soil conditions extended to depths ranging from 10 to 15 feet. Wet soil conditions were encountered in the deeper soil profile in borings BB-1, BB-2, BB-5, BB-8, BB-11, BB-13, CB-4, CB-6 and CB-7 at depths ranging from approximately 7 to 12 feet and extended to depths ranging 12 to 20 feet.

Groundwater level measurements were attempted at the termination of drilling in all of the borings and groundwater was encountered in eight borings (BB-4, BB-9, BB-12, BB-13, CB-3, CB-4, CB-5 and CB-8) at depths ranging from 3.7 to 15.7 feet. Borings BB-2, BB-4, BB-8, BB-11, BB-12, CB-1, CB-6 and CB-8 were backfilled immediately after drilling completion due to their locations either in the road, residential yards, or driveways. Groundwater level measurements were attempted again in the remaining borings after a stabilization period of approximately 24-hours had elapsed after completion of drilling. Stabilized groundwater was encountered in borings BB-5, BB-6, BB-7, BB-9, BB-13, CB-2 to CB-5 and CB-9 at depths ranging from 2.4 to 9.2 feet with the exception of boring CB-3 where groundwater was encountered at the surface. A majority of the borings caved-in at depths ranging from 3.9 to 13.7 feet, which may 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.

4.4 SOIL CORROSIVITY EVALUATION

Twelve soil samples were subjected to laboratory testing to determine pH, Chloride, Sulfate and Sulfide concentrations, Electrical Resistivity and Redox Potential. The results of this testing are presented in the following table:

Boring	Sample Depth (ft)	Soil Type (USCS)	pH	Chloride (mg/kg)	Sulfate (mg/kg)	Sulfides (mg/kg)	Electrical Resistivity (ohm-cm)	Redox Potential (mV)
BB-1	8.5-10.0	ML	4.5	<25*	50	<52.4*	9,390	362
BB-2	3.5-5.0	ML	4.4	<25*	<150*	<59.2*	13,800	351
BB-8	8.5-10.0	CL	5.0	7.7	<150*	<49.4*	10,600	397
BB-9	8.5-10.0	SM	4.8	<25*	48	<46.5*	11,900	362
BB-11	8.5-10.0	SM	4.4	15	<150*	<52.8*	12,500	375
BB-12	4.0-5.0	SM	5.5	<25*	<150*	<52.1*	8,800	368
BB-13	8.5-10.0	CL	4.6	8.1	<150*	<48.6*	14,500	358
CB-1	8.5-10.0	CL	4.6	<25*	<150*	<48.8*	13,500	361
CB-3	3.5-5.0	CH	4.7	<25*	48	<48.6*	16,200	378
CB-6	13.5-15	SC	4.8	<25*	<150*	<47.5*	13,900	376
CB-7	8.5-10.0	SC	4.3	<25*	<150*	<50.4*	11,900	380
CB-9	0-1.5 3.5-5.0	SM	5.0	<25*	<150*	<48.3*	14,500	388

*Below indicated reporting limits

Based on AWWA C105/A21.5 (Polyethylene Encasement for Ductile-Iron Pipe Systems), the soils on this site do not appear to have a high corrosion potential based on the relatively neutral to slightly acidic pH readings, generally trace sulfide concentrations, moderate to high resistivity, and high redox potential. Based on DIPRA's (Ductile Iron Pipe Research Association) "The Design Decision Model for Corrosion Control of Ductile Iron Pipelines" Figure 1, the site is categorized as Level 1, which recommends "Installing the pipe as-manufactured with its protective standard shop coating/annealing oxide system."

We are not aware of the existence of other corrosive factors such as coal, cinders, muck, peat, mine wastes, or landfills at this site, which would otherwise automatically categorize the site as highly corrosive and negate the test results.

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 15 soil test borings and six hand auger 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 construction. It is our opinion that the subsurface conditions encountered at the project site are generally suitable for the proposed construction 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.

5.2 MANHOLE FOUNDATION AND SEWER LINE SUPPORT

Based on our review of the project plans, it appears that open-cut construction will be used to install a majority of the proposed sewer line. The depth of the open-cut line will range from approximately 4 to 14.5 feet below the existing ground surface. Based on the results of the test borings, it is anticipated that the manholes and sewer lines will typically extend through moist to wet, very loose to dense sand (SM or SC) or firm to hard low to high plasticity clay or silt soils (CL, ML and CH). As such, PWR or difficult excavation materials will not likely be encountered during construction. It should be noted that borings BB-4, BB-6, BB-7, BB-12 and CB-5 were not able to extend to the proposed invert elevations due to soil caving which resulted in hand auger boring termination above the proposed invert elevation. As such, F&R is unable to provide bearing grade recommendations near the area of these borings. However, based on the soil conditions encountered near these borings it is not anticipated that PWR or difficult excavation materials will be encountered near these borings.

Based on the results of the test borings, it is anticipated that the manholes and sewer lines will typically bear in moist to wet, medium dense sand (SM or SC) or stiff to very stiff low to high plasticity clay or silt soils (CL, ML and CH). Given the presence of very loose, wet/saturated soils, and groundwater above the invert elevations in several borings, some subgrade repair may be required to provide a stable base for construction of the proposed sewer line and associated manholes, although we do not anticipate that wide-spread repairs will be necessary to install manholes and sewer lines in the open-cut areas.

At borings BB-4 to BB-7, BB-9, BB-12, BB-13, CB-3, CB-4, CB-5 and CB-9 groundwater was encountered approximately 1 to 6 feet above the proposed invert elevations. As such, wet and saturated soils should be anticipated during pipe installation in these areas, and dewatering will likely be necessary. Stabilized groundwater was not measured in borings BB-2, BB-4, BB-8, BB-11, BB-12, CB-1, CB-6 and CB-8 due to their locations in the road. It should be noted that groundwater elevations at these borings were based on a measurement obtained immediately after drilling completion and would likely have been shallower if the groundwater level was allowed to

stabilize for at least 24-hours. As such, the groundwater depths indicated in this report could vary considerably during construction from what has been presented herein.
We recommend that a qualified geotechnical engineer or his representative evaluate all of the trench and manhole excavations and 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 may be required and should be performed as directed by the project geotechnical engineer. If softened/saturated soils or standing water are present at the trench bearing level, a layer of clean washed #57 stone may be recommended to provide a stable bedding for the pipe. The clean washed stone should be encased in geotextile fabric (Mirafi 140N or equivalent) in order to allow sump pumping out of the washed stone and help maintain lowered groundwater during pipe installation and backfilling operations.

5.3 BORE AND JACK PITS

As previously indicated, we understand that bore and jack techniques will be used to install the sewer line at several locations. The locations, depths and borings performed near the bore and jacks are described in the following:

i) **Cliffdale Road Crossing** approximately from station 0+40 to manhole MH B51 station 2+49. The depth of the sewer line at the bore and jack pit locations range from approximately 9 to 10 feet. Borings BB-1 and BB-2 were performed at the bore and jack locations.

ii) **Hickory Knoll Connector** between manhole MH B9 approximately from station 0+00 and manhole MH B10 station 1+51. Another bore and jack is located in this section between proposed manhole MH B11 approximately from station 1+98 and manhole MH B12 station 3+75. The depth of the sewer line at the bore and jack pit locations range from approximately 9 to 12 feet. Borings BB-5 to BB-8 were performed at the bore and jack locations.

iii) **Bostic Upper Connector** approximately from station 0+20 to manhole MH B40 station 2+10. The depth of the sewer line at the bore and jack pit locations range from approximately 8 to 12 feet. Boring BB-9 was performed at the receiving pit location.

iv) **Paddington Place** between manhole MH C3 approximately from station 0+00 and manhole MH C8 station 1+62. The depth of the sewer line at the bore and jack pit locations range from approximately 5 to 11 feet. Borings CB-1 and CB-2 were performed at the bore and jack locations.

v) **Bond Court** between proposed manhole MH C15 approximately from station 0+35 and manhole MH C16 approximately from station 2+11. The depth of bore and jack pits at this section were not available at the time of this report preparation. However, we anticipate the bottom of the entry and receiving pits will be approximately 1 foot deeper than the proposed sewer line invert elevation. As such, the depth of the pits are assumed to be 4 to 14 feet at this location. Borings CB-4 and CB-5 were performed at the bore and jack locations.

The dimensions of the proposed entry and receiving pits will be 20 feet by 40 feet and 10 feet by 10 feet, respectively. The bearing grades of the pits are approximately 1 to 2 feet deeper than the proposed sewer line.

It should be noted that borings BB-6, BB-7 and CB-5 were not able to extend to the pit bottom elevations due to soil caving which resulted in hand auger boring termination above the proposed bottom elevations. As such, F&R is unable to provide bearing grade recommendations near the area of these borings. However, based on the soil conditions encountered near these borings it is not anticipated that PWR or difficult excavation materials will be encountered near these borings.

Based on the results of the test borings, it is anticipated that the casings will typically be installed through moist to wet loose to medium dense silty and clayey sands (SM & SC) and firm to very stiff low to high plasticity silts and clays (CL, ML, CH and MH). As such, it is not anticipated that hard/difficult materials will be encountered during bore and jack activities.

Given the presence of loose and wet soils in the areas of borings located near the bore and jack pits, some bearing grade repair will likely be required to provide a stable base for construction of the proposed bore and jack pits, although we do not anticipate that wide-spread repairs will be necessary to install the pits.

Due to the anticipated excavation depth to the casing invert elevations and anticipated 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 BB-4 to BB-7, BB-9, CB-4 and CB-5 approximately 1 to 6 feet above the proposed invert elevations. As such, wet and saturated soils should be anticipated during excavation in these areas, and dewatering will likely be necessary. However, as previously discussed, groundwater levels could vary from what has been described in this report. And 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, and may require dewatering measures such as sumps 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, a majority of the soils encountered consisted of very loose to dense silty and clayey sands and soft to hard sandy clays and silts. Therefore, we anticipate that the open-cut excavations will likely be performed in soils that can be excavated using conventional backhoes, track excavators, and boring machines.

5.5 STRUCTURAL FILL PLACEMENT AND COMPACTION

It is expected that the low to moderate plasticity on-site cut soils (SM, SC, CL and ML) will be suitable for use as structural fill/backfill material provided they are at a moisture content suitable to achieve proper compaction and are stable during compaction and at final subgrade. These low to moderately plastic soils are generally considered fair to good materials for use as structural earth fill. Based on proposed excavation depths, highly plastic (CH and MH) soils will likely be encountered during excavation in the areas near borings BB-1, BB-3, BB-6, BB-13 and CB-2 to CB-4. Highly plastic soils should not be re-use as structural fill/backfill because they can become unstable at higher moisture contents and be difficult to properly place and compact.

As previously indicated, a majority of the cut soils will likely be wet. Depending upon the cut depths and site conditions at the time of construction, 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 $\pm$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, some of 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 surfaces 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

At borings BB-4 to BB-7, BB-9, BB-12, BB-13, CB-3, CB-4, CB-5 and CB-9 groundwater was encountered approximately 1 to 6 feet above the proposed invert elevations. As such, wet and saturated soils should be anticipated during pipe installation in these areas, and dewatering will likely be necessary. Therefore, it should be expected that groundwater will be encountered during construction and dewatering will be required. The dewatering system to be used should be selected and designed by the contractor, but may consist of sump pit and pumping techniques or a series of well points strategically placed around the construction area. F&R recommends that groundwater levels should be maintained to at least three feet or more below proposed subgrade elevations. Groundwater levels should be lowered prior to performing final excavations to subgrade elevation.

It should be noted that stabilized groundwater was not measured in borings BB-2, BB-4, BB-8, BB-11, BB-12, CB-1, CB-6 and CB-8 due to their locations in the road. It should be noted that groundwater observations performed at these borings were based on a measurement obtained immediately after drilling and would likely have been shallower if the groundwater level was allowed to stabilize for at least 24-hours. As such, the groundwater depths indicated in this report could vary considerably during construction from what has been presented herein.

It should be noted that if groundwater levels are not effectively maintained below the base of the excavation during construction, unstable and loosened/softened subgrade conditions could develop, which may cause excessive settlements to develop beneath the completed structure or require additional subgrade repair (*e.g.,* densification, undercutting & replacement with washed stone, etc.). Therefore, efforts should be incorporated in the construction sequence to properly control groundwater levels during construction. Additionally, it is recommended that only excavation contractors experienced in similar excavations and groundwater control should be allowed to perform this work.

5.7 TEMPORARY EXCAVATION RECOMMENDATIONS

Due to excavations reaching approximately 15 feet or greater in depth and to limit disturbance to the road and neighboring properties, we anticipate that the excavations may not be able to be sufficiently sloped and 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. It should be noted that excavations will extend through and into very loose to loose soils, wet and saturated soils, and below the groundwater, and flatter side slopes and/or special excavation or stabilization systems may be required.

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 W.K. Dickson & Co., 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 GBA, 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

SITE VICINITY MAP

North

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310 Hubert Street
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T 919.828.3441 | F 919.828.5751
www.fandr.com

CLIENT: WK Dickson	
PROJECT: FAYPWC Annexation Area 24	
LOCATION: Fayetteville, NC	
F&R PROJECT No.: 66X-0120	FIGURE No.: 1
DRAWN BY: M. Kayser, P.E.	
DATE: February 2020	SCALE: Not to Scale

⊕ Approximate Boring Location

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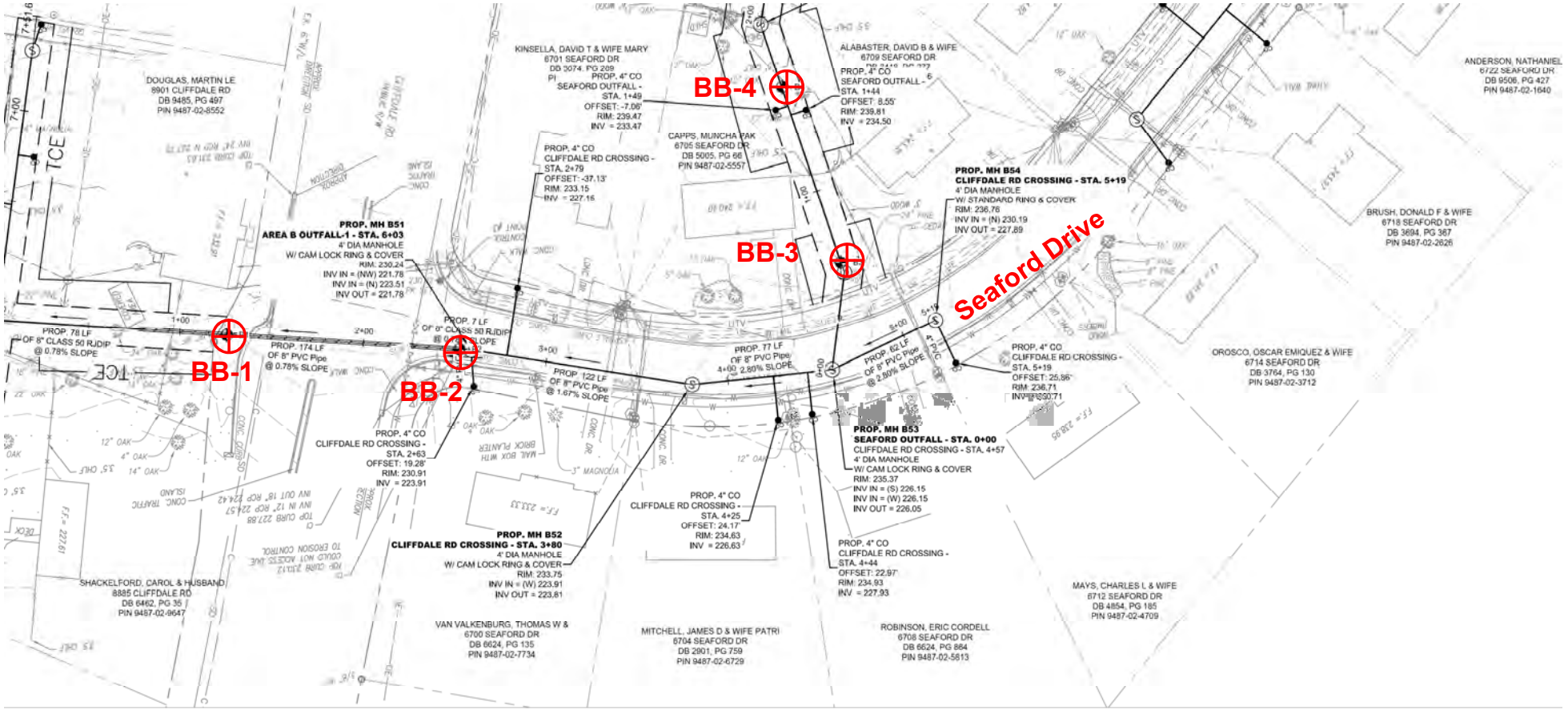
BORING LOCATION PLAN

CLIENT: W.K. Dickson	
PROJECT: FAYPWC Annexation Area 24 (Area B)	
LOCATION: Fayetteville, North Carolina	
F&R PROJECT No: 66X-0120	FIGURE No.: 2A
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.
DATE: February 2020	SCALE: Not to Scale



GENERAL NOTE:

1. CONTRACTOR SHALL BE RESPONSIBLE TO COORDINATE THE PROPOSED SEWER LATERAL INSTALLATION WITH THE EXISTING UTILITIES. CONTRACTOR SHALL USE PWC STANDARD DETAIL S.12 SEWER SERVICE LATERAL UTILITY CONFLICT SEPARATION REQUIREMENTS ONLY WHEN APPROVED BY PWC PROJECT COORDINATOR.

⊕ Approximate Boring Location

CLIFFDALE ROAD CROSSING

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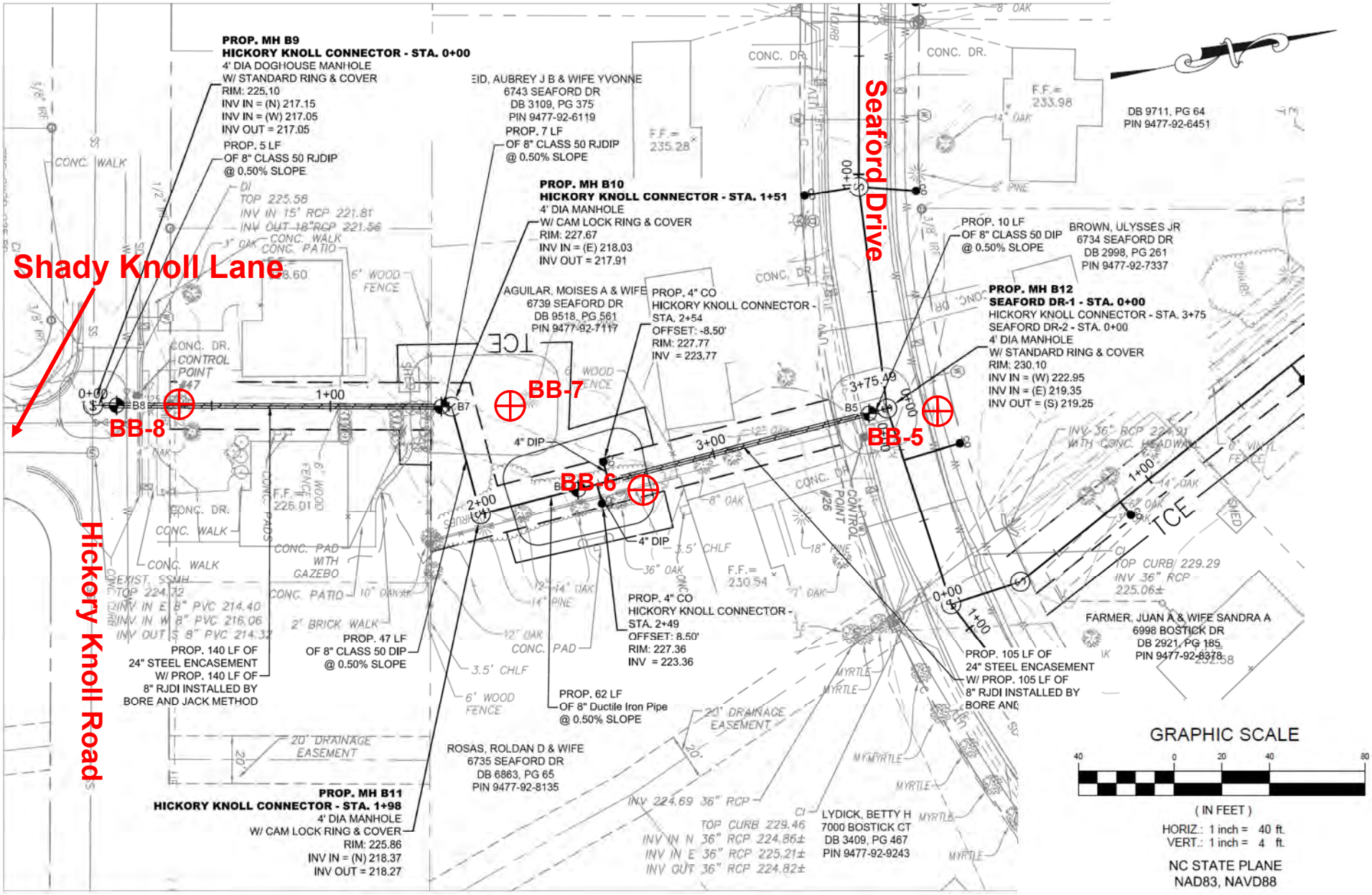
BORING LOCATION PLAN

CLIENT: W.K. Dickson		
PROJECT: FAYPWC Annexation Area 24 (Area B)		
LOCATION: Fayetteville, North Carolina		
F&R PROJECT No: 66X-0120		FIGURE No.: 2B
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.	
DATE: February 2020	SCALE: As Shown	



⊕ Approximate Boring Location

HICKORY KNOLL CONNECTOR

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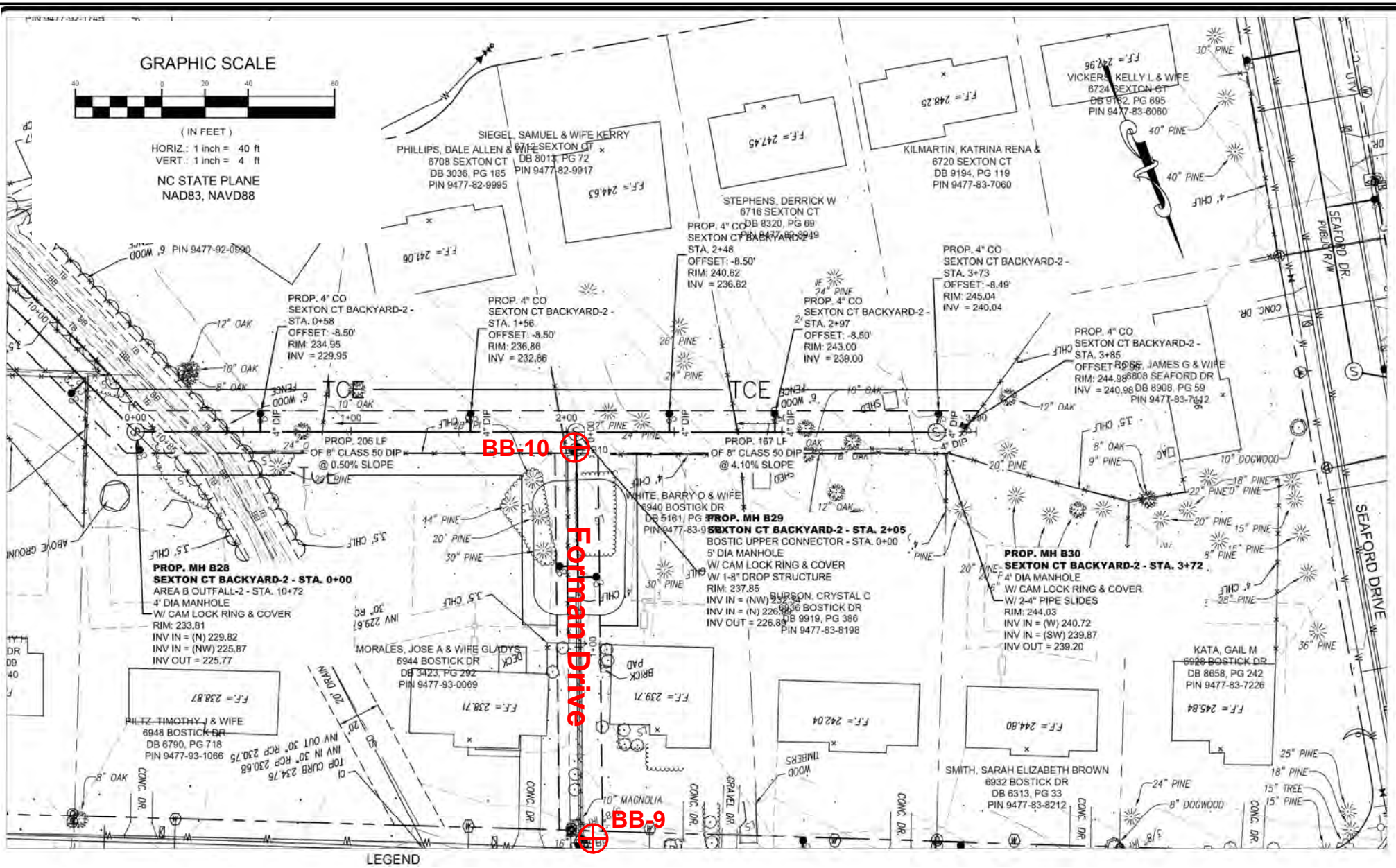
BORING LOCATION PLAN

CLIENT: W.K. Dickson	
PROJECT: FAYPWC Annexation Area 24 (Area B)	
LOCATION: Fayetteville, North Carolina	
F&R PROJECT No: 66X-0120	
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.
DATE: February 2020	SCALE: As Shown

FIGURE No.: 2C



⊕ Approximate Boring Location

SEXTON COURT BACKYARD 2

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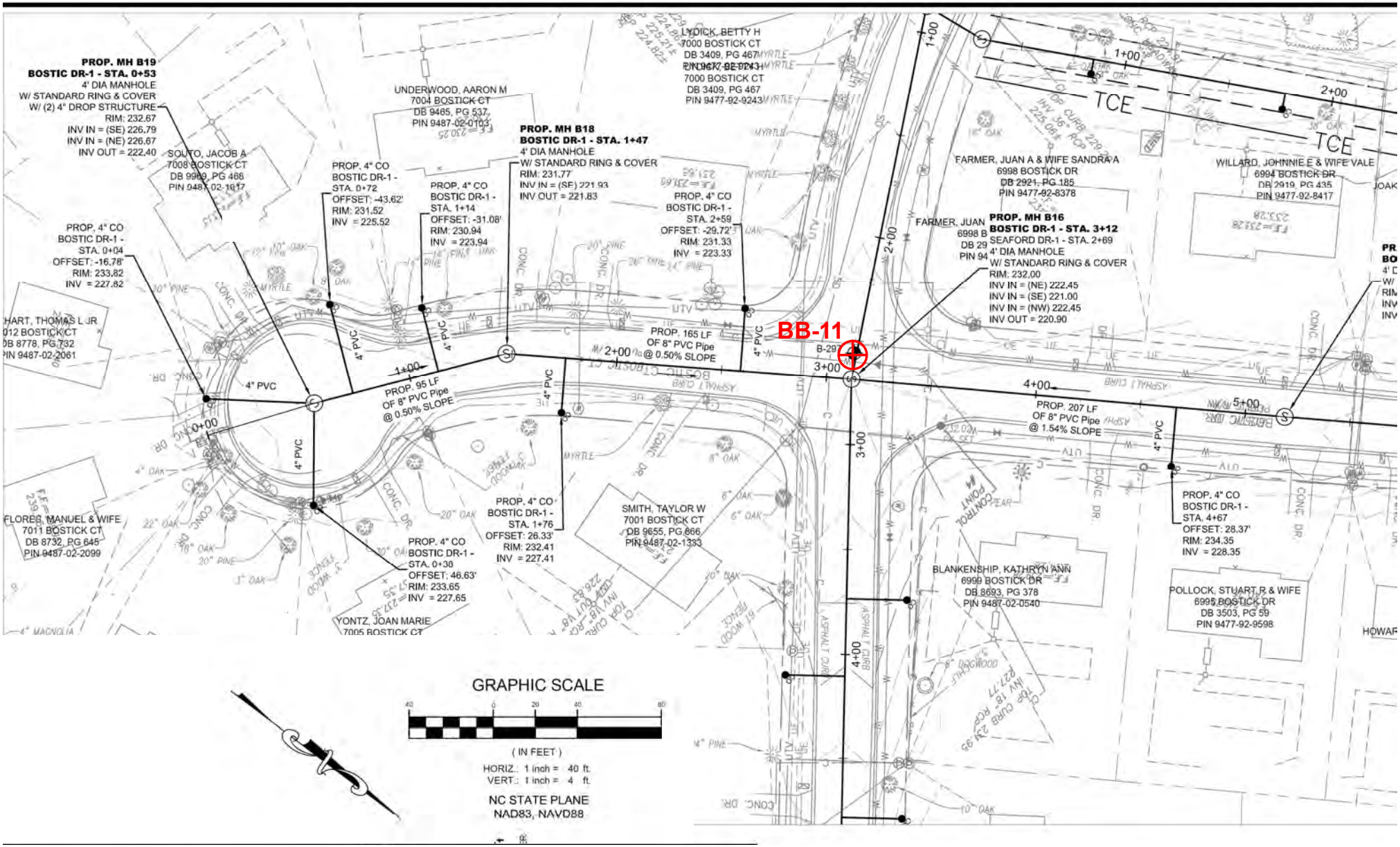
BORING LOCATION PLAN

CLIENT: W.K. Dickson	
PROJECT: FAYPWC Annexation Area 24 (Area B)	
LOCATION: Fayetteville, North Carolina	
F&R PROJECT No: 66X-0120	
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.
DATE: February 2020	SCALE: As Shown

FIGURE No.: 2D



⊕ Approximate Boring Location

BOSTIC DRIVE

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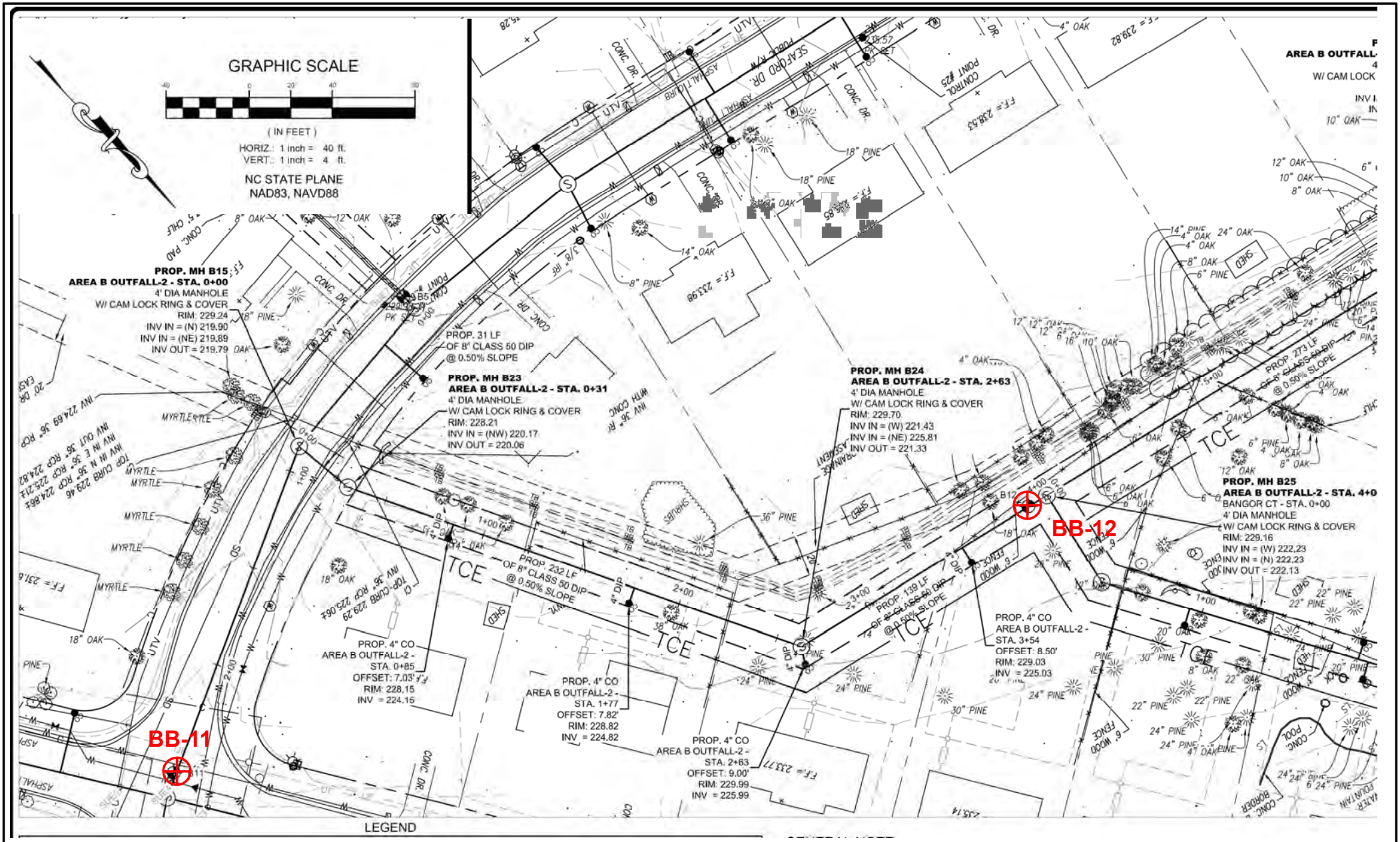
BORING LOCATION PLAN

CLIENT: W.K. Dickson	
PROJECT: FAYPWC Annexation Area 24 (Area B)	
LOCATION: Fayetteville, North Carolina	
F&R PROJECT No: 66X-0120	
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.
DATE: February 2020	SCALE: As Shown

FIGURE No.: 2E



⊕ Approximate Boring Location

AREA B OUTFALL 2

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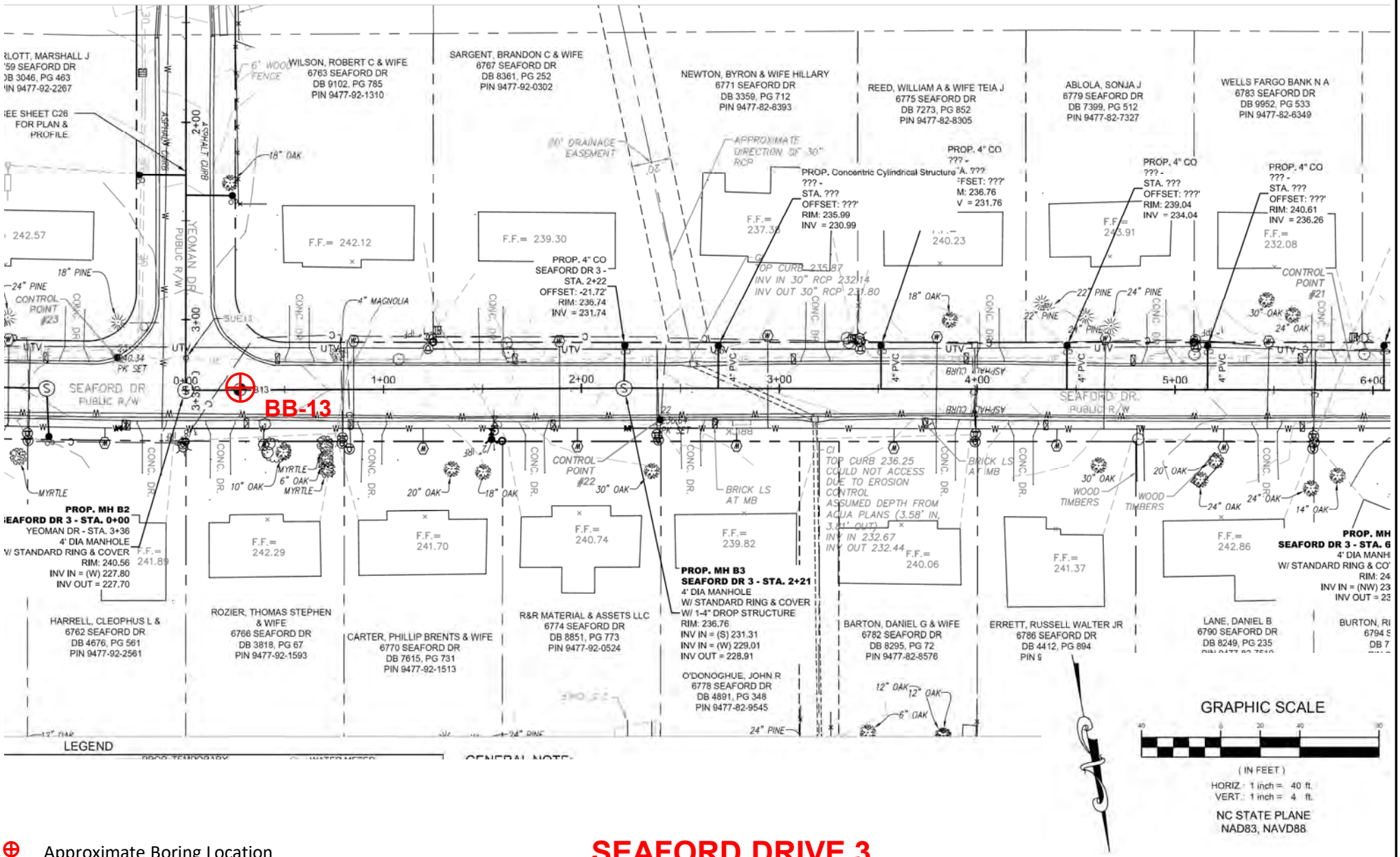
BORING LOCATION PLAN

CLIENT: W.K. Dickson		
PROJECT: FAYPWC Annexation Area 24 (Area B)		
LOCATION: Fayetteville, North Carolina		
F&R PROJECT No: 66X-0120		FIGURE No.: 2F
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.	
DATE: February 2020	SCALE: As Shown	



⊕ Approximate Boring Location

SEAFORD DRIVE 3

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BORING LOCATION PLAN

CLIENT: W.K. Dickson		
PROJECT: FAYPWC Annexation Area 24 (Area B)		
LOCATION: Fayetteville, North Carolina		
F&R PROJECT No: 66X-0120		FIGURE No.: 2G
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.	
DATE: February 2020	SCALE: As Shown	

⊕ Approximate Boring Location

AREA C

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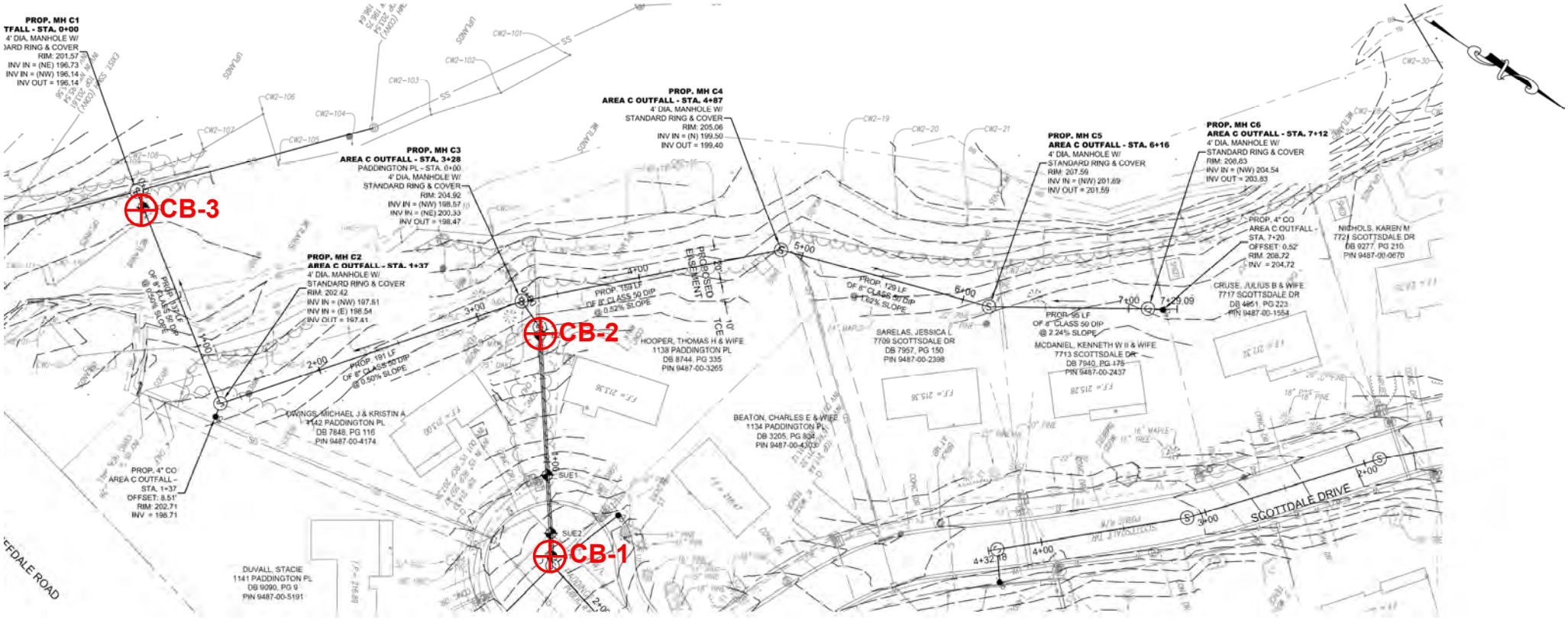
BORING LOCATION PLAN

CLIENT: W.K. Dickson		
PROJECT: FAYPWC Annexation Area 24 (Area C)		
LOCATION: Fayetteville, North Carolina		
F&R PROJECT No: 66X-0120		FIGURE No.: 2H
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.	
DATE: February 2020	SCALE: Not to Scale	



- WATER METER
- IRRIGATION VALVE
- ELECTRIC TRANSFORMER
- TELEPHONE PEDESTAL
- TELEVISION PEDISTAL
- DRAINAGE MANHOLE
- FIRE HYDRANT
- MAILBOX
- LIGHT POLE
- DROP INLET
- F.F. FINISH FLOOR
- INV. INVERT
- POST
- LAMP
- BUSH
- SIGN

GENERAL NOTE:

1. CONTRACTOR SHALL BE RESPONSIBLE TO COORDINATE THE PROPOSED SEWER LATERAL INSTALLATION WITH THE EXISTING UTILITIES. CONTRACTOR SHALL USE PWC STANDARD DETAIL S.12 SEWER SERVICE LATERAL UTILITY CONFLICT SEPARATION REQUIREMENTS ONLY WHEN APPROVED BY PWC PROJECT COORDINATOR.

GRAPHIC SCALE

(IN FEET)

HORIZ.: 1 inch = 40 ft.
VERT.: 1 inch = 4 ft.

NC STATE PLANE
NAD83, NAVD88

⊕ Approximate Boring Location

SCOTTDALE OUTFALL

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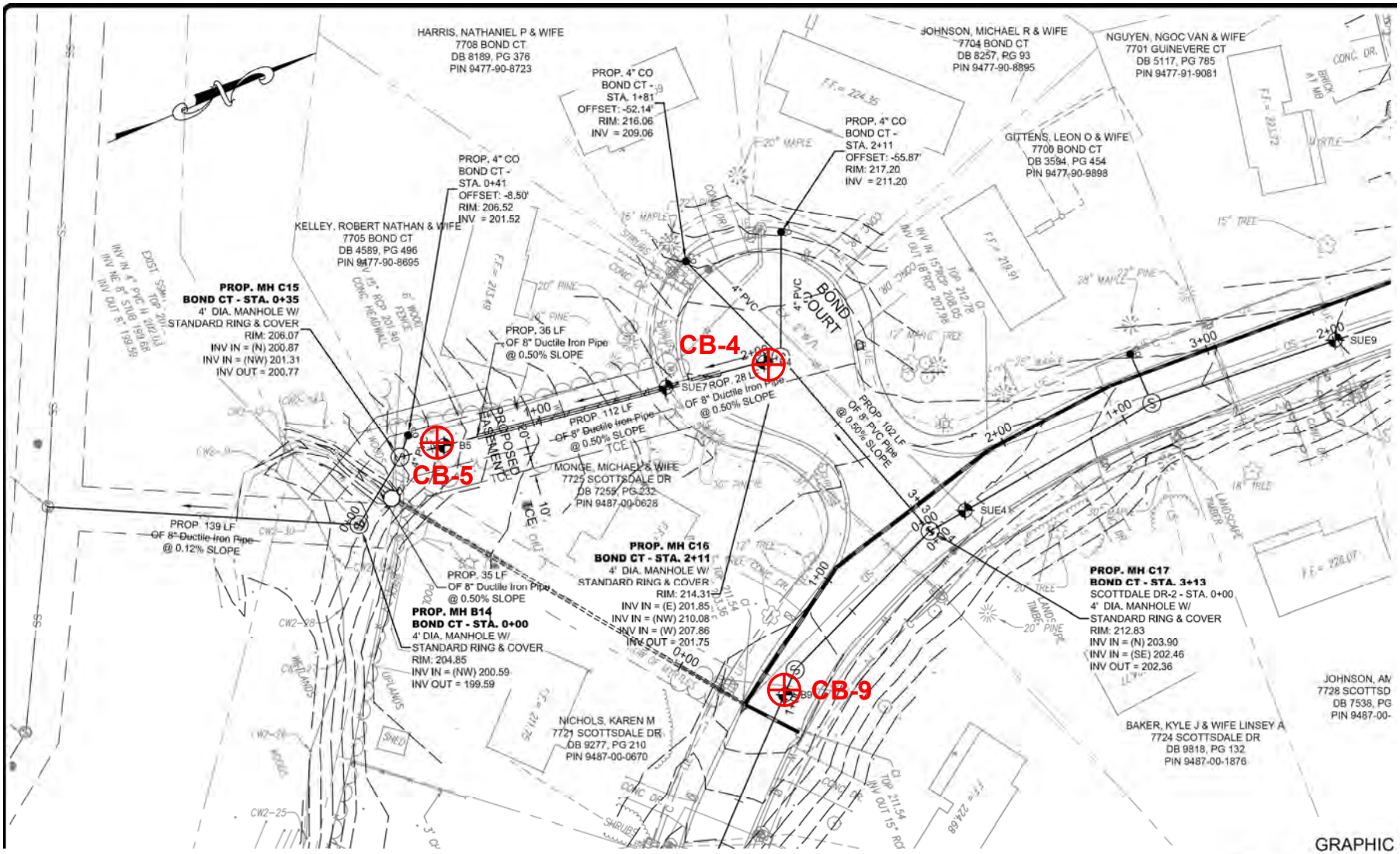
BORING LOCATION PLAN

CLIENT: W.K. Dickson	
PROJECT: FAYPWC Annexation Area 24 (Area C)	
LOCATION: Fayetteville, North Carolina	
F&R PROJECT No: 66X-0120	
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.
DATE: February 2020	SCALE: As Shown

FIGURE No.: 2I



⊕ Approximate Boring Location

BOND COURT

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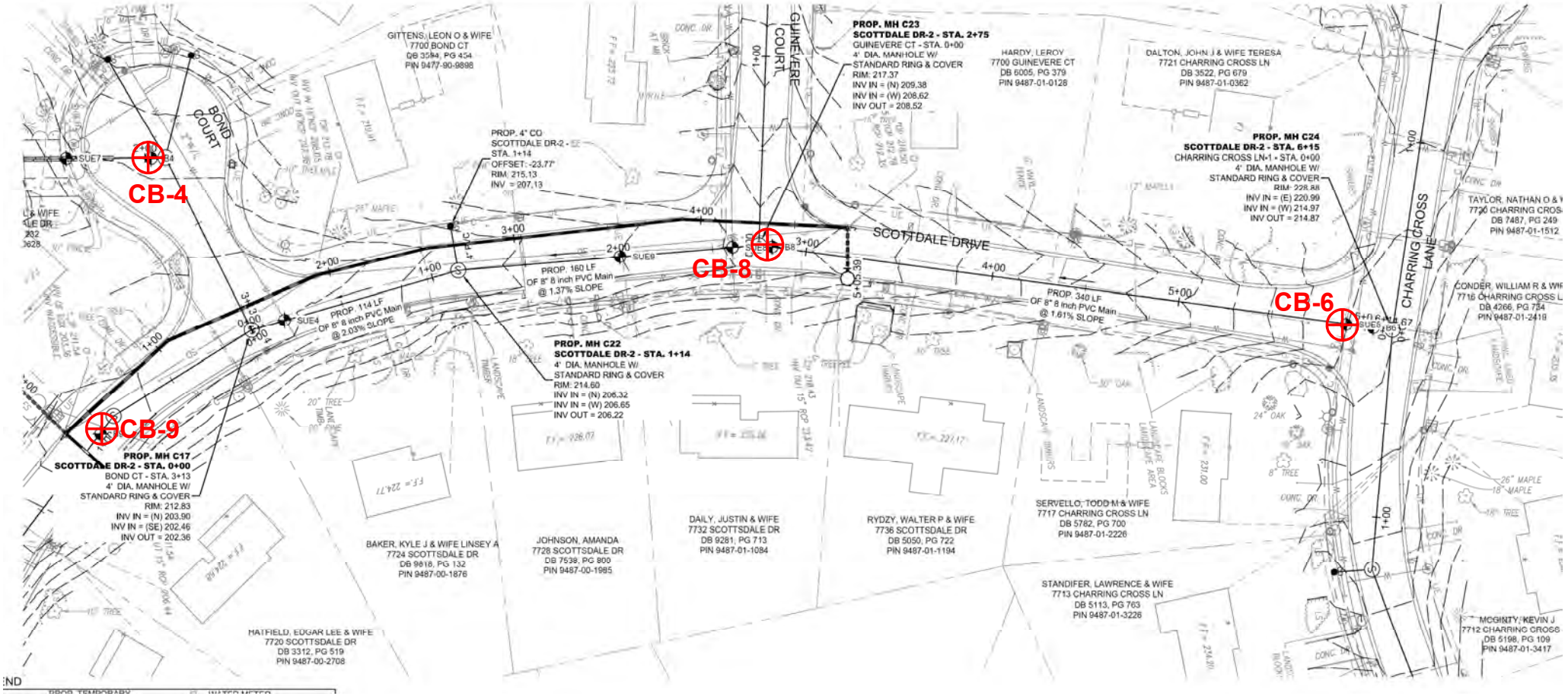
BORING LOCATION PLAN

CLIENT: W.K. Dickson		
PROJECT: FAYPWC Annexation Area 24 (Area C)		
LOCATION: Fayetteville, North Carolina		
F&R PROJECT No: 66X-0120		FIGURE No.: 2J
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.	
DATE: February 2020	SCALE: As Shown	



GRAPHIC SCALE

(IN FEET)

HORIZ.: 1 inch = 40 ft.

VERT.: 1 inch = 4 ft.

NC STATE PLANE
NAD83, NAVD88

⊕ Approximate Boring Location

SCOTTDALE DRIVE 2

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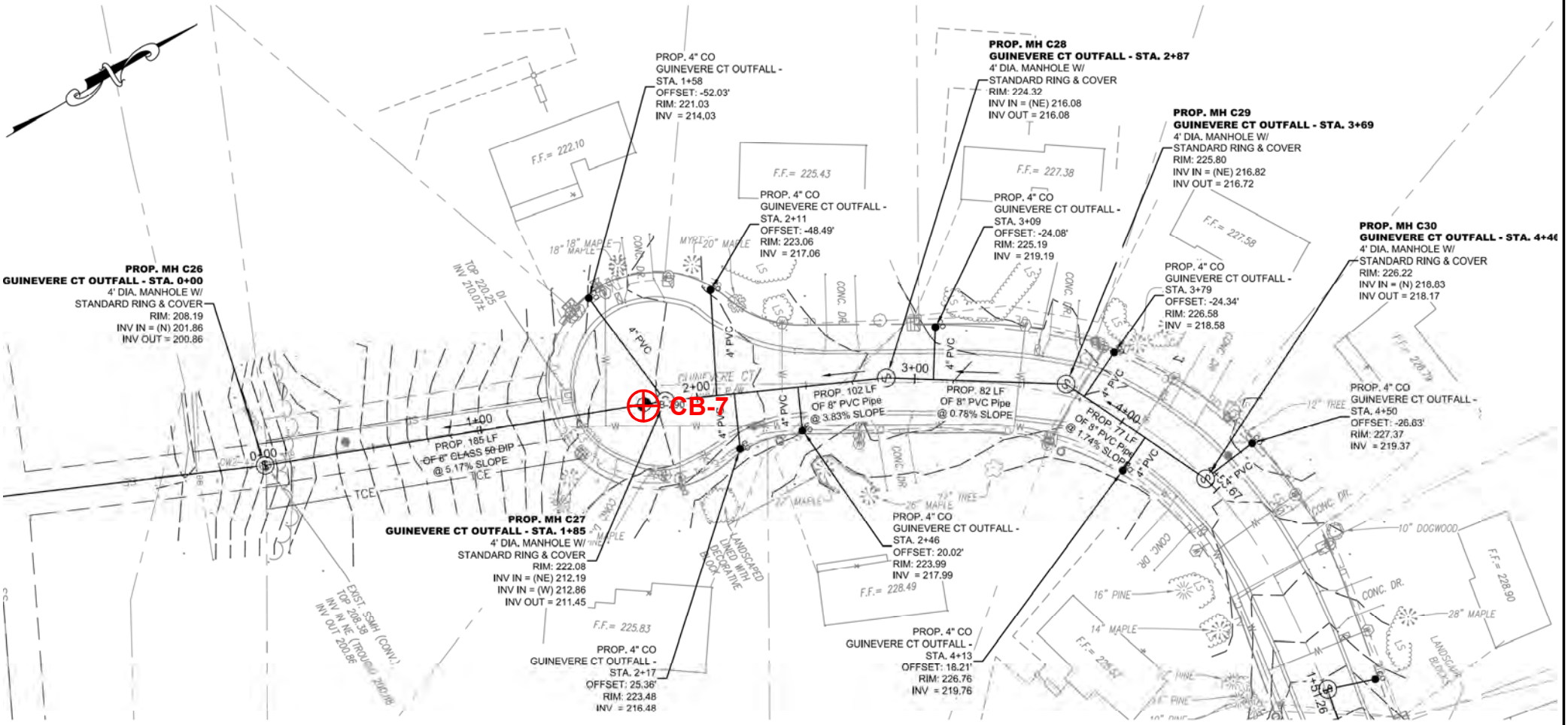
BORING LOCATION PLAN

CLIENT: W.K. Dickson		
PROJECT: FAYPWC Annexation Area 24 (Area C)		
LOCATION: Fayetteville, North Carolina		
F&R PROJECT No: 66X-0120		FIGURE No.: 2K
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.	
DATE: February 2020	SCALE: As Shown	



GUINEVERE COURT OUTFALL

⊕ Approximate Boring Location

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Engineering Stability Since 1881

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BORING LOCATION PLAN

CLIENT: W.K. Dickson		
PROJECT: FAYPWC Annexation Area 24 (Area C)		
LOCATION: Fayetteville, North Carolina		
F&R PROJECT No: 66X-0120		FIGURE No.: 2L
DRAWN BY: M. Kayser, P.E.	CHECKED BY: M. Sabodish, P.E.	
DATE: February 2020	SCALE: As Shown	

Froehling & Robertson, Inc.

SUBSURFACE PROFILE

Plot Based on Elevation

Profile Name: Figure No. 3

Project No: 66X-0120

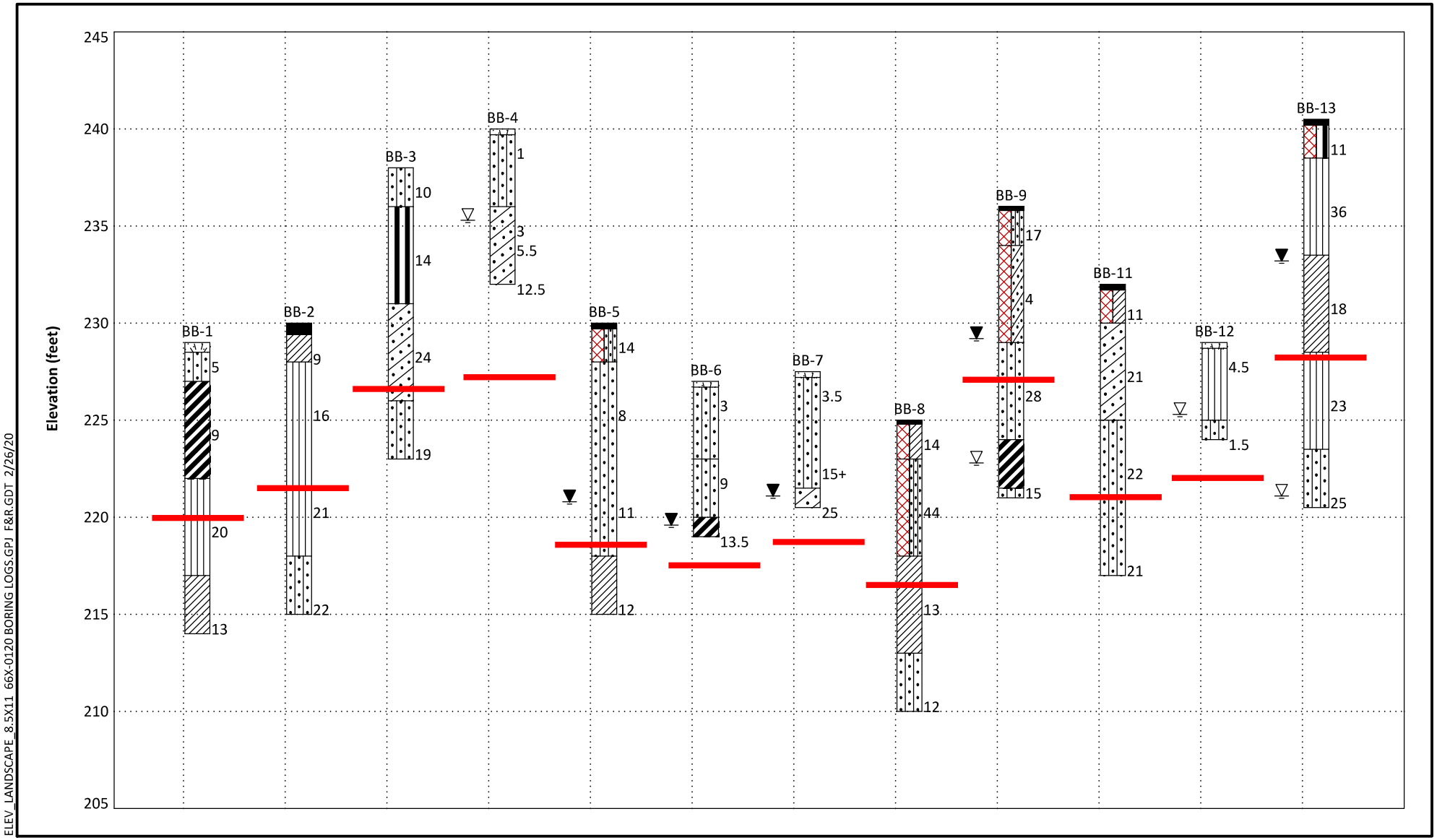
Client: W K Dickson & Company, Inc.

Project: FAYPWC Phase V Annexation Area 24

City/State: Fayetteville, NC

SPT: BB-1 to BB-3, BB-5, BB-8 to BB-11, BB-13
HA with DCP: BB-4, BB-6, BB-7 and BB-12

Approximate Invert Elevation



ELEV_LANDSCAPE_8.5X11 66X-0120 BORING LOGS.GPJ F&R.GDT 2/26/20

Froehling & Robertson, Inc.

SUBSURFACE PROFILE

Plot Based on Elevation

Profile Name: Figure No. 4

Project No: 66X-0120

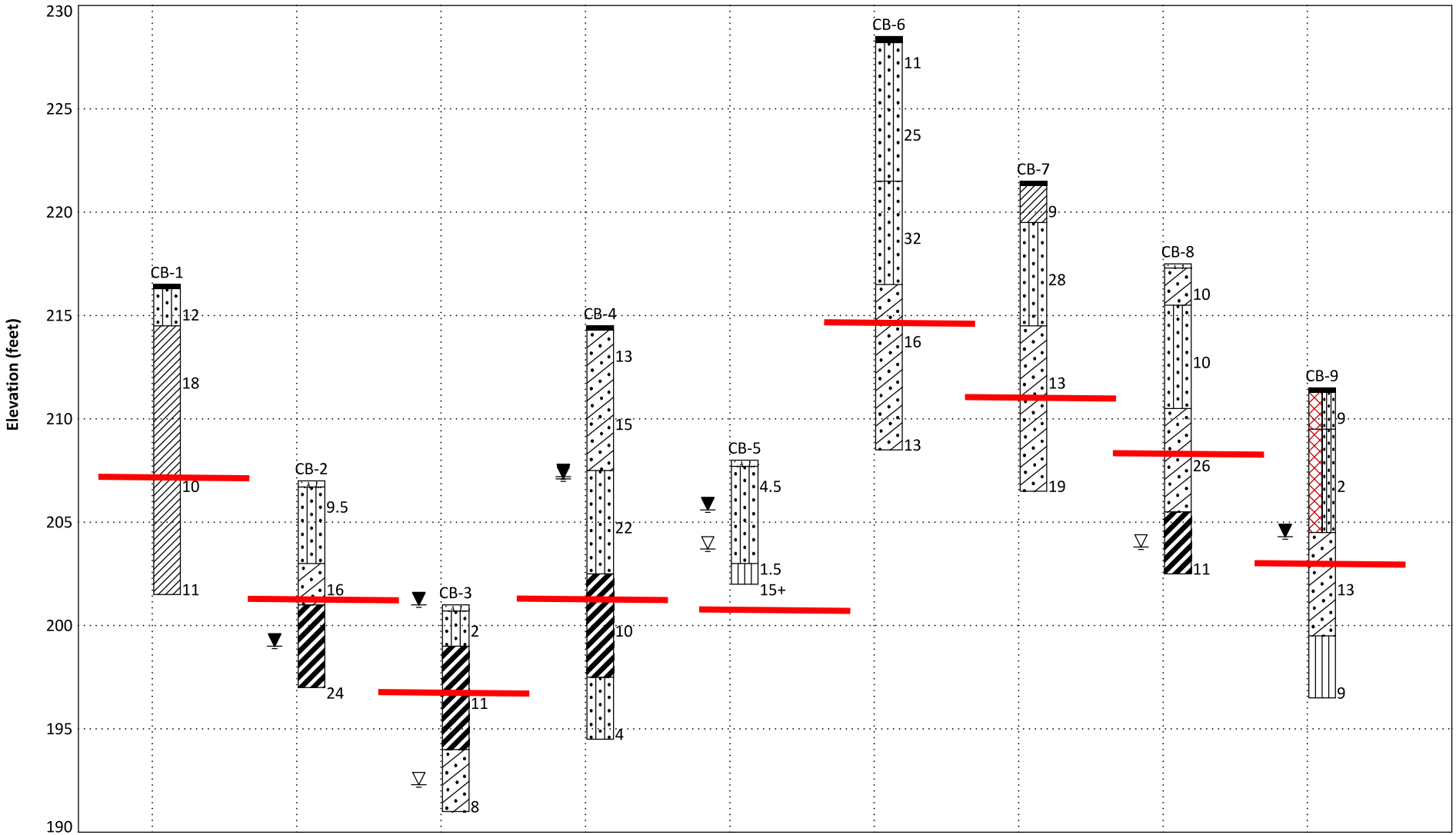
Client: W K Dickson & Company, Inc.

Project: FAYPWC Phase V Annexation Area 24

City/State: Fayetteville, NC

SPT: CB-1, CB-3, CB-4, CB-6 to CB-9
HA with DCP: CB-2 and CB-5

Approximate Invert Elevation



ELEV_LANDSCAPE_8.5X11 66X-0120 BORING LOGS.GPJ F&R.GDT 2/26/20

APPENDIX II

BORING LOGS

KEY TO SOIL CLASSIFICATION

Correlation of Penetration Resistance with Relative Density and Consistency

Sands and Gravels

No. of Blows, N	Relative Density
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium dense
31 - 50	Dense
Over 50	Very dense

Silts and Clays

No. of Blows, N	Relative Density
0 - 2	Very soft
3 - 4	Soft
5 - 8	Firm
9 - 15	Stiff
16 - 30	Very stiff
31 - 50	Hard
Over 50	Very hard

Particle Size Identification (Unified Classification System)

Boulders:	Diameter exceeds 8 inches
Cobbles:	3 to 8 inches diameter
Gravel:	**Coarse** - 3/4 to 3 inches diameter **Fine** - 4.76 mm to 3/4 inch diameter
Sand:	**Coarse** - 2.0 mm to 4.76 mm diameter **Medium** - 0.42 mm to 2.0 mm diameter **Fine** - 0.074 mm to 0.42 mm diameter
Silt and Clay:	Less than 0.07 mm (particles cannot be seen with naked eye)

Modifiers

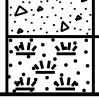
The modifiers provide our estimate of the amount of silt, clay or sand size particles in the soil sample.

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

SINCE F&R 1881

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

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: BB-1 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 229 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/21/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
228.5	0.5	SURFICIAL ORGANIC SOILS	2-3-2	0.0	5	GROUNDWATER DATA: 0 Hr: Dry inside PVC 24 Hr.: Dry inside PVC
		COASTAL PLAIN: Loose, Dark Brown, Moist, Slightly Clayey Very Silty Fine SAND (SM) with Trace Roots		1.5		
227.0	2.0	Stiff, Brown-Gray, Wet, Fine Very Sandy CLAY (CH)	3-4-5	3.5	9	
				5.0		
222.0	7.0	Very Stiff, Gray, Moist, Slightly Clayey Fine Sandy SILT (ML)	7-10-10	8.5	20	
				10.0		
217.0	12.0	Stiff, Brown, Wet, Fine Very Sandy CLAY (CL)	10-5-8	13.5	13	
214.0	15.0	Boring Terminated at 15 feet.		15.0		

*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.

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: BB-2 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 230 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/21/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
229.4	0.6	ASPHALT				GROUNDWATER DATA: 0 Hr: Dry, Caved at 11.7' 24 Hrs.: Backfilled Immediately After Drilling Completion
		COASTAL PLAIN: Stiff, Brown, Wet, Fine Sandy Silty CLAY (CL)	5-4-5	0.6	9	
228.0	2.0	Very Stiff, Gray-Orange-Brown to Brown, Moist, Fine Sandy Clayey SILT (ML)		2.1		
			4-8-8	3.5	16	
				5.0		
			10-10-11	8.5	21	
				10.0		
218.0	12.0	Medium Dense, Orange-Brown, Wet, Very Silty Fine SAND (SM)	8-10-12	13.5	22	
215.0	15.0	Boring Terminated at 15 feet.		15.0		

*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.

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: BB-3 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 238 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/21/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		COASTAL PLAIN: Loose, Dark Gray, Moist, Slightly Clayey Very Silty Fine SAND (SM) with Trace Roots	3-4-6	0.0	10	GROUNDWATER DATA: 0 Hr: Dry inside PVC 24 Hr.: Dry inside PVC
				1.5		
236.0	2.0	Stiff, Brown, Wet, Fine Very Sandy Clayey SILT (MH) with Trace Roots	5-6-8	3.5	14	
				5.0		
231.0	7.0	Medium Dense, Gray-Pink, Wet, Silty Clayey Fine to Coarse SAND (SC)	5-11-13	8.5	24	
				10.0		
226.0	12.0	Medium Dense, Brown, Moist, Clayey Silty Fine to Medium SAND (SM)	6-7-12	13.5	19	
223.0	15.0	Boring Terminated at 15 feet.		15.0		

*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.

FROEHLING & ROBERTSON, INC.

HAND AUGER/DCP LOG

Boring: BB-4 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 240 ±
Total Depth: 8.0'
Boring Location: See Boring Location Plan

Drilling Method: Hand Auger
Hammer Type: DCP
Date Drilled: 1/28/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	Nc	Remarks
239.7	0.3	SURFICIAL ORGANIC SOIL	2-1-1	0.0	1	GROUNDWATER DATA: 0 Hr: 4.7', Caved at 6.3' 24 Hrs.: Backfilled Immediately After Drilling Completion
		Tan to Gray, Moist, Very Silty Fine SAND (SM)		1.0		
236.0	4.0	Orange-Brown, Wet, Silty Clayey Fine SAND (SC)	3-3-3	4.0	3	
			3-4-7	5.0	5.5	
				6.0		
			8-9-16	7.0	12.5	
232.0	8.0	Hand Auger Boring Terminated at 8 feet		8.0		

*Penetration is the number of blows required for a 15 lb hammer dropping 20" to drive 1.375" truncated rod a total of 1.75".

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: BB-5 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 230 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/20/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
229.7	0.3	ASPHALT	6-7-7	0.0	14	GROUNDWATER DATA:
		POSSIBLE FILL: Medium Dense, Dark Brown, Moist, Slightly Clayey Silty Fine to Medium SAND (SM)		1.5		0 Hr: Dry, caved at 12.8'
228.0	2.0	COASTAL PLAIN: Loose to Medium Dense, Brown, Moist to Wet, Slightly Clayey Very Silty Fine to Medium SAND (SM)	4-4-4	3.5	8	24 Hrs.: 9.2', caved at 10.6'
				5.0		
			5-4-7	8.5	11	
				10.0		
218.0	12.0	Stiff, Gray-Brown, Wet, Fine Very Sandy Silty CLAY (CL)	3-6-6	13.5	12	
215.0	15.0	Boring Terminated at 15 feet.		15.0		

*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.

FROEHLING & ROBERTSON, INC.

HAND AUGER/DCP LOG

Boring: BB-6 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 227 ±
Total Depth: 8.0'
Boring Location: See Boring Location Plan

Drilling Method: Hand Auger
Hammer Type: DCP
Date Drilled: 1/27/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	Nc	Remarks
226.7	0.3	SURFICIAL ORGANIC SOIL	3-3-3	0.0	3	GROUNDWATER DATA: 0 Hr: Dry, Caved at 8.0' 24 Hrs.: 7.4'
		Tan, Moist, Silty Fine SAND (SM)		1.0		
223.0	4.0	Orange-Brown, Moist, Clayey Silty Fine to Medium SAND (SM)	10-6-12	4.0	9	
				5.0		
220.0	7.0	Gray-Brown, Wet, Fine Sandy Silty CLAY (CH)	22-15-12	7.0	13.5	
219.0	8.0	Hand Auger Boring Terminated at 8 feet		8.0		

*Penetration is the number of blows required for a 15 lb hammer dropping 20" to drive 1.375" truncated rod a total of 1.75".

FROEHLING & ROBERTSON, INC.

HAND AUGER/DCP LOG

Boring: BB-7 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 227.5 ±
Total Depth: 7.0'
Boring Location: See Boring Location Plan

Drilling Method: Hand Auger
Hammer Type: DCP
Date Drilled: 1/27/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	Nc	Remarks
227.2	0.3	SURFICIAL ORGANIC SOIL	3-3-4	0.0	3.5	GROUNDWATER DATA: 0 Hr: Dry, Caved at 6.0' 24 Hrs.: 6.4', Caved at 6.9'
		Tan to Orange-Brown, Moist, Clayey Silty Fine To Medium SAND (SM)		1.0		
			40/1.75"	4.0	15+	
				5.0		
221.5	6.0	Orange-Brown, Moist, Silty Clayey Fine to Medium SAND (SC)	28-26-24	6.0	25	
220.5	7.0	Hand Auger Boring Terminated at 7 feet		7.0		

*Penetration is the number of blows required for a 15 lb hammer dropping 20" to drive 1.375" truncated rod a total of 1.75".

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: BB-8 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 225 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/11/20
Driller: F&R Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
224.8	0.2	ASPHALT	12-7-7	0.0	14	GROUNDWATER DATA:
		POSSIBLE FILL: Stiff, Orange-Brown, Moist, Fine to Medium Sandy Silty CLAY (CL)		1.5		0 Hr: Dry
223.0	2.0	POSSIBLE FILL: Dense, Red-Brown, Moist, Silty Fine to Medium SAND (SM) with Trace Fine Rock Fragments	6-20-24	3.5	44	24 Hrs.: Backfilled
				5.0		Immediately After Drilling Completion
218.0	7.0	COASTAL PLAIN: Stiff, Gray-Brown, Wet, Fine Very Sandy Silty CLAY (CL)	4-6-7	8.5	13	
				10.0		
213.0	12.0	Medium Dense, Gray, Wet, Slightly Clayey Silty Fine to Medium SAND (SM)	7-5-7	13.5	12	
210.0	15.0	Boring Terminated at 15 feet.		15.0		

*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.

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: BB-9 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 236 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/20/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
235.8	0.2	ASPHALT	4-8-9	0.2	17	GROUNDWATER DATA: 0 Hr: 13.2', Caved at 13.7' 24 Hr.: 6.8', Caved at 12.7'
		FILL: Medium Dense, Brown, Moist, Clayey Silty Fine to Medium SAND (SM)		1.7		
234.0	2.0	FILL: Very Loose, Gray, Wet, Silty Clayey Fine SAND (SC) with Trace Fine Gravel	2-2-2	3.5	4	
				5.0		
229.0	7.0	COASTAL PLAIN: Medium Dense, Brown, Wet, Slightly Clayey Silty Fine to Medium SAND (SM)	13-13-15	8.5	28	
				10.0		
224.0	12.0	Stiff, Gray, Wet, Fine Sandy CLAY (CH)	7-3-12	13.5	15	
221.5	14.5					
221.0	15.0	Medium Dense, Gray, Wet, Very Silty Fine SAND (SM) Boring Terminated at 15 feet.		15.0		

*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.

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: BB-11 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 232 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/20/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
231.7	0.3	ASPHALT	5-5-6	0.3	11	GROUNDWATER DATA: 0 Hr: Dry, Caved at 12.7' 24 Hrs.: Backfilled Immediately After Drilling Completion
		POSSIBLE FILL: Stiff, Brown, Moist, Fine to Medium Very Sandy Silty CLAY (CL) with Trace Fine Gravel		1.8		
230.0	2.0	COASTAL PLAIN: Medium Dense, Brown-Orange-Gray, Moist, Silty Clayey Fine to Medium SAND (SC) with Trace Fine Gravel	6-9-12	3.5	21	
				5.0		
225.0	7.0	Medium Dense, Brown to Gray-Brown, Moist to Wet, Slightly Clayey Very Silty Fine SAND (SM)	5-12-10	8.5	22	
				10.0		
		Wet from 13.5' to 15.0'	10-10-11	13.5	21	
217.0	15.0	Boring Terminated at 15 feet.		15.0		

*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.

FROEHLING & ROBERTSON, INC.

HAND AUGER/DCP LOG

Boring: BB-12 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 229 ±
Total Depth: 5.0'
Boring Location: See Boring Location Plan

Drilling Method: Hand Auger
Hammer Type: DCP
Date Drilled: 1/28/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	Nc	Remarks
228.7	0.3	SURFICIAL ORGANIC SOIL	3-4-5	0.0	4.5	GROUNDWATER DATA: 0 Hr: 3.7', Caved at 4.8' 24 Hrs.: Backfilled Immediately After Drilling Completion
		Black, Moist, Slightly Clayey Fine Very Sandy SILT (ML) with Trace Roots		1.0		
225.0	4.0	Black, Wet, Clayey Silty Fine to Medium SAND (SM)	1-2-1	4.0	1.5	
224.0	5.0	Hand Auger Boring Terminated at 5 feet		5.0		

*Penetration is the number of blows required for a 15 lb hammer dropping 20" to drive 1.375" truncated rod a total of 1.75".

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: BB-13 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 240.5 ±
Total Depth: 20.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/20/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
240.2	0.3	ASPHALT	6-5-6	0.3	11	GROUNDWATER DATA: 0 Hr: 15.7' inside PVC 24 Hr.: 7.3' inside PVC
		POSSIBLE FILL: Stiff, Red-Brown, Wet, Fine Sandy Clayey SILT (MH)		1.8		
238.5	2.0	COASTAL PLAIN: Hard, Red-Brown, Moist, Fine Very Sandy Clayey SILT (ML) with Trace Rock Fragments	11-16-20	3.5	36	
				5.0		
233.5	7.0 ▼	Very Stiff, Gray-Brown, Wet, Fine Very Sandy Silty CLAY (CL)	9-8-10	8.5	18	
				10.0		
228.5	12.0	Very Stiff, Brown, Moist, Fine Sandy Clayey SILT (ML)	10-9-14	13.5	23	
	▽			15.0		
223.5	17.0	Medium Dense, Brown, Wet, Silty Fine to Medium SAND (SM) with Trace Fine Gravel	8-17-8	18.5	25	
220.5	20.0	Boring Terminated at 20 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.

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: CB-1 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 216.5 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/22/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
216.3	0.2	ASPHALT	4-5-7	0.2	12	GROUNDWATER DATA: 0 Hr: Dry, Caved at 12.7' 24 Hrs.: Backfilled Immediately After Drilling Completion
		COASTAL PLAIN: Medium Dense, Brown, Moist, Silty Fine to Medium SAND (SM)		1.7		
214.5	2.0	Stiff to Very Stiff, Gray-Orange to Gray-Brown, Wet, Fine Very Sandy Silty CLAY (CL)	9-8-10	3.5	18	
				5.0		
			12-5-5	8.5	10	
				10.0		
			5-5-6	13.5	11	
201.5	15.0	Boring Terminated at 15 feet.		15.0		

*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.

FROEHLING & ROBERTSON, INC.

HAND AUGER/DCP LOG

Boring: CB-2 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 207 ±
Total Depth: 10.0'
Boring Location: See Boring Location Plan

Drilling Method: Hand Auger
Hammer Type: DCP
Date Drilled: 1/27/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	Nc	Remarks
206.7	0.3	SURFICIAL ORGANIC SOIL	6-9-10	0.0	9.5	GROUNDWATER DATA: 0 Hr: Dry, Caved at 10.0' 24 Hrs.: 8', Caved at 8.5'
		Tan, Moist, Very Silty Fine SAND (SM)		1.0		
203.0	4.0	Orange, Wet, Silty Clayey Fine to Medium SAND (SC)	13-18-14	4.0	16	
				5.0		
201.0	6.0	Orange-Brown, Wet, Fine Sandy Silty CLAY (CH)				
			17-26-22	9.0	24	
197.0	10.0	Hand Auger Boring Terminated at 10 feet		10.0		

*Penetration is the number of blows required for a 15 lb hammer dropping 20" to drive 1.375" truncated rod a total of 1.75".

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: CB-3 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 201 ±
Total Depth: 10.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/22/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
200.7	0.3	SURFICIAL ORGANIC SOILS	1-1-1	0.0	2	GROUNDWATER DATA: 0 Hr: 8.7', Caved at 7.1' 24 Hrs.: 0', Caved at 3.9'
		ALLUVIAL: Very Loose, Dark Gray, Wet, Slightly Clayey Silty Fine to Medium SAND (SM) with Trace Roots		1.5		
199.0	2.0	COASTAL PLAIN: Stiff, Gray-Orange, Wet, Fine Sandy CLAY (CH)	3-4-7	3.5	11	
				5.0		
194.0	7.0	Loose, Gray-Brown, Wet, Silty Clayey Fine to Medium SAND (SC)	8-5-3	8.5	8	
191.0	10.0	Boring Terminated at 10 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.

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: CB-4 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 214.5 ±
Total Depth: 20.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/22/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
214.3	0.2	ASPHALT	4-4-9	0.2	13	GROUNDWATER DATA: 0 Hr: 7.4' inside PVC 24 Hr.: 7.3' inside PVC
		COASTAL PLAIN: Medium Dense, Gray-Brown, Moist, Silty Clayey Fine to Medium SAND (SC)		1.7		
			6-7-8	3.5	15	
				5.0		
207.5	7.0	Medium Dense, Gray, Wet, Silty Fine to Medium SAND (SM)	12-14-8	8.5	22	
				10.0		
202.5	12.0	Stiff, Pink-Brown, Wet, Fine Sandy Silty CLAY (CH)	3-4-6	13.5	10	
				15.0		
197.5	17.0	Very Loose, Brown, Wet, Very Silty Fine SAND (SM)	2-2-2	18.5	4	
194.5	20.0	Boring Terminated at 20 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.

FROEHLING & ROBERTSON, INC.

HAND AUGER/DCP LOG

Boring: CB-5 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 208 ±
Total Depth: 6.0'
Boring Location: See Boring Location Plan

Drilling Method: Hand Auger
Hammer Type: DCP
Date Drilled: 1/27/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	Nc	Remarks
207.7	0.3	SURFICIAL ORGANIC SOIL	4-4-5	0.0	4.5	GROUNDWATER DATA: 0 Hr: 4.3', Caved at 6.0' 24 Hrs.: 2.4', Caved at 4.0'
		Dark Gray, Moist to Wet, Silty Fine to Medium SAND (SM)		1.0		
		Wet from 4'-5'	5-1-2	4.0	1.5	
203.0	5.0	Gray, Wet, Fine Sandy Clayey SILT (ML)	40/2"	5.0	15+	
202.0	6.0	Hand Auger Boring Terminated at 6 feet		6.0		

*Penetration is the number of blows required for a 15 lb hammer dropping 20" to drive 1.375" truncated rod a total of 1.75".

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: CB-6 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 228.5 ±
Total Depth: 20.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/21/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
228.2	0.3	ASPHALT	7-5-6	0.0	11	GROUNDWATER DATA: 0 Hr: Dry, Caved at 12.7' 24 Hrs.: Backfilled Immediately After Drilling Completion
		COASTAL PLAIN: Medium Dense, Brown, Moist, Slightly Clayey Silty Fine to Medium SAND (SM) with Trace Fine Gravel		1.5		
			9-10-15	3.5	25	
				5.0		
221.5	7.0	Dense, Brown, Moist, Silty Fine to Medium SAND (SM)	12-15-17	8.5	32	
				10.0		
216.5	12.0	Medium Dense, Gray-Brown to Gray, Wet, Silty Clayey Fine to Medium SAND (SC)	6-6-10	13.5	16	
				15.0		
			3-5-8	18.5	13	
208.5	20.0	Boring Terminated at 20 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.

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: CB-7 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 221.5 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/22/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
221.3	0.2	ASPHALT	6-4-5	0.2	9	GROUNDWATER DATA: 0 Hr: Dry inside PVC 24 Hr.: Dry inside PVC
		COASTAL PLAIN: Stiff, Brown, Wet, Fine Sandy Silty CLAY (CL)		1.7		
219.5	2.0	Medium Dense, Brown, Moist, Silty Fine to Medium SAND (SM)	9-16-12	3.5	28	
				5.0		
214.5	7.0	Medium Dense, Gray, Wet, Silty Clayey Fine to Medium SAND (SC)	7-6-7	8.5	13	
				10.0		
			8-9-10	13.5	19	
206.5	15.0	Boring Terminated at 15 feet.		15.0		

*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.

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: CB-8 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 217.5 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/22/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
217.3	0.2	SURFICIAL ORGANIC SOILS	7-5-5	0.2	10	GROUNDWATER DATA: 0 Hr: 13.7', Caved at 13.7' 24 Hrs.: Backfilled Immediately After Drilling Completion
		COASTAL PLAIN: Loose, Brown, Moist, Silty Clayey Fine to Medium SAND (SC)		1.7		
215.5	2.0	Loose, Brown, Wet, Clayey Silty Fine to Medium SAND (SM)	8-5-5	3.5	10	
				5.0		
210.5	7.0	Medium Dense, Brown-Gray, Wet, Silty Clayey Fine to Medium SAND (SC)	6-10-16	8.5	26	
				10.0		
205.5	12.0	Stiff, Pink-Brown, Wet, Fine Sandy CLAY (CH)	8-5-6	13.5	11	
202.5	15.0	Boring Terminated at 15 feet.		15.0		

▽

*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.

FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: CB-9 (1 of 1)

Project No: 66X-0120
Client: W K Dickson & Company, Inc.
Project: FAYPWC Phase V Annexation Area 24
City/State: Fayetteville, NC

Elevation: 211.5 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 1/22/20
Driller: F&R-Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
211.3	0.2	ASPHALT	4-5-4	0.2	9	GROUNDWATER DATA: 0 Hr: Dry inside PVC 24 Hr.: 7.2' inside PVC
		FILL: Loose, Brown, Wet, Clayey Silty Fine to Medium SAND (SM) with Trace Roots		1.7		
209.5	2.0	FILL: Very Loose, Brown, Wet, Slightly Clayey Silty Fine to Medium SAND (SM) with Trace Roots	3-1-1	3.5	2	
				5.0		
204.5	▼7.0	COASTAL PLAIN: Medium Dense, Gray-Brown, Wet, Silty Clayey Fine to Medium SAND (SC)	4-5-8	8.5	13	
				10.0		
199.5	12.0	Stiff, Gray-Brown, Wet, Fine Sandy Clayey SILT (ML)	3-4-5	13.5	9	
196.5	15.0	Boring Terminated at 15 feet.		15.0		

*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

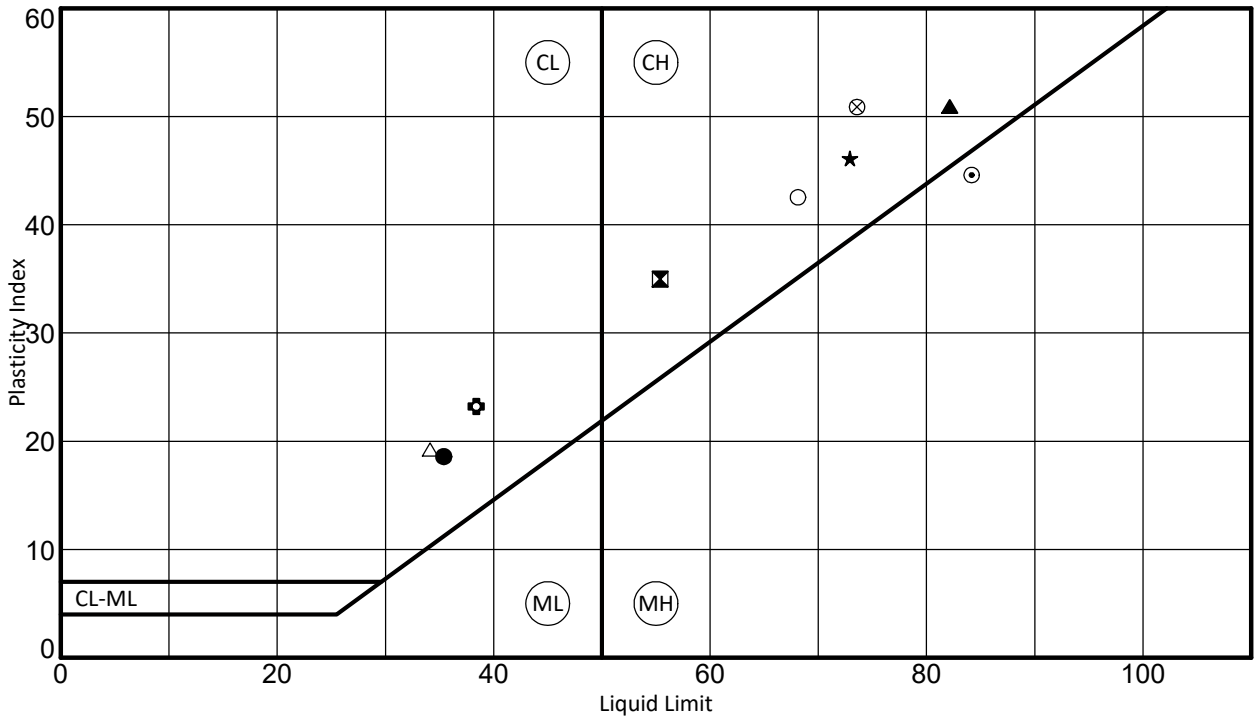
LABORATORY TEST RESULTS

FROEHLING & ROBERTSON
Engineering Stability Since 1881

ATTERBERG LIMITS

Sheet: 1 of 1

Project No: 66X-0120
Client: WK Dickson
Project: FAYPWC Annexation Area 24
City/State: Fayetteville, North Carolina



Boring No.	Depth	LL	PL	PI	Fines	Classification	% Natural Water Content
● AB-2	13.5' - 15.0'	35	17	18	49.0	CLAYEY SAND (SC)	19.8
⊠ AB-4	8.5' - 10.0'	55	20	35	56.4	VERY SANDY CLAY (CH)	19.2
▲ AB-6	8.5' - 10.0'	82	31	51	86.7	SILTY CLAY (CH)	33.0
★ BB-1	3.5' - 5.0'	73	27	46	54.6	VERY SANDY CLAY (CH)	19.5
⊙ BB-3	3.5' - 5.0'	84	40	44	53.6	SANDY ELASTIC SILT (MH)	22.4
✿ BB-4	4.0' - 5.0'	38	15	23	47.1	CLAYEY SAND (SC)	18.2
○ BB-6	7.0' - 8.0'	68	26	42	66.2	SANDY CLAY (CH)	22.3
△ BB-9	3.5' - 5.0'	34	15	19	47.1	CLAYEY SAND (SC)	17.9
⊗ CB-2	6.0' - 7.0'	74	23	51	67.1	SANDY CLAY (CH)	22.6

NC Certification No. 402
NC Drinking Water Cert No. 37735
SC Certification No. 99012

Case Narrative

2/11/20 15:16

Froehling & Robertson, Inc. (Raleigh)
Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Lab Submittal Date: 01/31/2020
Work Order: 0020006

This data package contains the analytical results for the project identified above and includes a Case Narrative, Sample Results and Chain of Custody. Unless otherwise noted, all samples were received in acceptable condition and processed according to the referenced methods.

Data qualifiers are flagged individually on each sample. A key reference for the data qualifiers appears at the end of this case narrative.

Narrative Notes:

ORP analysis was subcontracted to Pace Labs. Laboratory report is attached.

Sulfide and resistivity subcontracted Analytical Environmental Services. Laboratory report is attached.

Please call if you have any questions relating to this analytical report.

Respectfully,

WAYPOINT ANALYTICAL

Angela D. Overcash

Senior Project Manager

Reviewed By Angela D. Overcash

Senior Project Manager

Data Qualifiers Key Reference:

HT	Sample received and analyzed outside of the hold time.
BRL	Below Reporting Limit
MDL	Method Detection Limit
RPD	Relative Percent Difference
*	Results reported to the reporting limit. All other results are reported to the MDL with values between MDL and reporting limit indicated with a J.

Sample Receipt Summary

02/11/2020

Work Order: 0020006

Client Sample ID	Lab Sample ID	Matrix	Date/Time Sampled	Date/Time Received
AB-2 (18.5-20/22.5-25)	0020006-01	Solid	01/23/20 0:00	01/31/20 16:10
AB-4 (13.5-15)	0020006-02	Solid	01/11/20 0:00	01/31/20 16:10
AB-5 (13.5-15)	0020006-03	Solid	01/13/20 0:00	01/31/20 16:10
AB-7 (8.5-10)	0020006-04	Solid	01/12/20 0:00	01/31/20 16:10
AB-9 (9-10)	0020006-05	Solid	01/27/20 0:00	01/31/20 16:10
AB-10 (8.5-10)	0020006-06	Solid	01/11/20 0:00	01/31/20 16:10
AB-11 (3.5-5)	0020006-07	Solid	01/12/20 0:00	01/31/20 16:10
AB-12 (8.5-10)	0020006-08	Solid	01/23/20 0:00	01/31/20 16:10
BB-1 (8.5-10)	0020006-09	Solid	01/21/20 0:00	01/31/20 16:10
BB-2 (3.5-5)	0020006-10	Solid	01/21/20 0:00	01/31/20 16:10
BB-8 (8.5-10)	0020006-11	Solid	01/11/20 0:00	01/31/20 16:10
BB-9 (8.5-10)	0020006-12	Solid	01/20/20 0:00	01/31/20 16:10
BB-11 (8.5-10)	0020006-13	Solid	01/20/20 0:00	01/31/20 16:10
BB-12 (4-5)	0020006-14	Solid	01/28/20 0:00	01/31/20 16:10
BB-13 (8.5-10)	0020006-15	Solid	01/20/20 0:00	01/31/20 16:10
CB-1 (8.5-10)	0020006-16	Solid	01/22/20 0:00	01/31/20 16:10
CB-3 (3.5-5)	0020006-17	Solid	01/22/20 0:00	01/31/20 16:10
CB-6 (13.5-15)	0020006-18	Solid	01/21/20 0:00	01/31/20 16:10
CB-7 (8.5-10)	0020006-19	Solid	01/22/20 0:00	01/31/20 16:10
CB-9 (0-.5/3.5-5)	0020006-20	Solid	01/22/20 0:00	01/31/20 16:10

Samples were received at 12.1 degrees C. See case narrative for further information.

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Laboratory Report

02/11/2020

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: AB-2 (18.5-20/22.5-25)
Sample ID: 0020006-01
Work Order: 0020006
Time Collected: 01/23/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 13:40	BMS	P0B0104
Sulfate	BRL		150	44	1	*9056A	2/7/20 13:40	BMS	P0B0104
General Chemistry Parameters									
% Solids	**87.7**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/4/20 12:12**	**EDV**	**P0B0029**
pH	**3.8**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**12.3**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/4/20 12:12**	**EDV**	**P0B0029**
Temperature	**20.0**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

02/11/2020

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: AB-4 (13.5-15)
Sample ID: 0020006-02
Work Order: 0020006
Time Collected: 01/11/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	**8.8**		**25**	**7.2**	**1**	***9056A**	**2/7/20 13:55**	**BMS**	**P0B0104**
Sulfate	BRL		150	44	1	*9056A	2/7/20 13:55	BMS	P0B0104
General Chemistry Parameters									
% Solids	**84.1 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/4/20 12:12**	**EDV**	**P0B0029**
pH	**3.7**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**15.9 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/4/20 12:12**	**EDV**	**P0B0029**
Temperature	**20.1**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

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Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: AB-5 (13.5-15)
Sample ID: 0020006-03
Work Order: 0020006
Time Collected: 01/13/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	**8.5**		**25**	**7.2**	**1**	***9056A**	**2/7/20 14:10**	**BMS**	**P0B0104**
Sulfate	BRL		150	44	1	*9056A	2/7/20 14:10	BMS	P0B0104
General Chemistry Parameters									
% Solids	**80.6 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/4/20 12:12**	**EDV**	**P0B0029**
pH	**4.1**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**19.4 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/4/20 12:12**	**EDV**	**P0B0029**
Temperature	**20.3**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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02/11/2020

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: AB-7 (8.5-10)
Sample ID: 0020006-04
Work Order: 0020006
Time Collected: 01/12/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 14:26	BMS	P0B0104
Sulfate	BRL		150	44	1	*9056A	2/7/20 14:26	BMS	P0B0104
General Chemistry Parameters									
% Solids	**82.4 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**3.8**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**17.6 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.4**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: AB-9 (9-10)
Sample ID: 0020006-05
Work Order: 0020006
Time Collected: 01/27/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	**8.6**		**25**	**7.2**	**1**	***9056A**	**2/7/20 14:41**	**BMS**	**P0B0104**
Sulfate	**63**		**150**	**44**	**1**	***9056A**	**2/7/20 14:41**	**BMS**	**P0B0104**
General Chemistry Parameters									
% Solids	**85.4**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**3.9**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**14.6**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.5**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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02/11/2020

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: AB-10 (8.5-10)
Sample ID: 0020006-06
Work Order: 0020006
Time Collected: 01/11/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 14:56	BMS	P0B0104
Sulfate	BRL		150	44	1	*9056A	2/7/20 14:56	BMS	P0B0104
General Chemistry Parameters									
% Solids	**92.5 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**3.8**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**7.46 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.1**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: AB-11 (3.5-5)
Sample ID: 0020006-07
Work Order: 0020006
Time Collected: 01/12/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 15:12	BMS	P0B0104
Sulfate	BRL		150	44	1	*9056A	2/7/20 15:12	BMS	P0B0104
General Chemistry Parameters									
% Solids	**89.3 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**4.6**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**10.7 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.6**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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02/11/2020

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: AB-12 (8.5-10)
Sample ID: 0020006-08
Work Order: 0020006
Time Collected: 01/23/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	**11**		**25**	**7.2**	**1**	***9056A**	**2/7/20 15:27**	**BMS**	**P0B0104**
Sulfate	BRL		150	44	1	*9056A	2/7/20 15:27	BMS	P0B0104
General Chemistry Parameters									
% Solids	**85.9**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**4.4**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**14.1**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.8**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

02/11/2020

Waypoint ANALYTICAL

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: BB-1 (8.5-10)
Sample ID: 0020006-09
Work Order: 0020006
Time Collected: 01/21/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 16:13	BMS	P0B0104
Sulfate	**50**		**150**	**44**	**1**	***9056A**	**2/7/20 16:13**	**BMS**	**P0B0104**
General Chemistry Parameters									
% Solids	**87.0 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**4.5**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**13.0 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.6**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

02/11/2020

Waypoint ANALYTICAL

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: BB-2 (3.5-5)
Sample ID: 0020006-10
Work Order: 0020006
Time Collected: 01/21/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 16:28	BMS	P0B0104
Sulfate	BRL		150	44	1	*9056A	2/7/20 16:28	BMS	P0B0104
General Chemistry Parameters									
% Solids	**86.6 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**4.4**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**13.4 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.4**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

02/11/2020

Waypoint ANALYTICAL

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: BB-8 (8.5-10)
Sample ID: 0020006-11
Work Order: 0020006
Time Collected: 01/11/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	**7.7**		**25**	**7.2**	**1**	***9056A**	**2/7/20 17:45**	**BMS**	**P0B0105**
Sulfate	BRL		150	44	1	*9056A	2/7/20 17:45	BMS	P0B0105
General Chemistry Parameters									
% Solids	**87.9 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**5.0**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**12.1 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.8**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

02/11/2020

Waypoint ANALYTICAL

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: BB-9 (8.5-10)
Sample ID: 0020006-12
Work Order: 0020006
Time Collected: 01/20/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 18:00	BMS	P0B0105
Sulfate	**48**		**150**	**44**	**1**	***9056A**	**2/7/20 18:00**	**BMS**	**P0B0105**
General Chemistry Parameters									
% Solids	**86.6 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**4.8**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**13.4 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.6**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

02/11/2020

Waypoint ANALYTICAL

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: BB-11 (8.5-10)
Sample ID: 0020006-13
Work Order: 0020006
Time Collected: 01/20/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	**15**		**25**	**7.2**	**1**	***9056A**	**2/7/20 18:15**	**BMS**	**P0B0105**
Sulfate	BRL		150	44	1	*9056A	2/7/20 18:15	BMS	P0B0105
General Chemistry Parameters									
% Solids	**83.6 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**4.4**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**16.4 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.2**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

02/11/2020

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: BB-12 (4-5)
Sample ID: 0020006-14
Work Order: 0020006
Time Collected: 01/28/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 18:31	BMS	P0B0105
Sulfate	BRL		150	44	1	*9056A	2/7/20 18:31	BMS	P0B0105
General Chemistry Parameters									
% Solids	**83.6**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**5.5**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**16.4**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.2**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

Laboratory Report

02/11/2020

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: BB-13 (8.5-10)
Sample ID: 0020006-15
Work Order: 0020006
Time Collected: 01/20/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	**8.1**		**25**	**7.2**	**1**	***9056A**	**2/7/20 19:17**	**BMS**	**P0B0105**
Sulfate	BRL		150	44	1	*9056A	2/7/20 19:17	BMS	P0B0105
General Chemistry Parameters									
% Solids	**84.1 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**4.6**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**15.9 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.4**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

02/11/2020

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: CB-1 (8.5-10)
Sample ID: 0020006-16
Work Order: 0020006
Time Collected: 01/22/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 19:32	BMS	P0B0105
Sulfate	BRL		150	44	1	*9056A	2/7/20 19:32	BMS	P0B0105
General Chemistry Parameters									
% Solids	**85.6**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**4.6**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**14.4**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.8**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

02/11/2020

Waypoint ANALYTICAL

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: CB-3 (3.5-5)
Sample ID: 0020006-17
Work Order: 0020006
Time Collected: 01/22/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 19:47	BMS	P0B0105
Sulfate	**48**		**150**	**44**	**1**	***9056A**	**2/7/20 19:47**	**BMS**	**P0B0105**
General Chemistry Parameters									
% Solids	**76.9**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**4.7**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**23.1**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.6**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

02/11/2020

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: CB-6 (13.5-15)
Sample ID: 0020006-18
Work Order: 0020006
Time Collected: 01/21/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 20:03	BMS	P0B0105
Sulfate	BRL		150	44	1	*9056A	2/7/20 20:03	BMS	P0B0105
General Chemistry Parameters									
% Solids	**86.7 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**4.8**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**13.3 HT**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.6**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

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Laboratory Report

02/11/2020

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: CB-7 (8.5-10)
Sample ID: 0020006-19
Work Order: 0020006
Time Collected: 01/22/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 20:18	BMS	P0B0105
Sulfate	BRL		150	44	1	*9056A	2/7/20 20:18	BMS	P0B0105
General Chemistry Parameters									
% Solids	**87.3**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**4.3**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**12.7**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.5**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

Laboratory Report

02/11/2020

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Sample Matrix: Solid

Client Sample ID: CB-9 (0-.5/3.5-5)
Sample ID: 0020006-20
Work Order: 0020006
Time Collected: 01/22/20 00:00
Time Submitted: 01/31/20 16:10

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Anions by Ion Chromatography									
Chloride	BRL		25	7.2	1	*9056A	2/7/20 20:33	BMS	P0B0105
Sulfate	BRL		150	44	1	*9056A	2/7/20 20:33	BMS	P0B0105
General Chemistry Parameters									
% Solids	**87.7**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
pH	**5.0**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**
% Moisture	**12.3**		**0.100**	**0.100**	**1**	***SM2540 G**	**2/5/20 10:17**	**EDV**	**P0B0030**
Temperature	**20.6**				**1**	***9045D**	**2/5/20 11:20**	**CLB**	**P0B0075**

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Work Order: 0020006
Time Submitted: 1/31/2020 4:10:00PM

Anions by Ion Chromatography - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P0B0104 - Default Prep GenChem										
Matrix Spike (P0B0104-MS1)		**Source: 0020006-10**		Prepared & Analyzed: 02/07/20						
Chloride	1040	25	mg/kg wet		BRL		80-120			
Sulfate	1070	150	mg/kg wet		BRL		80-120			
Matrix Spike Dup (P0B0104-MSD1)		**Source: 0020006-10**		Prepared & Analyzed: 02/07/20						
Chloride	1030	25	mg/kg wet		BRL		80-120	1	15	
Sulfate	1050	150	mg/kg wet		BRL		80-120	1	15	
Batch P0B0105 - Default Prep GenChem										
Matrix Spike (P0B0105-MS1)		**Source: 0020006-20**		Prepared & Analyzed: 02/07/20						
Chloride	1040	25	mg/kg wet		BRL		80-120			
Sulfate	1060	150	mg/kg wet		BRL		80-120			
Matrix Spike Dup (P0B0105-MSD1)		**Source: 0020006-20**		Prepared & Analyzed: 02/07/20						
Chloride	1030	25	mg/kg wet		BRL		80-120	0.5	15	
Sulfate	1060	150	mg/kg wet		BRL		80-120	0.3	15	

Froehling & Robertson, Inc. (Raleigh)
Attn: Mohammad Kayser
310 Hubert Street
Raleigh, NC 27603

Project: 66X-0120 Annexation Area 24

Work Order: 0020006
Time Submitted: 1/31/2020 4:10:00PM

General Chemistry Parameters - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P0B0029 - NO PREP										
Duplicate (P0B0029-DUP2)		**Source: 0020006-02**		Prepared & Analyzed: 02/04/20						
% Solids	80.5	0.100	% by Weight		84.1			4	20	
% Moisture	19.5	0.100	% by Weight		15.9			20	20	
Batch P0B0030 - NO PREP										
Duplicate (P0B0030-DUP1)		**Source: 0020006-09**		Prepared: 02/04/20 Analyzed: 02/05/20						
% Solids	87.9	0.100	% by Weight		87.0			1	20	
% Moisture	12.1	0.100	% by Weight		13.0			7	20	
Duplicate (P0B0030-DUP2)		**Source: 0020006-17**		Prepared: 02/04/20 Analyzed: 02/05/20						
% Solids	78.6	0.100	% by Weight		76.9			2	20	
% Moisture	21.4	0.100	% by Weight		23.1			7	20	
Batch P0B0075 - NO PREP										
Duplicate (P0B0075-DUP1)		**Source: 0020006-10**		Prepared & Analyzed: 02/05/20						
pH	4.39		pH Units		4.38			0.228	20	
Temperature	20.8		pH Units		20.4			1.94	200	
Duplicate (P0B0075-DUP2)		**Source: 0020006-20**		Prepared & Analyzed: 02/05/20						
pH	5.00		pH Units		5.00			0.00	20	
Temperature	20.6		pH Units		20.6			0.00	200	

Sample Extraction Data

Prep Method: Default Prep GenChem

Lab Number	Batch	Initial	Final	Date/Time
0020006-01	P0B0104	5	50	02/07/20 9:25
0020006-02	P0B0104	5	50	02/07/20 9:25
0020006-03	P0B0104	5	50	02/07/20 9:25
0020006-04	P0B0104	5	50	02/07/20 9:25
0020006-05	P0B0104	5	50	02/07/20 9:25
0020006-06	P0B0104	5	50	02/07/20 9:25
0020006-07	P0B0104	5	50	02/07/20 9:25
0020006-08	P0B0104	5	50	02/07/20 9:25
0020006-09	P0B0104	5	50	02/07/20 9:25
0020006-10	P0B0104	5	50	02/07/20 9:25
0020006-11	P0B0105	5	50	02/07/20 10:03
0020006-12	P0B0105	5	50	02/07/20 10:03
0020006-13	P0B0105	5	50	02/07/20 10:03
0020006-14	P0B0105	5	50	02/07/20 10:03
0020006-15	P0B0105	5	50	02/07/20 10:03
0020006-16	P0B0105	5	50	02/07/20 10:03
0020006-17	P0B0105	5	50	02/07/20 10:03
0020006-18	P0B0105	5	50	02/07/20 10:03
0020006-19	P0B0105	5	50	02/07/20 10:03
0020006-20	P0B0105	5	50	02/07/20 10:03

Subcontracted Analyses

The following analyses were subcontracted to Analytical Environmental Services , Inc.

Lab Number	Analysis
0020006-01	Resistivity (Sub)
0020006-01	Sulfide (Sub)
0020006-02	Resistivity (Sub)
0020006-02	Sulfide (Sub)
0020006-03	Resistivity (Sub)
0020006-03	Sulfide (Sub)
0020006-04	Resistivity (Sub)
0020006-04	Sulfide (Sub)
0020006-05	Resistivity (Sub)
0020006-05	Sulfide (Sub)
0020006-06	Resistivity (Sub)
0020006-06	Sulfide (Sub)
0020006-07	Resistivity (Sub)
0020006-07	Sulfide (Sub)
0020006-08	Resistivity (Sub)
0020006-08	Sulfide (Sub)
0020006-09	Resistivity (Sub)
0020006-09	Sulfide (Sub)
0020006-10	Resistivity (Sub)
0020006-10	Sulfide (Sub)
0020006-11	Resistivity (Sub)
0020006-11	Sulfide (Sub)
0020006-12	Resistivity (Sub)
0020006-12	Sulfide (Sub)
0020006-13	Resistivity (Sub)
0020006-13	Sulfide (Sub)
0020006-14	Resistivity (Sub)
0020006-14	Sulfide (Sub)
0020006-15	Resistivity (Sub)
0020006-15	Sulfide (Sub)
0020006-16	Resistivity (Sub)
0020006-16	Sulfide (Sub)
0020006-17	Resistivity (Sub)
0020006-17	Sulfide (Sub)
0020006-18	Resistivity (Sub)
0020006-18	Sulfide (Sub)
0020006-19	Resistivity (Sub)
0020006-19	Sulfide (Sub)
0020006-20	Resistivity (Sub)
0020006-20	Sulfide (Sub)

The following analyses were subcontracted to Pace Analytical Gulf Coast

Lab Number	Analysis
0020006-01	ORP (Sub)
0020006-02	ORP (Sub)
0020006-03	ORP (Sub)
0020006-04	ORP (Sub)
0020006-05	ORP (Sub)
0020006-06	ORP (Sub)
0020006-07	ORP (Sub)
0020006-08	ORP (Sub)
0020006-09	ORP (Sub)
0020006-10	ORP (Sub)

The following analyses were subcontracted to Pace Analytical Gulf Coast

Lab Number	Analysis
0020006-11	ORP (Sub)
0020006-12	ORP (Sub)
0020006-13	ORP (Sub)
0020006-14	ORP (Sub)
0020006-15	ORP (Sub)
0020006-16	ORP (Sub)
0020006-17	ORP (Sub)
0020006-18	ORP (Sub)
0020006-19	ORP (Sub)
0020006-20	ORP (Sub)

449 Springbrook Road - P.O. Box 240543 - Charlotte, NC 28224-0543
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IRT-14 12.0 12.1

PRISM LABORATORIES, INC.

Full Service Analytical & Environmental Solutions

449 Springbrook Road • P.O. Box 240543 • Charlotte, NC 28224-0543
Phone: 704/529-6364 • Fax: 704/525-0409

CHAIN OF CUSTODY RECORD

PAGE 1 OF 2 QUOTE # TO ENSURE PROPER BILLING: _____

Project Name: FAYPWC Annexation Area 24

Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)

*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements

Invoice To: ~~65~~ F&R

Address: 310 Hubert Street, Raleigh, NC

Purchase Order No./Billing Reference 65X-0120

Client Company Name: WK Dickson

Report To/Contact Name: Mohammad Kayser

Reporting Address: 310 Hubert Street, Raleigh, NC, 27603

Phone: 919-719-1845 Fax (Yes) (No): _____

Email (Yes) (No) Email Address MKAYSER@FAYPWC.COM

EDD Type: ____ PDF ____ Excel ____ Other

Site Location Name: Fayetteville, NC

Site Location Physical Address: _____

Requested Due Date ❑ 1 Day ❑ 2 Days ❑ 3 Days ❑ 4 Days ❑ 5 Days

"Working Days" ❑ 6-9 Days ❑ Standard 10 days

Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?	✓		
Received ON WET ICE? Temp ____ °F	✓	✓	
PROPER PRESERVATIVES indicated?	✓		
Received WITHIN HOLDING TIMES?	✓		
CUSTODY SEALS INTACT?			✓
VOLATILES rec'd W/OUT HEADSPACE?			✓
PROPER CONTAINERS used?	✓		

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL

Certification: NELAC ____ USACE ____ FL ____ NC ____
SC ____ OTHER ____ N/A ____

Water Chlorinated: YES ____ NO ____

Sample Iced Upon Collection: YES ____ NO ____

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	SAMPLE CONTAINER NO.	SAMPLE CONTAINER SIZE	PRESERVATIVES	ANALYSES REQUESTED: PH	Moisture content	Chloride	Sulfate	Electrical Resistivity	Redox	Sulfides	REMARKS	PRISM LAB ID NO.
AB-2 (18.5-20, 23.5-25)	1/23/2020		S	G												
AB-4 (13.5-15)	1/11/2020															
AB-5 (13.5-15)	1/13/2020															
AB-7 (8.5-10)	1/12/2020															
AB-9 (9-10)	1/27/2020															
AB-10 (8.5-10)	1/11/2020															
AB-11 (3.5-5)	1/12/2020															
AB-12 (8.5-10)	1/23/2020															
BB-1 (8.5-10)	1/21/2020															
BB-2 (3.5-5)	1/21/2020		↓	↓				↓	↓	↓	↓	↓	↓	↓		

Sampler's Signature _____ Sampled By (Print Name) _____ Affiliation _____

PRESS DOWN FIRMLY - 3 COPIES

Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

		Date	Military/Hours
Relinquished By: (Signature) E.A. KAYSER	Received By: (Signature) Philip Paige	01-30-20	14:00
Relinquished By: (Signature) Philip Paige	Received By: (Signature)	1-31-20	1200
Relinquished By: (Signature) 1-31-2020 1610	Received For Prism Laboratories By:	1.31.20	1610

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.

❑ Fed Ex ❑ UPS ❑ Hand-delivered ☒ Prism Field Service ❑ Other _____

Log-In Group No. 002006

Additional Comments:

PRISM USE ONLY

Site Arrival Time:

Site Departure Time:

Field Tech Fee:

Mileage:

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC
❑ _____	❑ _____	❑ _____	❑ _____	❑ _____	❑ _____	❑ _____	❑ _____	❑ _____

*CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

SEE REVERSE FOR TERMS & CONDITIONS

ORIGINAL

IRT-14 12.0 12.1

PRISM LABORATORIES, INC.

Full Service Analytical & Environmental Solutions

449 Springbrook Road • P.O. Box 240543 • Charlotte, NC 28224-0543
Phone: 704/529-6364 • Fax: 704/525-0409

CHAIN OF CUSTODY RECORD

PAGE 2 OF 2 QUOTE # TO ENSURE PROPER BILLING: _____

Client Company Name: WK Dickson
Report To/Contact Name: Mohammed Kayser
Reporting Address: 310 Hubert Street Raleigh, NC
Phone: _____ Fax (Yes) (No): _____
Email (Yes) (No) Email Address _____
EDD Type: ___ PDF ✓ Excel ___ Other
Site Location Name: Fayetteville, NC
Site Location Physical Address: _____

Project Name: Annexation Area 24
Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)
*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements
Invoice To: F&R
Address: ~~B~~10 Hubert Street

Purchase Order No./Billing Reference 66X-0120

Requested Due Date ❑ 1 Day ❑ 2 Days ❑ 3 Days ❑ 4 Days ❑ 5 Days
"Working Days" ❑ 6-9 Days ❑ Standard 10 days
Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?			
Received ON WET ICE? Temp	TNTX		
PROPER PRESERVATIVES indicated?			
Received WITHIN HOLDING TIMES?			
CUSTODY SEALS INTACT?			
VOLATILES rec'd W/OUT HEADSPACE?			
PROPER CONTAINERS used?			

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL

Certification: NELAC ___ USACE ___ FL ___ NC ___
SC ___ OTHER ___ N/A ___
Water Chlorinated: YES ___ NO ___
Sample Iced Upon Collection: YES ___ NO ___

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	SAMPLE CONTAINER NO.	SAMPLE CONTAINER SIZE	PRESERVATIVES	ANALYSES REQUESTED PH	M.C.	Chloride	Sulfate	Electrical Conductivity	Redox	Sulfide	REMARKS	PRISM LAB ID NO.
BB-8 (8.5-10)	1/11/2020		S	G												
BB-9 (8.5-10)	1/20/2020															
BB-11 (8.5-10)	1/20/2020															
BB-12 (4-5)	1/28/2020															
BB-13 (8.5-10)	1/20/2020															
CB-1 (8.5-10)	1/22/2020															
CB-3 (3.5-5)	1/22/2020															
CB-6 (13.5-15)	1/21/2020															
CB-7 (8.5-10)	1/22/2020															
CB-9 (3.5-5)	1/22/2020															

Sampler's Signature _____ Sampled By (Print Name) _____ Affiliation _____

PRESS DOWN FIRMLY - 3 COPIES

Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

		Date	Military/Hours
Relinquished By: (Signature) F.A. KAYSER	Received By: (Signature) Philip Paige	01-30-20	14:00
Relinquished By: (Signature) Philip Paige	Received By: (Signature)	1-31-2020	1200
Relinquished By: (Signature) 1-31-2020 1610	Received For Prism Laboratories By:	1.31.20	1610

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.

Log-In Group No.

❑ Fed Ex ❑ UPS ❑ Hand-delivered ❑ Prism Field Service ❑ Other _____

Additional Comments:

PRISM USE ONLY

Site Arrival Time:
Site Departure Time:
Field Tech Fee:
Mileage:

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC	❑ NC ❑ SC
❑ _____	❑ _____	❑ _____	❑ _____	❑ _____	❑ _____	❑ _____	❑ _____	❑ _____

*CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

SEE REVERSE FOR TERMS & CONDITIONS

ORIGINAL

ACCESS
ANALYTICAL, INC.

ANALYTICAL REPORT

CLIENT

Waypoint Analytical
PO Box 240543
Charlotte NC 282240543

ATTENTION
Angela Overcash

PROJECT ID
0020006

LABORATORY REPORT NUMBER
2002171

DATE
February 11, 2020

Primary Data Review By

Chris Pafford
Project Manager, AES

Secondary Data Review By

Ashley Amick

Project Manager, Access Analytical
aamick@axs-inc.com

PLEASE NOTE:

- **Unless otherwise noted, all analysis on this report performed at Analytical Environmental Services Inc. (AES Inc), 3080 Presidential Drive, Atlanta, GA 30340.**
- **AES is SCDHEC certified laboratory # 98016, NCDENR certified lab # 562, GA certified lab # FL-E87582, NELAP certified laboratory # E87582**
- **AIHA-LAP,LLC Laboratory ID:100671 for Industrial Hygiene samples (Organics, Metals, PCM Asbestos, Gravimetric), Environmental Lead (Paint, Soil, Dust Wipes, Air), and Environmental Microbiology (Fungal) Direct Examination.**
- Local support services for this project are provided by Access Analytical, Inc. Access Analytical is a representative of AES serving client in the SC/NC/GA areas. All questions regarding this report should be directed to your local Access Analytical representative at 803.781.4243 or toll fee at 883.315.4243

Waypoint ANALYTICAL

2002171

SUBCONTRACT ORDER

Waypoint Analytical

0020006

Certification: NELAC___ USACE___
NC ✓ SC___ Other ___
N/A ___

SENDING LABORATORY:

Waypoint Analytical
P. O. Box 240543
Charlotte, NC 28224-0543
Phone: 800-529-6364
Fax: 704-525-0409
Project Manager: Angela D. Overcash

RECEIVING LABORATORY:

Analytical Environmental Services, Inc.
3080 Presidential Parkway
Atlanta, GA 30340
Phone :(770) 457-8177
Fax: NA

Need 5 dy TAT

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 0020006-01	**Solid**	**Sampled:01/23/20 00:00**	AB-2	
Sulfide (Sub)		01/30/20 00:00		
Resistivity (Sub)		02/20/20 00:00		
Containers Supplied: 4oz glass				
Sample ID: 0020006-02	**Solid**	**Sampled:01/11/20 00:00**	AB-4	
Resistivity (Sub)		02/08/20 00:00		
Sulfide (Sub)		01/18/20 00:00		
Containers Supplied:				
Sample ID: 0020006-03	**Solid**	**Sampled:01/15/20 00:00**	AB-5	
Resistivity (Sub)		02/10/20 00:00		
Sulfide (Sub)		01/20/20 00:00		
Containers Supplied:				
Sample ID: 0020006-04	**Solid**	**Sampled:01/12/20 00:00**	AB-7	
Resistivity (Sub)		02/09/20 00:00		
Sulfide (Sub)		01/19/20 00:00		

Released By	Date	Received By	Date
	2-3-20	FedEx	
JC	FedEx	[illegible]	2/4/20 9:50
Released By	Date	Received By	Date
Released By	Date	Received By	Date

SUBCONTRACT ORDER

Waypoint Analytical

0020006

2002171

Certification: NELAC___ USACE___
NC___ SC___ Other ___
N/A___

Analysis	Due	Expires	Laboratory ID	Comments
Containers Supplied:				
Sample ID: 0020006-05	**Solid**	**Sampled:01/27/20 00:00**	AB-9	
Resistivity (Sub)		02/21/20 00:00		
Sulfide (Sub)		02/03/20 00:00		
Containers Supplied:				
Sample ID: 0020006-06	**Solid**	**Sampled:01/11/20 00:00**	AB-10	
Sulfide (Sub)		01/13/20 00:00		
Resistivity (Sub)		02/03/20 00:00		
Containers Supplied:				
Sample ID: 0020006-07	**Solid**	**Sampled:01/12/20 00:00**	AB-11	
Sulfide (Sub)		01/19/20 00:00		
Resistivity (Sub)		02/09/20 00:00		
Containers Supplied:				
Sample ID: 0020006-08	**Solid**	**Sampled:01/23/20 00:00**	AB-12	
Resistivity (Sub)		02/20/20 00:00		
Sulfide (Sub)		01/30/20 00:00		
Containers Supplied:				
Sample ID: 0020006-09	**Solid**	**Sampled:01/21/20 00:00**	BB-1	
Resistivity (Sub)		02/18/20 00:00		
Sulfide (Sub)		01/28/20 00:00		
Containers Supplied				

Released By	Date	Received By	Date
[signature]	2-3-20	FedEx	
FedEx		[signature]	2/4/20 9:54

200271

SUBCONTRACT ORDER

Waypoint Analytical

0020006

Certification: NELAC___ USACE___
NC___ SC___ Other ___
N/A___

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 0020006-10	**Solid**	**Sampled:01/21/20 00:00**	BB-2	
Sulfide (Sub)		01/23/20 00:00		
Resistivity (Sub)		02/13/20 00:00		
Containers Supplied:				
Sample ID: 0020006-11	**Solid**	**Sampled:01/11/20 00:00**	BB-8	
Sulfide (Sub)		01/13/20 00:00		
Resistivity (Sub)		02/03/20 00:00		
Containers Supplied:				
Sample ID: 0020006-12	**Solid**	**Sampled:01/20/20 00:00**	BB-9	
Resistivity (Sub)		02/17/20 00:00		
Sulfide (Sub)		01/27/20 00:00		
Containers Supplied:				
Sample ID: 0020006-13	**Solid**	**Sampled:01/20/20 00:00**	BB-11	
Sulfide (Sub)		01/27/20 00:00		
Resistivity (Sub)		02/17/20 00:00		
Containers Supplied:				
Sample ID: 0020006-14	**Solid**	**Sampled:01/28/20 00:00**	BB-12	
Resistivity (Sub)		02/25/20 00:00		
Sulfide (Sub)		02/04/20 00:00		
Containers Supplied:				
Sample ID: 0020006-15	**Solid**	**Sampled:01/20/20 00:00**	BB-13	
Resistivity (Sub)		02/17/20 00:00		
Sulfide (Sub)		01/27/20 00:00		
Containers Supplied:				

Released By	Date	Received By	Date
[signature]	2-3-20	FedEx	
FedEx		Laymie	2/4/20 9:54

200217

SUBCONTRACT ORDER

Waypoint Analytical

0020006

Certification: NELAC___ USACE___
NC___ SC___ Other ___
N/A___

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 0020006-16	**Solid**	**Sampled:01/22/20 00:00**	CB-1	
Resistivity (Sub)		02/19/20 00:00		
Sulfide (Sub)		01/29/20 00:00		
Containers Supplied:				
Sample ID: 0020006-17	**Solid**	**Sampled:01/22/20 00:00**	CB-3	
Resistivity (Sub)		02/19/20 00:00		
Sulfide (Sub)		01/29/20 00:00		
Containers Supplied:				
Sample ID: 0020006-18	**Solid**	**Sampled:01/21/20 00:00**	CB-6	
Resistivity (Sub)		02/18/20 00:00		
Sulfide (Sub)		01/28/20 00:00		
Containers Supplied:				
Sample ID: 0020006-19	**Solid**	**Sampled:01/22/20 00:00**	CB-7	
Resistivity (Sub)		02/19/20 00:00		
Sulfide (Sub)		01/29/20 00:00		
Containers Supplied:				
Sample ID: 0020006-20	**Solid**	**Sampled:01/22/20 00:00**	CB-9	
Sulfide (Sub)		01/29/20 00:00		
Resistivity (Sub)		02/19/20 00:00		
Containers Supplied:				

Released By	Date	Received By	Date
[signature]	2-3-20	FedEx	
FedEx		[signature]	2/4/20 9:34

Analytical Environmental Services, Inc

Date: 11-Feb-20

Client:	Waypoint Analytical
Project:	0020006
Lab ID:	2002171

Case Narrative

Sample Receiving Nonconformance:

Work order 2002171 was received outside EPA SW-846 9034 specified holding time of 7 Days for Sulfide. The laboratory proceeded with analysis per client project history.

Sample information on the Chain of Custody (COC) did not match that on the sample bottle labels. All samples were labeled with the sampling depth in addition to the ID listed on the COC. All samples were logged in per COC.

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	AB-2
Lab Order	2002171	**Tag Number:**	0020006-01
Project Name:	0020006	**Collection Date:**	1/23/2020
Lab ID:	2002171-001A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	46.5	48.5	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	8240		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	12.9		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	AB-4
Lab Order	2002171	**Tag Number:**	0020006-02
Project Name:	0020006	**Collection Date:**	1/11/2020
Lab ID:	2002171-002A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	44.7	46.6	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	5370		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	18.6		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

- * Value exceeds maximum contaminant level
- BRL Not Detected at MDL
- H Holding times for preparation or analysis exceeded
- N Analyte not NELAC certified
- B Analyte detected in the associated method blank
- E Estimated value above quantitation range
- S Spike Recovery outside limits due to matrix
- > Greater than Result value
- J Estimated value detected below Reporting Limit
- < Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	AB-5
Lab Order	2002171	**Tag Number:**	0020006-03
Project Name:	0020006	**Collection Date:**	1/13/2020
Lab ID:	2002171-003A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	54.4	56.6	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	7720		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	19.6		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	AB-7
Lab Order	2002171	**Tag Number:**	0020006-04
Project Name:	0020006	**Collection Date:**	1/12/2020
Lab ID:	2002171-004A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	43.6	45.4	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	7700		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	15.5		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	AB-9
Lab Order	2002171	**Tag Number:**	0020006-05
Project Name:	0020006	**Collection Date:**	1/27/2020
Lab ID:	2002171-005A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	47.9	49.9	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	8180		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	14.5		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	AB-10
Lab Order	2002171	**Tag Number:**	0020006-06
Project Name:	0020006	**Collection Date:**	1/11/2020
Lab ID:	2002171-006A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	50.3	52.4	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	7990		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	4.36		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	AB-11
Lab Order	2002171	**Tag Number:**	0020006-07
Project Name:	0020006	**Collection Date:**	1/12/2020
Lab ID:	2002171-007A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	51.6	H	49.6	51.6	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	9180		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	9.22		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	AB-12
Lab Order	2002171	**Tag Number:**	0020006-08
Project Name:	0020006	**Collection Date:**	1/23/2020
Lab ID:	2002171-008A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	50.1	52.1	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	11600		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	14.1		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	BB-1
Lab Order	2002171	**Tag Number:**	0020006-09
Project Name:	0020006	**Collection Date:**	1/21/2020
Lab ID:	2002171-009A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	50.3	52.4	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	9390		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	12.8		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	BB-2
Lab Order	2002171	**Tag Number:**	0020006-10
Project Name:	0020006	**Collection Date:**	1/21/2020
Lab ID:	2002171-010A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	56.8	59.2	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	13800		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	13.4		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	BB-8
Lab Order	2002171	**Tag Number:**	0020006-11
Project Name:	0020006	**Collection Date:**	1/11/2020
Lab ID:	2002171-011A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	47.4	49.4	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	10600		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	12.9		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	BB-9
Lab Order	2002171	**Tag Number:**	0020006-12
Project Name:	0020006	**Collection Date:**	1/20/2020
Lab ID:	2002171-012A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	44.7	46.5	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	11900		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	15.2		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	BB-11
Lab Order	2002171	**Tag Number:**	0020006-13
Project Name:	0020006	**Collection Date:**	1/20/2020
Lab ID:	2002171-013A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	50.7	52.8	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	12500		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	16.6		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	BB-12
Lab Order	2002171	**Tag Number:**	0020006-14
Project Name:	0020006	**Collection Date:**	1/28/2020
Lab ID:	2002171-014A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	50.0	52.1	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	8800		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	18.1		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	BB-13
Lab Order	2002171	**Tag Number:**	0020006-15
Project Name:	0020006	**Collection Date:**	1/20/2020
Lab ID:	2002171-015A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	46.7	48.6	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	14500		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	14.9		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	CB-1
Lab Order	2002171	**Tag Number:**	0020006-16
Project Name:	0020006	**Collection Date:**	1/22/2020
Lab ID:	2002171-016A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	46.9	48.8	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	13500		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	12.8		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	CB-3
Lab Order	2002171	**Tag Number:**	0020006-17
Project Name:	0020006	**Collection Date:**	1/22/2020
Lab ID:	2002171-017A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	46.6	48.6	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	16200		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	24.3		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	CB-6
Lab Order	2002171	**Tag Number:**	0020006-18
Project Name:	0020006	**Collection Date:**	1/21/2020
Lab ID:	2002171-018A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	45.6	47.5	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	13900		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	19.4		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	CB-7
Lab Order	2002171	**Tag Number:**	0020006-19
Project Name:	0020006	**Collection Date:**	1/22/2020
Lab ID:	2002171-019A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	48.4	50.4	mg/Kg-dry	292043	1	02/06/2020 14:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	11900		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	12.7		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Analytical Environmental Services, Inc **Date:** 11-Feb-20

Client:	Waypoint Analytical	**Client Sample ID:**	CB-9
Lab Order	2002171	**Tag Number:**	0020006-20
Project Name:	0020006	**Collection Date:**	1/22/2020
Lab ID:	2002171-020A	**Matrix:**	Solid

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**				
Sulfide	BRL	H	46.4	48.3	mg/Kg-dry	292093	1	02/07/2020 12:00	AT
Soil Resistivity SW9050A					**(SW9050A)**				
Resistivity (@100% Moisture Saturation)	14500		0	0	ohms*cm	292102	1	02/07/2020 13:00	CS
PERCENT MOISTURE D2216									
Percent Moisture	11.5		0	0	wt%	R417798	1	02/07/2020 09:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated value above quantitation range
BRL	Not Detected at MDL	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	>	Greater than Result value
N	Analyte not NELAC certified	J	Estimated value detected below Reporting Limit
B	Analyte detected in the associated method blank	<	Less than Result value

Clear Save as

ANALYTICAL ENVIRONMENTAL SERVICES, INC. AES

SAMPLE/COOLER RECEIPT CHECKLIST

1. Client Name: **Access Analytical, Inc.** AES Work Order Number: **2002171**

2. Carrier: FedEx [■] UPS [ ] USPS [ ] Client [ ] Courier [ ] Other _____

		Yes	No	N/A	Details	Comments
3.	Shipping container/cooler received in good condition?	◉	○	○	damaged [ ] leaking [ ] other [ ]	
4.	Custody seals present on shipping container?	○	◉	○		
5.	Custody seals intact on shipping container?	○	○	◉		
6.	Temperature blanks present?	○	◉	○		
7.	Cooler temperature(s) within limits of 0-6°C? [See item 13 and 14 for temperature recordings.]	◉	○	○	Cooling initiated for recently collected samples / ice present [ ]	
8.	Chain of Custody (COC) present?	◉	○	○		
9.	Chain of Custody signed, dated, and timed when relinquished and received?	◉	○	○		
10.	Sampler name and/or signature on COC?	○	◉	○		
11.	Were all samples received within holding time?	○	◉	○		
12.	TAT marked on the COC?	◉	○	○	If no TAT indicated, proceeded with standard TAT per Terms & Conditions. [ ]	

13. Cooler 1 Temperature 1.4 °C Cooler 2 Temperature _____ °C Cooler 3 Temperature _____ °C Cooler 4 Temperature _____ °C

14. Cooler 5 Temperature _____ °C Cooler 6 Temperature _____ °C Cooler 7 Temperature _____ °C Cooler 8 Temperature _____ °C

15. Comments: _____

I certify that I have completed sections 1-15 (dated initials). MJ 2/4/2020

		Yes	No	N/A	Details	Comments
16.	Were sample containers intact upon receipt?	◉	○	○		
17.	Custody seals present on sample containers?	○	◉	○		
18.	Custody seals intact on sample containers?	○	○	◉		
19.	Do sample container labels match the COC?	○	◉	○	incomplete info [ ] illegible [ ] no label [ ] other [■]	
20.	Are analyses requested indicated on the COC?	◉	○	○		
21.	Were all of the samples listed on the COC received?	◉	○	○	samples received but not listed on COC [ ] samples listed on COC not received [ ]	
22.	Was the sample collection date/time noted?	◉	○	○		
23.	Did we receive sufficient sample volume for indicated analyses?	◉	○	○		
24.	Were samples received in appropriate containers?	◉	○	○		
25.	Were VOA samples received without headspace (< 1/4" bubble)?	○	○	◉		
26.	Were trip blanks submitted?	○	○	◉	listed on COC [ ] not listed on COC [ ]	

27. Comments: _____

This section only applies to samples where pH can be checked at Sample Receipt.

I certify that I have completed sections 16-27 (dated initials). LM 2/4/20

		Yes	No	N/A	Details	Comments
28.	Have containers needing chemical preservation been checked? *	○	○	◉		
29.	Containers meet preservation guidelines?	○	○	◉		
30.	Was pH adjusted at Sample Receipt?	○	○	◉		

* Note: Certain analyses require chemical preservation but must be checked in the laboratory and not upon Sample Receipt such as Coliforms, VOCs and Oil & Grease/TPH.

I certify that I have completed sections 28-30 (dated initials). LM 2/4/20

Analytical Environmental Services, Inc

Date: 11-Feb-20

Client:	Waypoint Analytical
Project Name:	0020006
Lab Order:	2002171

Dates Report

Lab Sample ID	Client Sample ID	Collection Date	Matrix	Test Name	TCLP Date	Prep Date	Analysis Date
2002171-001A	AB-2	1/23/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-001A	AB-2	1/23/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-001A	AB-2	1/23/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-002A	AB-4	1/11/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-002A	AB-4	1/11/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-002A	AB-4	1/11/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-003A	AB-5	1/13/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-003A	AB-5	1/13/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-003A	AB-5	1/13/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-004A	AB-7	1/12/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-004A	AB-7	1/12/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-004A	AB-7	1/12/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-005A	AB-9	1/27/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-005A	AB-9	1/27/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-005A	AB-9	1/27/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-006A	AB-10	1/11/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-006A	AB-10	1/11/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-006A	AB-10	1/11/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-007A	AB-11	1/12/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-007A	AB-11	1/12/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-007A	AB-11	1/12/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-008A	AB-12	1/23/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-008A	AB-12	1/23/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-008A	AB-12	1/23/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-009A	BB-1	1/21/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-009A	BB-1	1/21/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-009A	BB-1	1/21/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-010A	BB-2	1/21/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-010A	BB-2	1/21/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020

Analytical Environmental Services, Inc

Date: 11-Feb-20

Client:	Waypoint Analytical
Project Name:	0020006
Lab Order:	2002171

Dates Report

Lab Sample ID	Client Sample ID	Collection Date	Matrix	Test Name	TCLP Date	Prep Date	Analysis Date
2002171-010A	BB-2	1/21/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-011A	BB-8	1/11/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-011A	BB-8	1/11/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-011A	BB-8	1/11/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-012A	BB-9	1/20/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-012A	BB-9	1/20/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-012A	BB-9	1/20/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-013A	BB-11	1/20/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-013A	BB-11	1/20/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-013A	BB-11	1/20/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-014A	BB-12	1/28/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-014A	BB-12	1/28/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-014A	BB-12	1/28/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-015A	BB-13	1/20/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-015A	BB-13	1/20/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-015A	BB-13	1/20/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-016A	CB-1	1/22/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-016A	CB-1	1/22/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-016A	CB-1	1/22/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-017A	CB-3	1/22/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-017A	CB-3	1/22/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-017A	CB-3	1/22/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-018A	CB-6	1/21/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-018A	CB-6	1/21/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-018A	CB-6	1/21/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-019A	CB-7	1/22/2020 12:00:00AM	Solid	Sulfide		2/5/2020 2:30:00PM	02/06/2020
2002171-019A	CB-7	1/22/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-019A	CB-7	1/22/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020
2002171-020A	CB-9	1/22/2020 12:00:00AM	Solid	Sulfide		2/6/2020 11:40:00AM	02/07/2020

Analytical Environmental Services, Inc

Date: 11-Feb-20

Client:	Waypoint Analytical
Project Name:	0020006
Lab Order:	2002171

Dates Report

Lab Sample ID	Client Sample ID	Collection Date	Matrix	Test Name	TCLP Date	Prep Date	Analysis Date
2002171-020A	CB-9	1/22/2020 12:00:00AM	Solid	Soil Resistivity		2/6/2020 11:00:00AM	02/07/2020
2002171-020A	CB-9	1/22/2020 12:00:00AM	Solid	PERCENT MOISTURE			02/07/2020

Analytical Environmental Services, Inc

Date: 11-Feb-20

Client: Waypoint Analytical
Project Name: 0020006
Workorder: 2002171

ANALYTICAL QC SUMMARY REPORT

BatchID: 292043

Sample ID: MB-292043	Client ID:			Units: mg/Kg		Prep Date: 02/05/2020		Run No: 417772	
SampleType: MBLK	TestCode: Sulfide by SW9030B/9034			BatchID: 292043		Analysis Date: 02/06/2020		Seq No: 9430721	
Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Sulfide	BRL	40.0									

Sample ID: LCS-292043	Client ID:			Units: mg/Kg		Prep Date: 02/05/2020		Run No: 417772	
SampleType: LCS	TestCode: Sulfide by SW9030B/9034			BatchID: 292043		Analysis Date: 02/06/2020		Seq No: 9430730	
Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Sulfide	1260	40.0	1260		100	70	130				

Sample ID: 2002225-001AMS	Client ID: B-203 8-12'			Units: mg/Kg-dry		Prep Date: 02/05/2020		Run No: 417772	
SampleType: MS	TestCode: Sulfide by SW9030B/9034			BatchID: 292043		Analysis Date: 02/06/2020		Seq No: 9430751	
Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Sulfide	1748	52.2	1643		106	68.9	122				

Sample ID: 2002225-001AMSD	Client ID: B-203 8-12'			Units: mg/Kg-dry		Prep Date: 02/05/2020		Run No: 417772	
SampleType: MSD	TestCode: Sulfide by SW9030B/9034			BatchID: 292043		Analysis Date: 02/06/2020		Seq No: 9430752	
Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Sulfide	1647	50.7	1596		103	68.9	122	1748	5.96	20	

Qualifiers:

>	Greater than Result value	<	Less than Result value	B	Analyte detected in the associated method blank
BRL	Below reporting limit	E	Estimated (value above quantitation range)	H	Holding times for preparation or analysis exceeded
J	Estimated value detected below Reporting Limit	N	Analyte not NELAC certified	R	RPD outside limits due to matrix
Rpt Lim	Reporting Limit	S	Spike Recovery outside limits due to matrix		

Client: Waypoint Analytical
Project Name: 0020006
Workorder: 2002171

ANALYTICAL QC SUMMARY REPORT

BatchID: 292093

Sample ID: MB-292093	Client ID:	Units: mg/Kg	Prep Date: 02/06/2020	Run No: 417861
SampleType: MBLK	TestCode: Sulfide by SW9030B/9034	BatchID: 292093	Analysis Date: 02/07/2020	Seq No: 9433034

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Sulfide	BRL	40.0									

Sample ID: LCS-292093	Client ID:	Units: mg/Kg	Prep Date: 02/06/2020	Run No: 417861
SampleType: LCS	TestCode: Sulfide by SW9030B/9034	BatchID: 292093	Analysis Date: 02/07/2020	Seq No: 9433036

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Sulfide	1280	40.0	1280		100	70	130				

Sample ID: 2002171-020AMS	Client ID: CB-9	Units: mg/Kg-dry	Prep Date: 02/06/2020	Run No: 417861
SampleType: MS	TestCode: Sulfide by SW9030B/9034	BatchID: 292093	Analysis Date: 02/07/2020	Seq No: 9433039

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Sulfide	1570	48.3	1546		102	68.9	122				H

Sample ID: 2002171-020AMSD	Client ID: CB-9	Units: mg/Kg-dry	Prep Date: 02/06/2020	Run No: 417861
SampleType: MSD	TestCode: Sulfide by SW9030B/9034	BatchID: 292093	Analysis Date: 02/07/2020	Seq No: 9433040

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Sulfide	1459	47.8	1531		95.3	68.9	122	1570	7.34	20	H

Qualifiers:
> Greater than Result value
< Less than Result value
B Analyte detected in the associated method blank
BRL Below reporting limit
E Estimated (value above quantitation range)
H Holding times for preparation or analysis exceeded
J Estimated value detected below Reporting Limit
N Analyte not NELAC certified
R RPD outside limits due to matrix
Rpt Lim Reporting Limit
S Spike Recovery outside limits due to matrix

Client: Waypoint Analytical
Project Name: 0020006
Workorder: 2002171

ANALYTICAL QC SUMMARY REPORT

BatchID: 292102

Sample ID: LCS-292102	Client ID:		Units: ohms*cm	Prep Date: 02/06/2020	Run No: 417849
SampleType: LCS	TestCode: Soil Resistivity SW9050A		BatchID: 292102	Analysis Date: 02/07/2020	Seq No: 9432650

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Resistivity (@100% Moisture Saturatic	9259	0	10000		92.6	90	110				

Sample ID: 2002171-001ADUP	Client ID: AB-2		Units: ohms*cm	Prep Date: 02/06/2020	Run No: 417849
SampleType: DUP	TestCode: Soil Resistivity SW9050A		BatchID: 292102	Analysis Date: 02/07/2020	Seq No: 9432686

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Resistivity (@100% Moisture Saturatic	8197	0						8244	0.575	30	

Sample ID: 2002171-011ADUP	Client ID: BB-8		Units: ohms*cm	Prep Date: 02/06/2020	Run No: 417849
SampleType: DUP	TestCode: Soil Resistivity SW9050A		BatchID: 292102	Analysis Date: 02/07/2020	Seq No: 9432690

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Resistivity (@100% Moisture Saturatic	10580	0						10580	0.011	30	

Qualifiers:
> Greater than Result value
< Less than Result value
B Analyte detected in the associated method blank
BRL Below reporting limit
E Estimated (value above quantitation range)
H Holding times for preparation or analysis exceeded
J Estimated value detected below Reporting Limit
N Analyte not NELAC certified
R RPD outside limits due to matrix
Rpt Lim Reporting Limit
S Spike Recovery outside limits due to matrix

End of Report

ACCESS
ANALYTICAL, INC.

ANALYTICAL REPORT

CLIENT
Waypoint Analytical
PO BOX 240543
Charlotte, NC 28224

ATTENTION
Angela Overcash

PROJECT ID
0020006

LABORATORY REPORT NUMBER
220020432

DATE
02/07/2020

Primary Data Review By

Authorized Signature

Secondary Data Review By

Ashley B. Amick
Project Manager, Access Analytical, Inc.
aamick@accessanalyticalinc.com

LEASE NOTE:

Unless otherwise noted, all analysis on this report performed at Pace Analytical Gulf Coast, 7979 Innovation Park Dr., Baton Rouge, LA 70820.

Pace Gulf Coast is SCDHEC certified laboratory # 73006, NCDENR certified lab # 618, GA certified lab # A-01955, NELAP certified laboratory # 01955

cal support services for this project are provided by Access Analytical, Inc.. Access Analytical is a presentative of Pace Guld Coast serving clients in the SC/NC/GA areas. All questions regarding this report uld be directed to your local Access Analytical representative at 803.781.4243 or toll free at 888.315.4243.

LELAP CERTIFICATE NUMBER: 01955
DOD-ELAP ACCREDITATION NUMBER: 74960

ANALYTICAL RESULTS

PERFORMED BY

Pace Analytical Gulf Coast
7979 Innovation Park Dr.
Baton Rouge, LA 70820
(225) 769-4900

Report Date 02/07/2020

Report # 220020432

Project 0020006

Deliver To	*Additional Recipients*
Angela Overcash Waypoint Analytical PO BOX 240543 Charlotte, NC 28224 706-529-6364	NONE

PJLA Testing DoD ELAP

ISO 17025

NELAP ACCREDITED TNI LABORATORY

Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with Pace Gulf Coast's Standard Operating Procedures.

Common Abbreviations that may be Utilized in this Report

ND	Indicates the result was Not Detected at the specified reporting limit
NO	Indicates the sample did not ignite when preliminary test performed for EPA Method 1030
DO	Indicates the result was Diluted Out
MI	Indicates the result was subject to Matrix Interference
TNTC	Indicates the result was Too Numerous To Count
SUBC	Indicates the analysis was Sub-Contracted
FLD	Indicates the analysis was performed in the Field
DL	Detection Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
RE	Re-analysis
CF	HPLC or GC Confirmation
00:01	Reported as a time equivalent to 12:00 AM

Reporting Flags that may be Utilized in this Report

J or I	Indicates the result is between the MDL and LOQ
J	DOD flag on analyte in the parent sample for MS/MSD outside acceptance criteria
U	Indicates the compound was analyzed for but not detected
B or V	Indicates the analyte was detected in the associated Method Blank
Q	Indicates a non-compliant QC Result (See Q Flag Application Report)
*	Indicates a non-compliant or not applicable QC recovery or RPD -- see narrative
E	Organics - The result is estimated because it exceeded the instrument calibration range
E	Metals - % diference for the serial dilution is > 10%
L	Reporting Limits adjusted to meet risk-based limit.
P	RPD between primary and confirmation result is greater than 40
DL	Diluted analysis -- when appended to Client Sample ID

Sample receipt at Pace Gulf Coast is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of Pace Gulf Coast. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with The NELAC Institute (TNI) Standard 2009 and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.

Authorized Signature
Pace Gulf Coast Report 220020432

Certifications

Certification	Certification Number
DOD ELAP	74960
Alabama	01955
Arkansas	88-0655
Colorado	01955
Delaware	01955
Florida	E87854
Georgia	01955
Hawaii	01955
Idaho	01955
Illinois	200048
Indiana	01955
Kansas	E-10354
Kentucky	95
Louisiana	01955
Maryland	01955
Massachusetts	01955
Michigan	01955
Mississippi	01955
Missouri	01955
Montana	N/A
Nebraska	01955
New Mexico	01955
North Carolina	618
North Dakota	R-195
Oklahoma	9403
South Carolina	73006001
South Dakota	01955
Tennessee	01955
Texas	T104704178
Vermont	01955
Virginia	460215
Washington	C929
USDA Soil Permit	P330-16-00234

Case Narrative

Client: Access Analytical **Report:** 220020432

Pace Analytical Gulf Coast received and analyzed the sample(s) listed on the Report Sample Summary page of this report. Receipt of the sample(s) is documented by the attached chain of custody. This applies only to the sample(s) listed in this report. No sample integrity or quality control exceptions were identified unless noted below.

No anomalies were found for the analyzed sample(s).

Sample Summary

LAB ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
22002043201	AB-2	Solid	01/23/2020 00:01	02/04/2020 09:45
22002043202	AB-4	Solid	01/11/2020 00:01	02/04/2020 09:45
22002043203	AB-5	Solid	01/13/2020 00:01	02/04/2020 09:45
22002043204	AB-7	Solid	01/12/2020 00:01	02/04/2020 09:45
22002043205	AB-9	Solid	01/27/2020 00:01	02/04/2020 09:45
22002043206	AB-10	Solid	01/11/2020 00:01	02/04/2020 09:45
22002043207	AB-11	Solid	01/12/2020 00:01	02/04/2020 09:45
22002043208	AB-12	Solid	01/23/2020 00:01	02/04/2020 09:45
22002043209	BB-1	Solid	01/21/2020 00:01	02/04/2020 09:45
22002043210	BB-2	Solid	01/21/2020 00:01	02/04/2020 09:45
22002043211	BB-8	Solid	01/11/2020 00:01	02/04/2020 09:45
22002043212	BB-9	Solid	01/20/2020 00:01	02/04/2020 09:45
22002043213	BB-11	Solid	01/20/2020 00:01	02/04/2020 09:45
22002043214	BB-12	Solid	01/28/2020 00:01	02/04/2020 09:45
22002043215	BB-13	Solid	01/20/2020 00:01	02/04/2020 09:45
22002043216	CB-1	Solid	01/22/2020 00:01	02/04/2020 09:45
22002043217	CB-3	Solid	01/22/2020 00:01	02/04/2020 09:45
22002043218	CB-6	Solid	01/21/2020 00:01	02/04/2020 09:45
22002043219	CB-7	Solid	01/22/2020 00:01	02/04/2020 09:45
22002043220	CB-9	Solid	01/22/2020 00:01	02/04/2020 09:45

Summary of Compounds Detected

AB-2

Collect Date 01/23/2020 00:01 **LAB ID** 22002043201

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	332			mV

AB-4

Collect Date 01/11/2020 00:01 **LAB ID** 22002043202

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	338			mV

AB-5

Collect Date 01/13/2020 00:01 **LAB ID** 22002043203

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	328			mV

AB-7

Collect Date 01/12/2020 00:01 **LAB ID** 22002043204

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	326			mV

Summary of Compounds Detected

AB-9

Collect Date 01/27/2020 00:01 **LAB ID** 22002043205

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	358			mV

AB-10

Collect Date 01/11/2020 00:01 **LAB ID** 22002043206

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	350			mV

AB-11

Collect Date 01/12/2020 00:01 **LAB ID** 22002043207

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	351			mV

AB-12

Collect Date 01/23/2020 00:01 **LAB ID** 22002043208

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	350			mV

Summary of Compounds Detected

BB-1

Collect Date 01/21/2020 00:01 LAB ID 22002043209
Receive Date 02/04/2020 09:45 Matrix Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	362			mV

BB-2

Collect Date 01/21/2020 00:01 LAB ID 22002043210
Receive Date 02/04/2020 09:45 Matrix Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	351			mV

BB-8

Collect Date 01/11/2020 00:01 LAB ID 22002043211
Receive Date 02/04/2020 09:45 Matrix Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	397			mV

BB-9

Collect Date 01/20/2020 00:01 LAB ID 22002043212
Receive Date 02/04/2020 09:45 Matrix Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	362			mV

Summary of Compounds Detected

BB-11

Collect Date 01/20/2020 00:01 **LAB ID** 22002043213

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	375			mV

BB-12

Collect Date 01/28/2020 00:01 **LAB ID** 22002043214

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	368			mV

BB-13

Collect Date 01/20/2020 00:01 **LAB ID** 22002043215

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	358			mV

CB-1

Collect Date 01/22/2020 00:01 **LAB ID** 22002043216

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	361			mV

Summary of Compounds Detected

CB-3

Collect Date 01/22/2020 00:01 **LAB ID** 22002043217

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	378			mV

CB-6

Collect Date 01/21/2020 00:01 **LAB ID** 22002043218

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	376			mV

CB-7

Collect Date 01/22/2020 00:01 **LAB ID** 22002043219

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	380			mV

CB-9

Collect Date 01/22/2020 00:01 **LAB ID** 22002043220

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	388			mV

Sample Results

AB-2

Collect Date 01/23/2020 00:01 **LAB ID** 22002043201

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	332			mV

AB-4

Collect Date 01/11/2020 00:01 **LAB ID** 22002043202

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	338			mV

AB-5

Collect Date 01/13/2020 00:01 **LAB ID** 22002043203

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	328			mV

AB-7

Collect Date 01/12/2020 00:01 **LAB ID** 22002043204

Receive Date 02/04/2020 09:45 **Matrix** Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	326			mV

Sample Results

AB-9					
	Collect Date	01/27/2020 00:01	LAB ID	22002043205
	Receive Date	02/04/2020 09:45	Matrix	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	358			mV

AB-10					
	Collect Date	01/11/2020 00:01	LAB ID	22002043206
	Receive Date	02/04/2020 09:45	Matrix	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	350			mV

AB-11					
	Collect Date	01/12/2020 00:01	LAB ID	22002043207
	Receive Date	02/04/2020 09:45	Matrix	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	351			mV

Sample Results

AB-12

Collect Date	01/23/2020 00:01	**LAB ID**	22002043208
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	350			mV

BB-1

Collect Date	01/21/2020 00:01	**LAB ID**	22002043209
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	362			mV

BB-2

Collect Date	01/21/2020 00:01	**LAB ID**	22002043210
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	351			mV

Sample Results

BB-8

Collect Date	01/11/2020 00:01	**LAB ID**	22002043211
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	397			mV

BB-9

Collect Date	01/20/2020 00:01	**LAB ID**	22002043212
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	362			mV

BB-11

Collect Date	01/20/2020 00:01	**LAB ID**	22002043213
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	375			mV

Sample Results

BB-12

Collect Date	01/28/2020 00:01	**LAB ID**	22002043214
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	368			mV

BB-13

Collect Date	01/20/2020 00:01	**LAB ID**	22002043215
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	358			mV

CB-1

Collect Date	01/22/2020 00:01	**LAB ID**	22002043216
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	361			mV

Sample Results

CB-3

Collect Date	01/22/2020 00:01	**LAB ID**	22002043217
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	378			mV

CB-6

Collect Date	01/21/2020 00:01	**LAB ID**	22002043218
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	376			mV

CB-7

Collect Date	01/22/2020 00:01	**LAB ID**	22002043219
Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228 *Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	380			mV

Sample Results

CB-9	**Collect Date**	01/22/2020 00:01	**LAB ID**	22002043220
	Receive Date	02/04/2020 09:45	**Matrix**	Solid

HACH Method 10228

*Results Reported on Dry Weight Basis

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	02/05/2020 14:45	AJE	676940

CAS#	Parameter	Result	DL	LOQ	Units
WET-104	Oxidation Reduction Potential	388			mV

Waypoint ANALYTICAL

Client ID: 4565 - Access Analytical
SDG: 220020432
PM: DLH

SUBCONTRACT ORDER

Waypoint Analytical
0020006

Certification: NELAC__ USACE__ NC ✓ SC__ Other ____ N/A____

SENDING LABORATORY:
Waypoint Analytical
P. O. Box 240543
Charlotte, NC 28224-0543
Phone: 800-529-6364
Fax: 704-525-0409
Project Manager: Angela D. Overcash

RECEIVING LABORATORY:
Pace Analytical Gulf Coast
10781 Coursey Blvd
Baton Rouge, LA 70816
Phone :(225) 769-4900
Fax: (225) 767-5717

Need 5 dy TAT

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 0020006-01	Solid	Sampled:01/23/20 00:00	AB-2	1
ORP (Sub)		01/28/20 00:00		
Containers Supplied: 4oz glass				
Sample ID: 0020006-02	Solid	Sampled:01/11/20 00:00	AB-4	2
ORP (Sub)		01/16/20 00:00		
Containers Supplied:				
Sample ID: 0020006-03	Solid	Sampled:01/13/20 00:00	AB-5	3
ORP (Sub)		01/18/20 00:00		
Containers Supplied:				
Sample ID: 0020006-04	Solid	Sampled:01/12/20 00:00	AB-7	4
ORP (Sub)		01/17/20 00:00		
Containers Supplied:				
Sample ID: 0020006-05	Solid	Sampled:01/27/20 00:00	AB-9	5
ORP (Sub)		02/01/20 00:00		

Released By	Date	Received By	Date
[signature]	2-3-20	FedEx	
FedEx	2-4-20	DodieMcCune	2-4-20 9:45

Page 1 of 4

7716 7515 4968 01E20 374PM

Client ID: 4565 - Access Analytical
SDG: 220020432
PM: DLH

BCONTRACT ORDER
Waypoint Analytical
0020006

Certification: NELAC___ USACE___
NC___ SC___ Other ___
N/A___

Analysis	Due	Expires	Laboratory ID	Comments
Containers Supplied:				
Sample ID: 0020006-06	**Solid**	**Sampled:01/11/20 00:00**	AB-10	6
ORP (Sub)		01/16/20 00:00		
Containers Supplied:				
Sample ID: 0020006-07	**Solid**	**Sampled:01/12/20 00:00**	AB-11	7
ORP (Sub)		01/17/20 00:00		
Containers Supplied:				
Sample ID: 0020006-08	**Solid**	**Sampled:01/23/20 00:00**	AB-12	8
ORP (Sub)		01/28/20 00:00		
Containers Supplied:				
Sample ID: 0020006-09	**Solid**	**Sampled:01/21/20 00:00**	BB-1	9
ORP (Sub)		01/26/20 00:00		
Containers Supplied:				
Sample ID: 0020006-10	**Solid**	**Sampled:01/21/20 00:00**	BB-2	10
ORP (Sub)		01/26/20 00:00		
Containers Supplied:				
Sample ID: 0020006-11	**Solid**	**Sampled:01/11/20 00:00**	BB-8	11
ORP (Sub)		01/16/20 00:00		
Containers Supplied:				
Sample ID: 0020006-12	**Solid**	**Sampled:01/20/20 00:00**	BB-9	12
ORP (Sub)		01/25/20 00:00		
Containers Supplied:				

Released By	Date	Received By	Date
[signature]	2-3-20	FedEx	
FedEx	2-4-20	DollieMcClure	2-4-20 945
Released By	Date	Received By	Date
Released By	Date	Received By	Date
Released By	Date	Received By	Date

7776 7515 4968 0.1 E26 37CAM

Client ID: 4565 - Access Analytical
SDG: 220020432
PM: DLH

SUBCONTRACT ORDER
Waypoint Analytical
0020006

Certification: NELAC___ USACE___
NC___ SC___ Other _____
N/A____

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 0020006-13	Solid	Sampled:01/20/20 00:00	BB-11	13
ORP (Sub)		01/25/20 00:00		
Containers Supplied:				
Sample ID: 0020006-14	Solid	Sampled:01/28/20 00:00	BB-12	14
ORP (Sub)		02/02/20 00:00		
Containers Supplied:				
Sample ID: 0020006-15	Solid	Sampled:01/20/20 00:00	BB-13	15
ORP (Sub)		01/25/20 00:00		
Containers Supplied:				
Sample ID: 0020006-16	Solid	Sampled:01/22/20 00:00	CB-1	16
ORP (Sub)		01/27/20 00:00		
Containers Supplied:				
Sample ID: 0020006-17	Solid	Sampled:01/22/20 00:00	CB-3	17
ORP (Sub)		01/27/20 00:00		
Containers Supplied:				
Sample ID: 0020006-18	Solid	Sampled:01/21/20 00:00	CB-6	18
ORP (Sub)		01/26/20 00:00		
Containers Supplied:				
Sample ID: 0020006-19	Solid	Sampled:01/22/20 00:00	CB-7	19
ORP (Sub)		01/27/20 00:00		
Containers Supplied:				

Released By	Date	Received By	Date
[signature]	2-3-20	FedEx	
FedEx	2-4-20	DocuMCCure	2-4-20 9:45

7776 7515 4968 0.1 E26 3VGPM

Client ID: 4565 - Access Analytical
SDG: 220020432
PM: DLH

BCONTRACT ORDER
Waypoint Analytical
0020006

Certification: NELAC___ USACE___
NC___ SC___ Other ___
N/A___

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 0020006-20	Solid	Sampled:01/22/20 00:00	CB-9	20
ORP (Sub)		01/27/20 00:00		
Containers Supplied:				

Released By	Date	Received By	Date
[illegible]	2-3-20	FedEx	
FedEx	2-4-20	Doug McClure	2-4-20 9:45

7776 7515 4968 0.1 E26 31UPM

Pace Analytical

SAMPLE RECEIVING CHECKLIST

220020432

SAMPLE DELIVERY GROUP 220020432	
Client PM DLH 4565 - Access Analytical	Transport Method FEDEX
Profile Number 80251	Received By Savage, Tiffany R
Line Item(s) 2 - Solid	Receive Date(s) 02/04/20

CHECKLIST	YES	NO
Samples received with proper thermal preservation?	☑	☐
Radioactivity is <1600 cpm? If no, record cpm value in notes section.	☑	☐
COC relinquished and complete (including sampleIDs, collect times, and sampler)?	☑	☐
All containers received in good condition and within hold time?	☑	☐
All sample labels and containers received match the chain of custody?	☑	☐
Preservative added to any containers?	☐	☑
If received, was headspace for VOC water containers < 6mm?	☑	☐
Samples collected in containers provided by Pace Gulf Coast?	☐	☑

COOLERS

Airbill	Thermometer ID: E26	Temp °C
7776-7515-4968		0.1

DISCREPANCIES

None

LAB PRESERVATIONS

None

NOTES

Revision 1.6

APPENDIX IV

GBA DOCUMENT

Important Information about This

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.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering 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 given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- 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;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the 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. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include 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 personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Corporate HQ: 3015 Dumbarton Road Richmond, Virginia 23228 T 804.264.2701 F 804.264.1202 www.fandr.com

VIRGINIA • NORTH CAROLINA • SOUTH CAROLINA • MARYLAND • DISTRICT OF COLUMBIA

A Minority-Owned Business

APPENDIX F-SEWER PERMIT APPROVAL

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

March 9, 2021

Misty M. Manning
Fayetteville Public Works Commission
955 Old Wilmington Rd
Fayetteville, NC 28301

Re: Engineering Plans and Specifications Approval
Wastewater Collection System Expansion
Annexation Phase V, Project XI, Construction Area 24B-C
Cumberland County
Permit # PWC2021-S005

Dear **Mrs. Manning**:

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# PWC2021-S005,** effective **March 9, 2021** to the addressee for the construction, operation and maintenance of the subject wastewater collection system extension as described in the application for **Annexation Phase V, Project XI, Construction Area 24B-C.**

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 **Developer** for the construction of **3,896 LF of 8-Inch DIP, 1,462 LF of 8-Inch RJDIP, and 8,083 LF of 8-Inch PVC Gravity Main to discharge 70,230 GPD** of collected domestic wastewater into the City of Fayetteville existing sewer system, pursuant to the application received and in conformity with 15A NCAC 02T, PWC's Design Manual, the State's 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 Wastewater 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

Misty Manning

Misty Manning, P.E.
Water Resources Engineer/Manager

Enclosures
DS-15412
cc: **T. Carter Hubard, P.E.**
Project File

Authorization To Construct

Project Name:	**ANNEXATION PHASE V, PROJECT XI, CONSTRUCTION AREA 24B-C**
Permit Number:	**PWC2021-S005**
Issued To:	**FAYETTEVILLE PUBLIC WORKS COMMISSION**
Issue Date:	**March 9, 2021**
Expiration Date:	**March 9, 2023**

In accordance with Fayetteville PWC requirements this Authorization to Construct must be posted for inspection at the primary entrance of the job site during all construction.

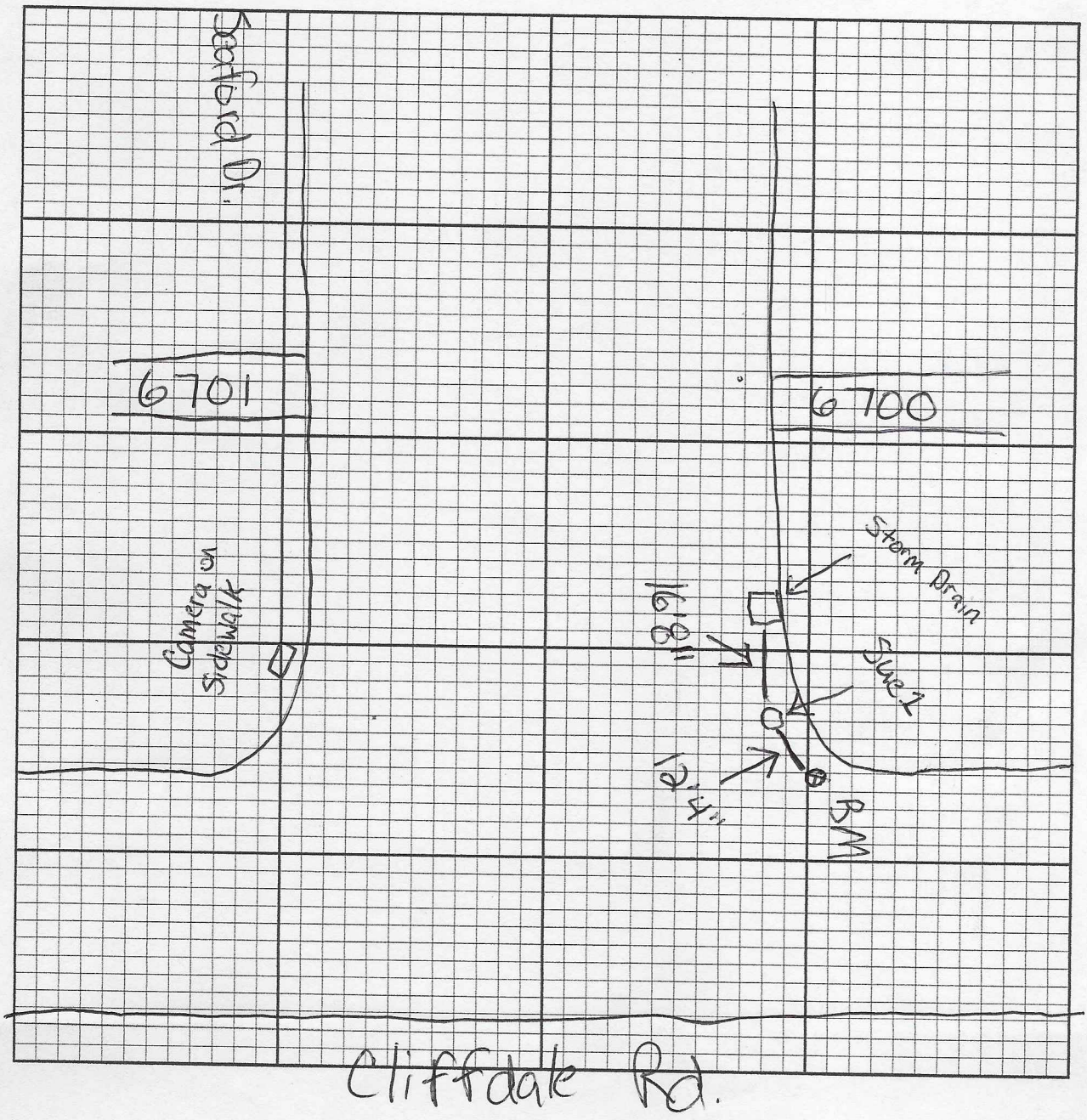
APPENDIX G-SUBSURFACE UTILITY ENGINEERING FIELD REPORTS

SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 1
PROJECT NAME: Area 24 B
PREPARED BY: JGH II INC
DATE: 3/11/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Water
PIPE DIAMETER: 6"
ROD READING ON MARK: 7'6"
ROD READING ON TOP
UTILITY PIPE: 11'3" 3/4

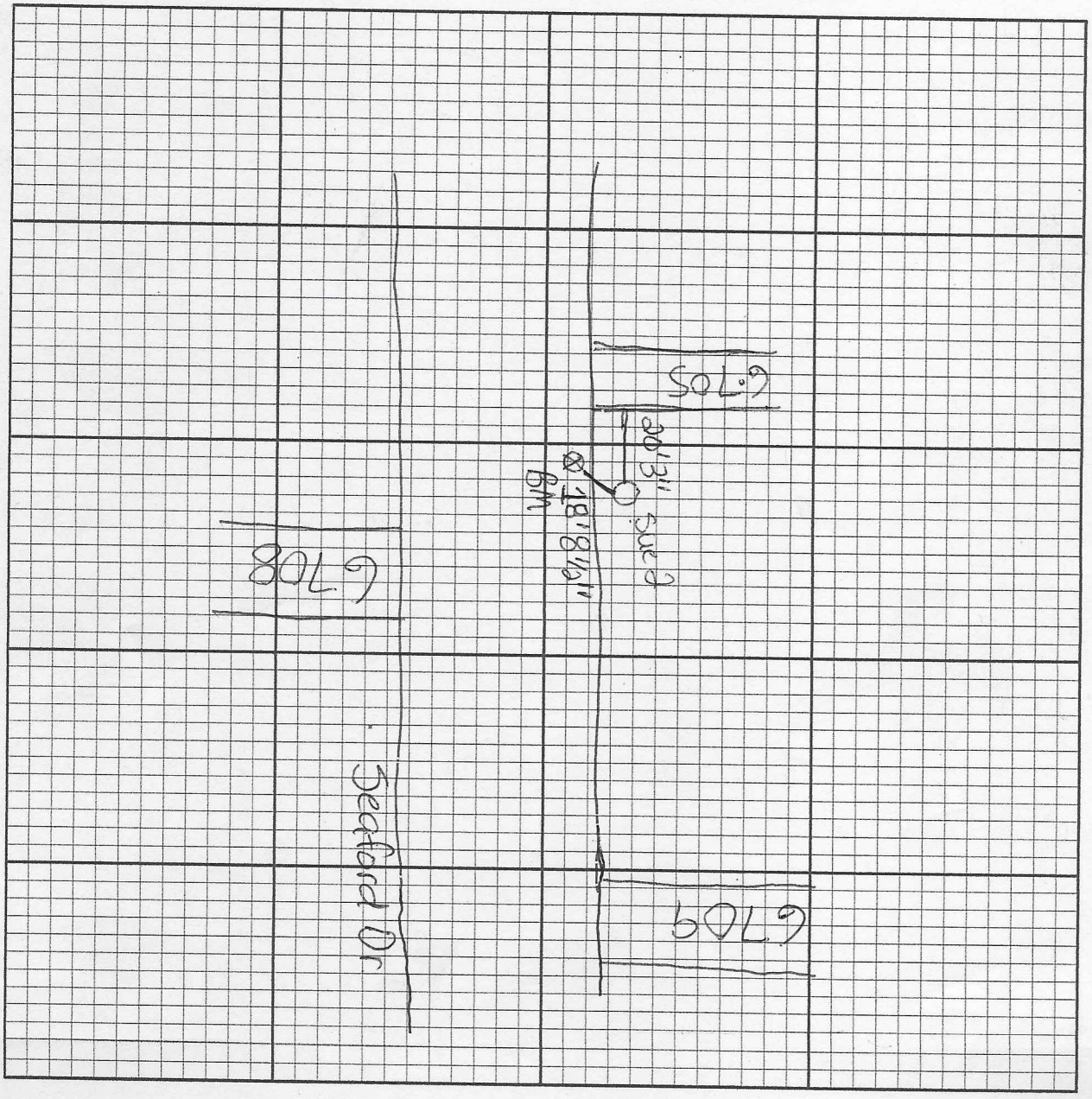


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 2
PROJECT NAME: Area 24 Area 13
PREPARED BY: JGH II INC
DATE: _____ TECH INITIALS: _____
CHEKCED BY: _____ PAGE ____ OF _____

UTILITY TYPE: Electric
PIPE DIAMETER: 2"
ROD READING ON MARK: 5'10 3/4"
ROD READING ON TOP
UTILITY PIPE: ~~[illegible]~~ 8'10½"

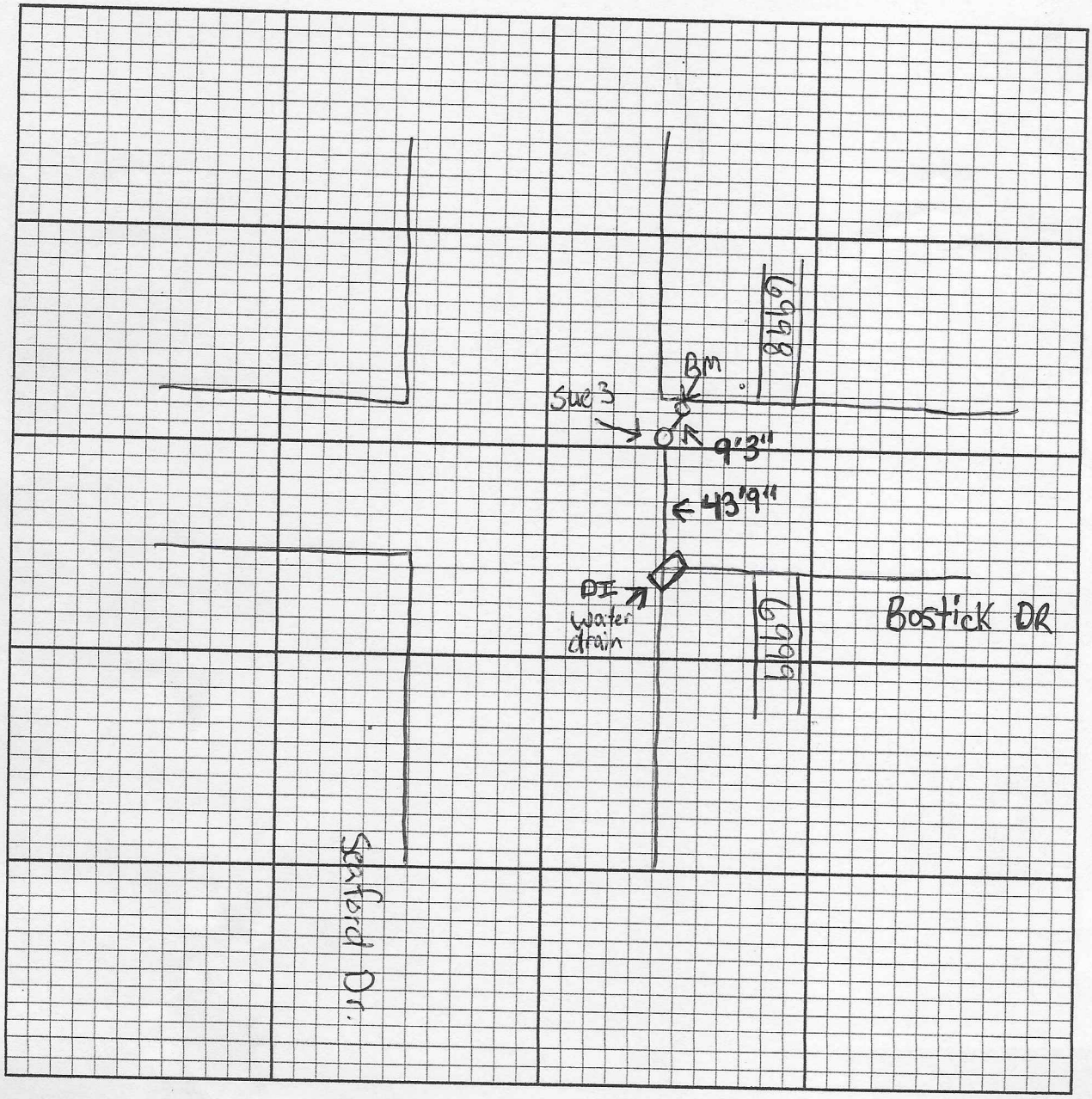


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 3
PROJECT NAME: Area 24 B
PREPARED BY: JGH II INC
DATE: 2/5/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Water
PIPE DIAMETER: 6"
ROD READING ON MARK: 5'10¼"
ROD READING ON TOP
UTILITY PIPE: 9'5"

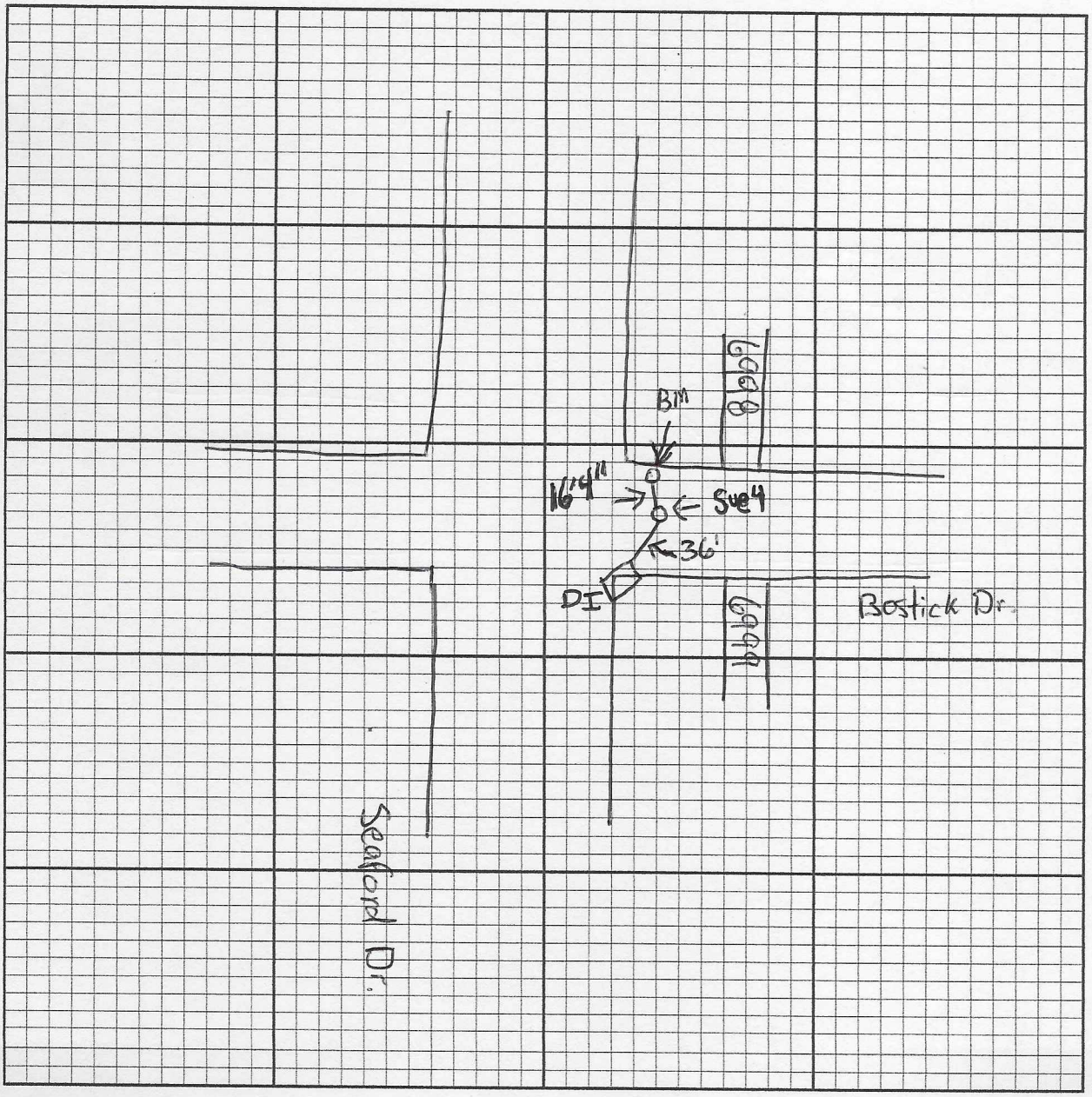


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 4
PROJECT NAME: Area 24B
PREPARED BY: JGH II INC
DATE: 2/5/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ____ OF ____

UTILITY TYPE: Water
PIPE DIAMETER: 6"
ROD READING ON MARK: 5'10 1/4"
ROD READING ON TOP
UTILITY PIPE: 9'5 1/8"



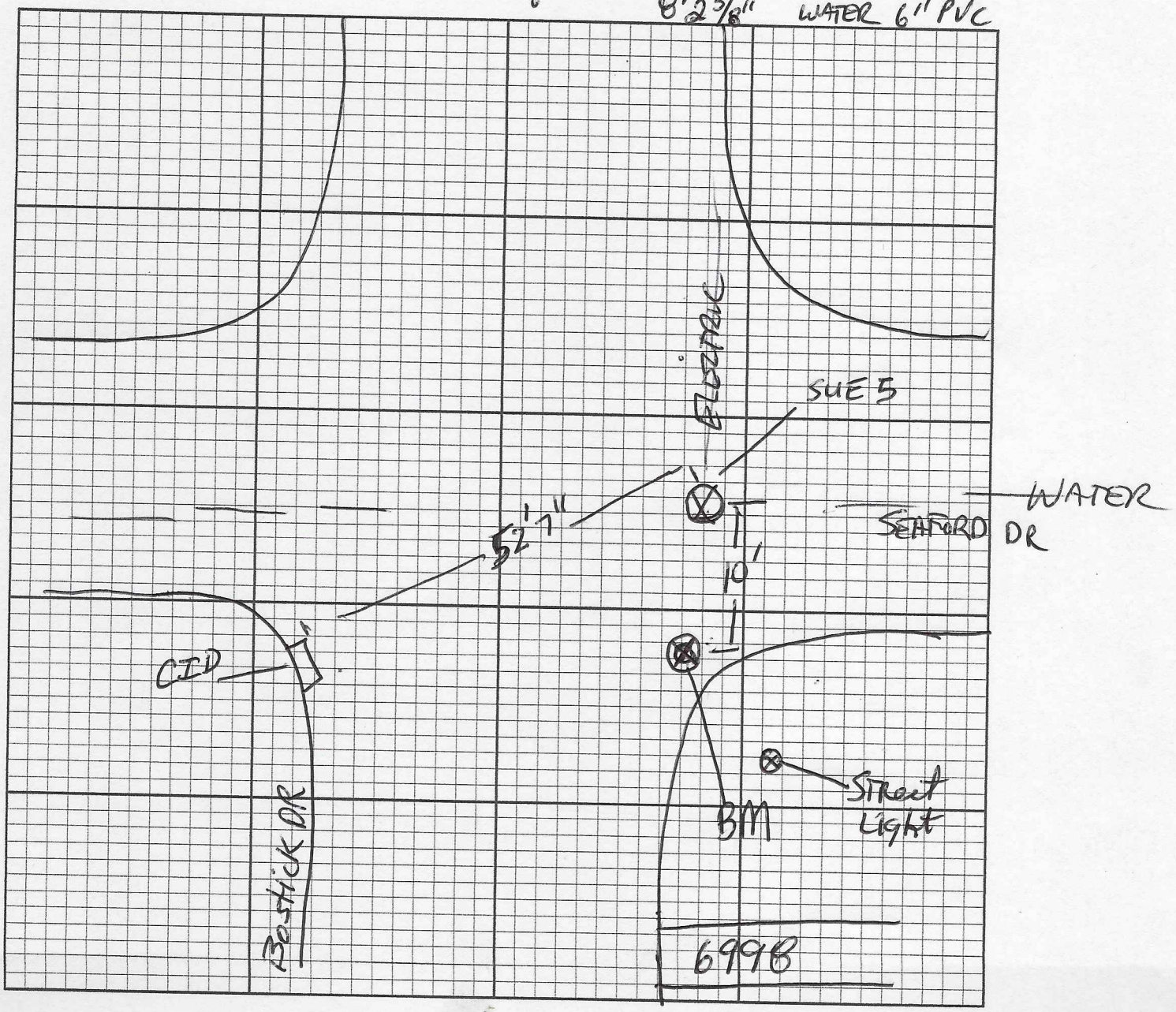
SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 5
PROJECT NAME: AREA 24 B
PREPARED BY: JGH II INC
DATE: 2/4/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: ELECTRIC
PIPE DIAMETER: 2-2" Red HDPE
ROD READING ON MARK: 5' 9 1/2"
ROD READING ON TOP
UTILITY PIPE: 11' 11 1/2" ELECTRIC
8' 2 3/8" WATER 6" PVC

Utility Perpendicular

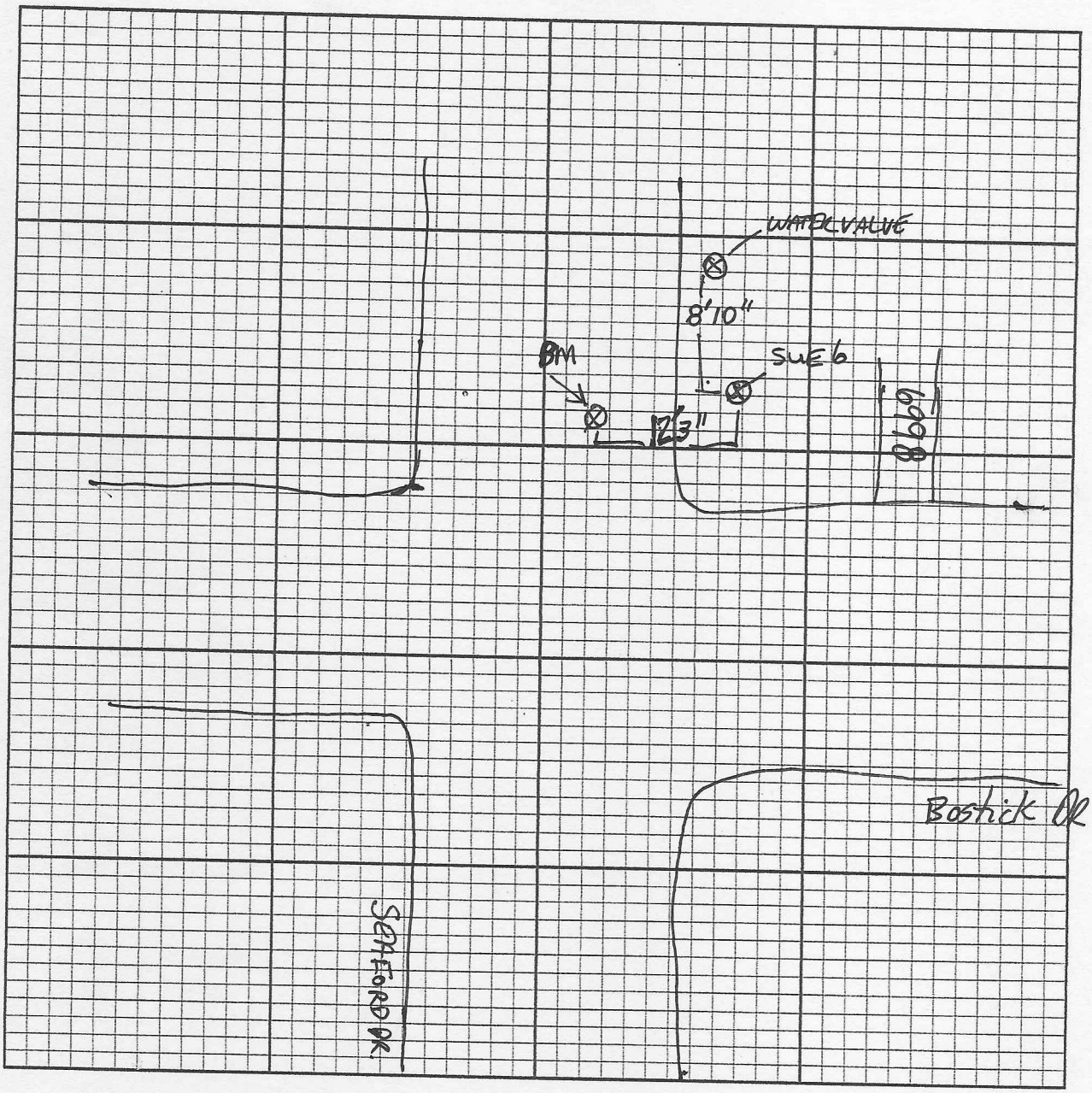


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 6
PROJECT NAME: AREA 24B
PREPARED BY: JGH II INC
DATE: 1/31/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: WATER
PIPE DIAMETER: 6"
ROD READING ON MARK: 6'1"
ROD READING ON TOP
UTILITY PIPE: 9'2"

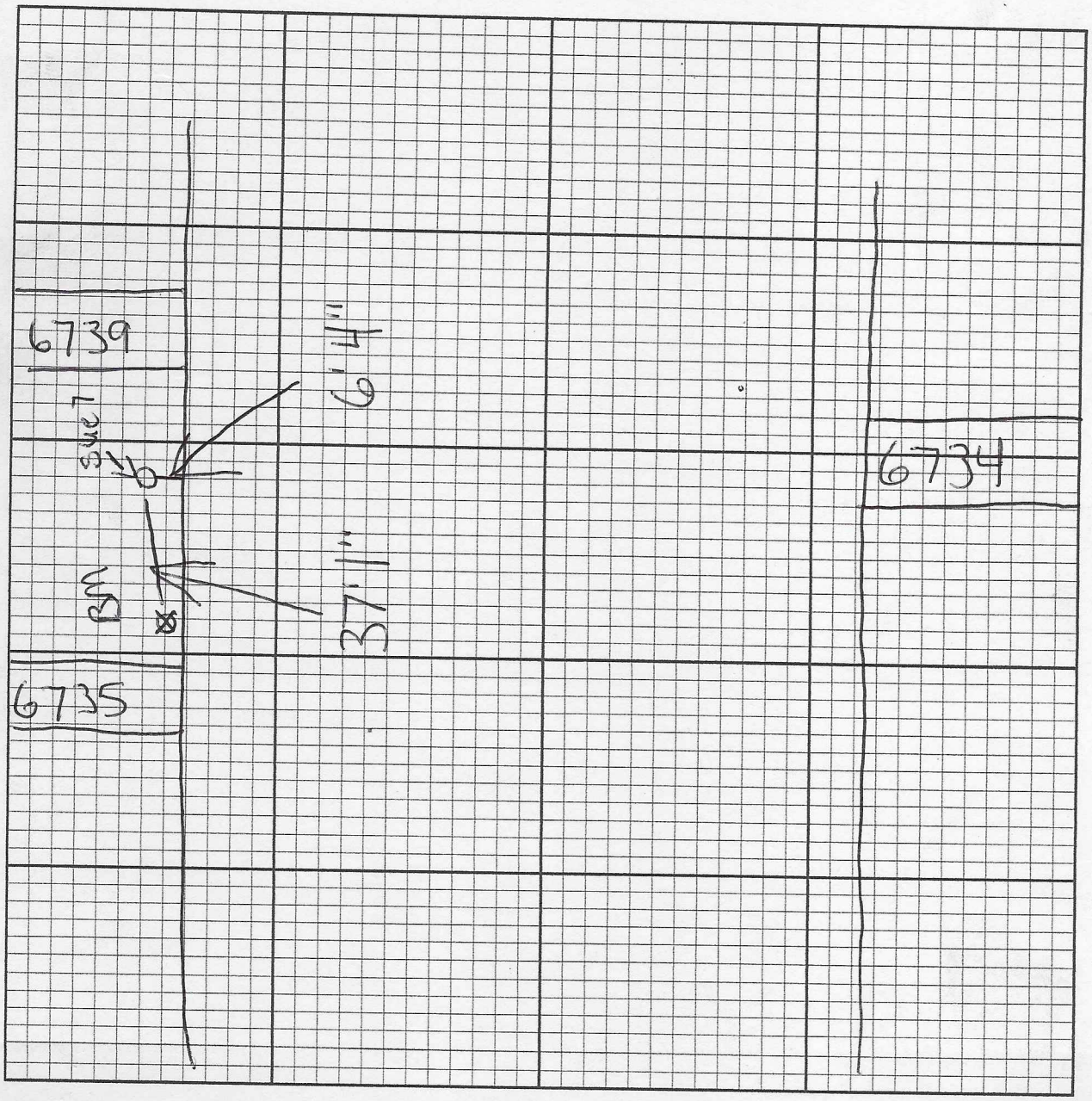


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # Sue 7
PROJECT NAME: Area 24 B
PREPARED BY: JGH II INC
DATE: 2/27/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: [redacted] Cable Didn't find electric
PIPE DIAMETER: _____
ROD READING ON MARK: 5'2" 7/8
ROD READING ON TOP
UTILITY PIPE: 6' 10" 7/8

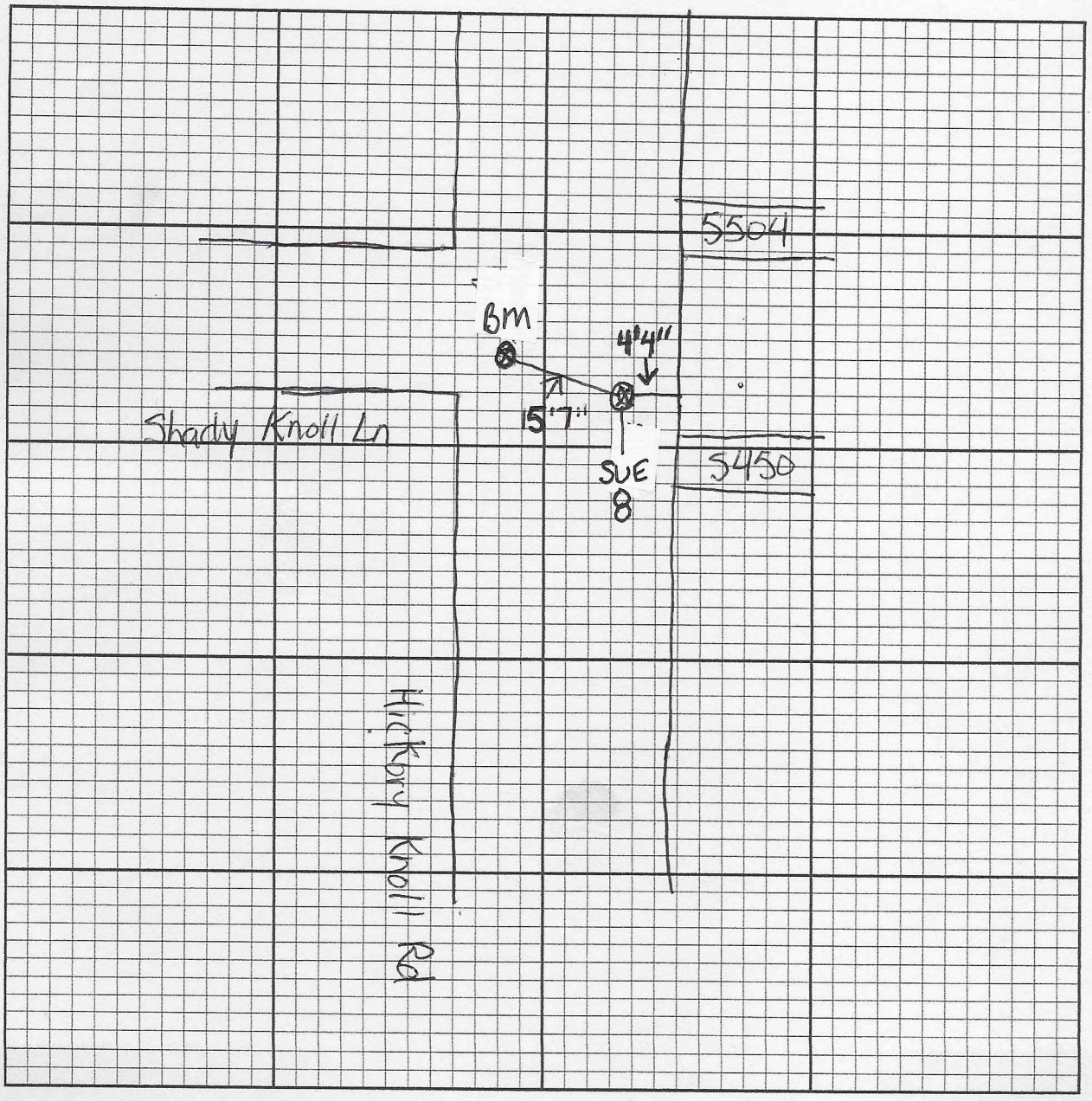


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 8
PROJECT NAME: Area 74 B
PREPARED BY: JGH II INC
DATE: 2/4/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ____ OF ____

UTILITY TYPE: Water
PIPE DIAMETER: 6"
ROD READING ON MARK: 5'½"
ROD READING ON TOP
UTILITY PIPE: 9'11½"

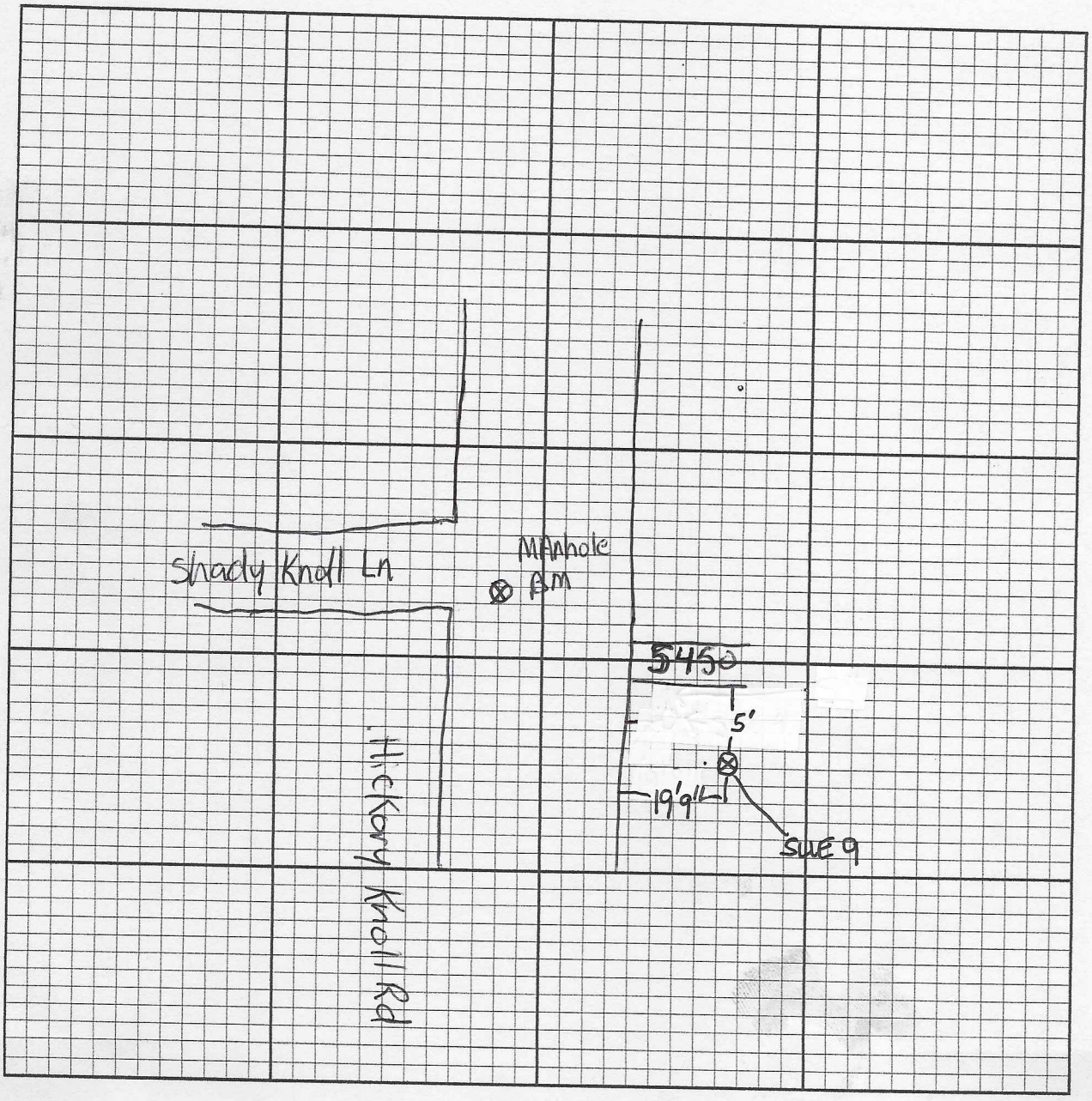


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 9
PROJECT NAME: Area 24 B
PREPARED BY: JGH II INC
DATE: 1/31/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Electric
PIPE DIAMETER: 3 2" pipes
ROD READING ON MARK: 5'
ROD READING ON TOP
UTILITY PIPE: 10'

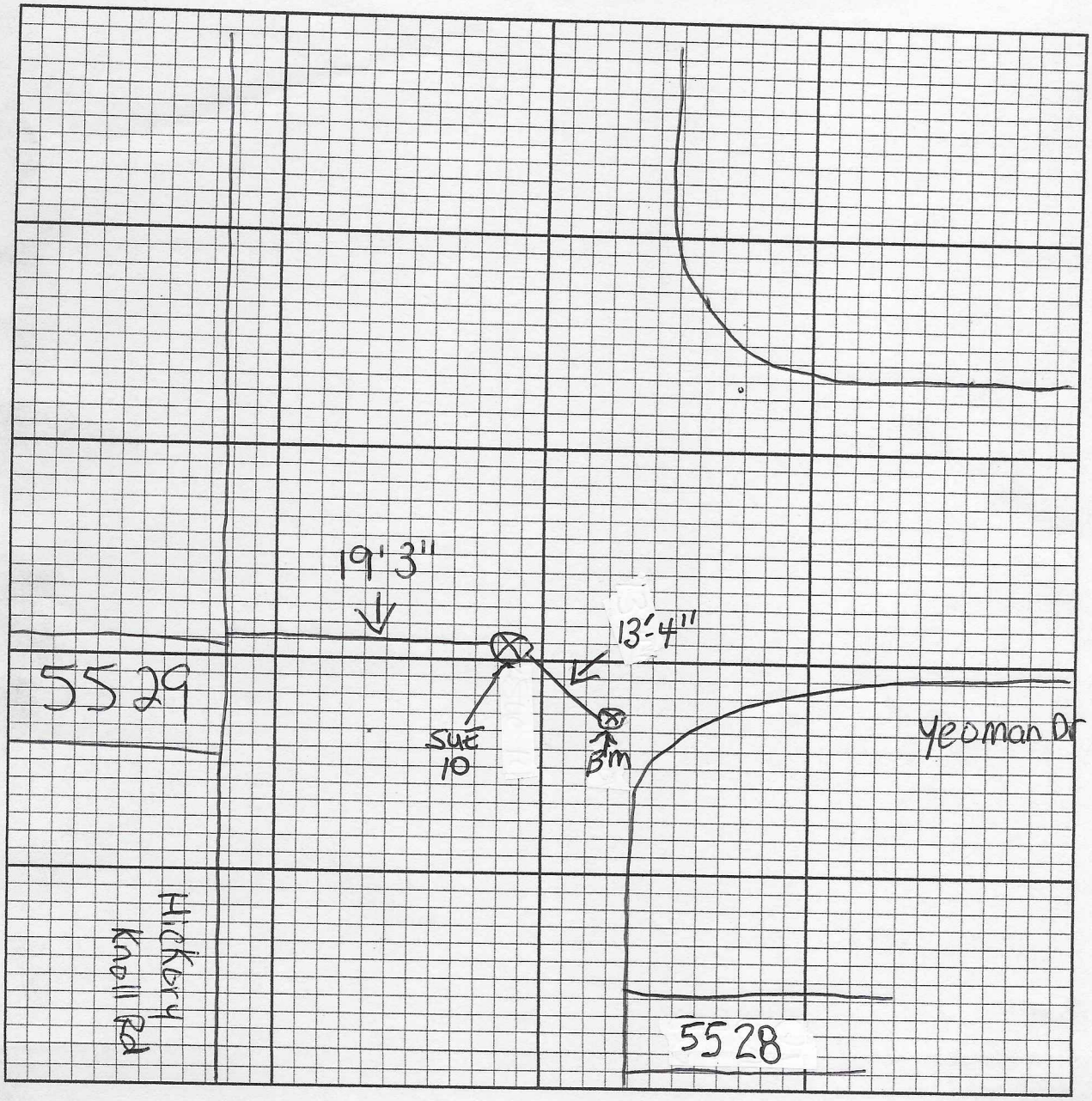


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 10
PROJECT NAME: Area 24 B
PREPARED BY: JGH II INC
DATE: 2/5/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Water
PIPE DIAMETER: 8"
ROD READING ON MARK: 5' 2 1/2"
ROD READING ON TOP
UTILITY PIPE: 8' 11 1/4"

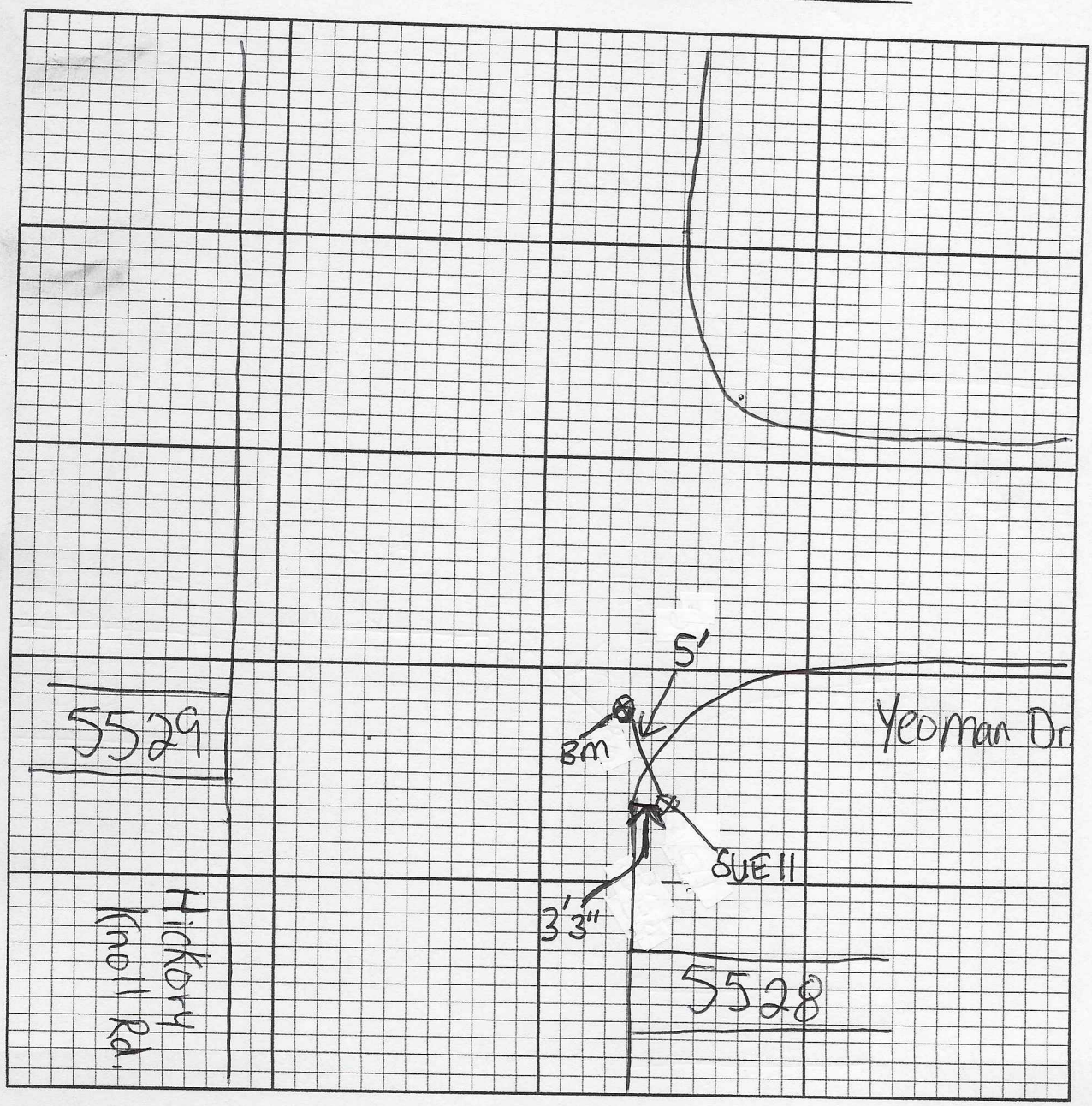


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 11
PROJECT NAME: Area 24 B
PREPARED BY: JGH II INC
DATE: 1/5/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Electric
PIPE DIAMETER: _____
ROD READING ON MARK: 5'2½"
ROD READING ON TOP
UTILITY PIPE: 6'9¾"

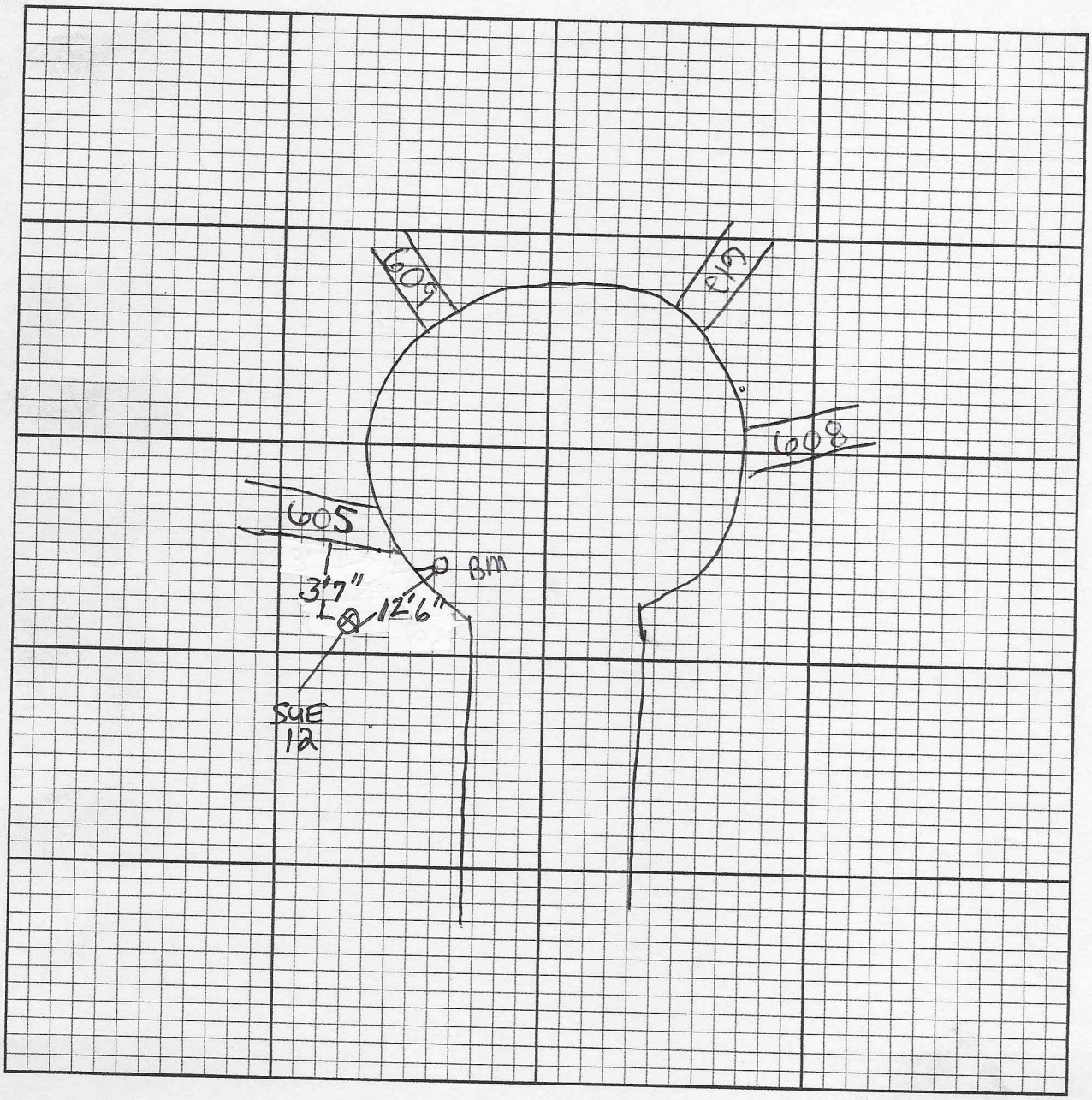


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 12
PROJECT NAME: Area 24 B
PREPARED BY: JGH II INC
DATE: 1/31/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Water
PIPE DIAMETER: 4"
ROD READING ON MARK: 4'10 1/8"
ROD READING ON TOP
UTILITY PIPE: 7'11"

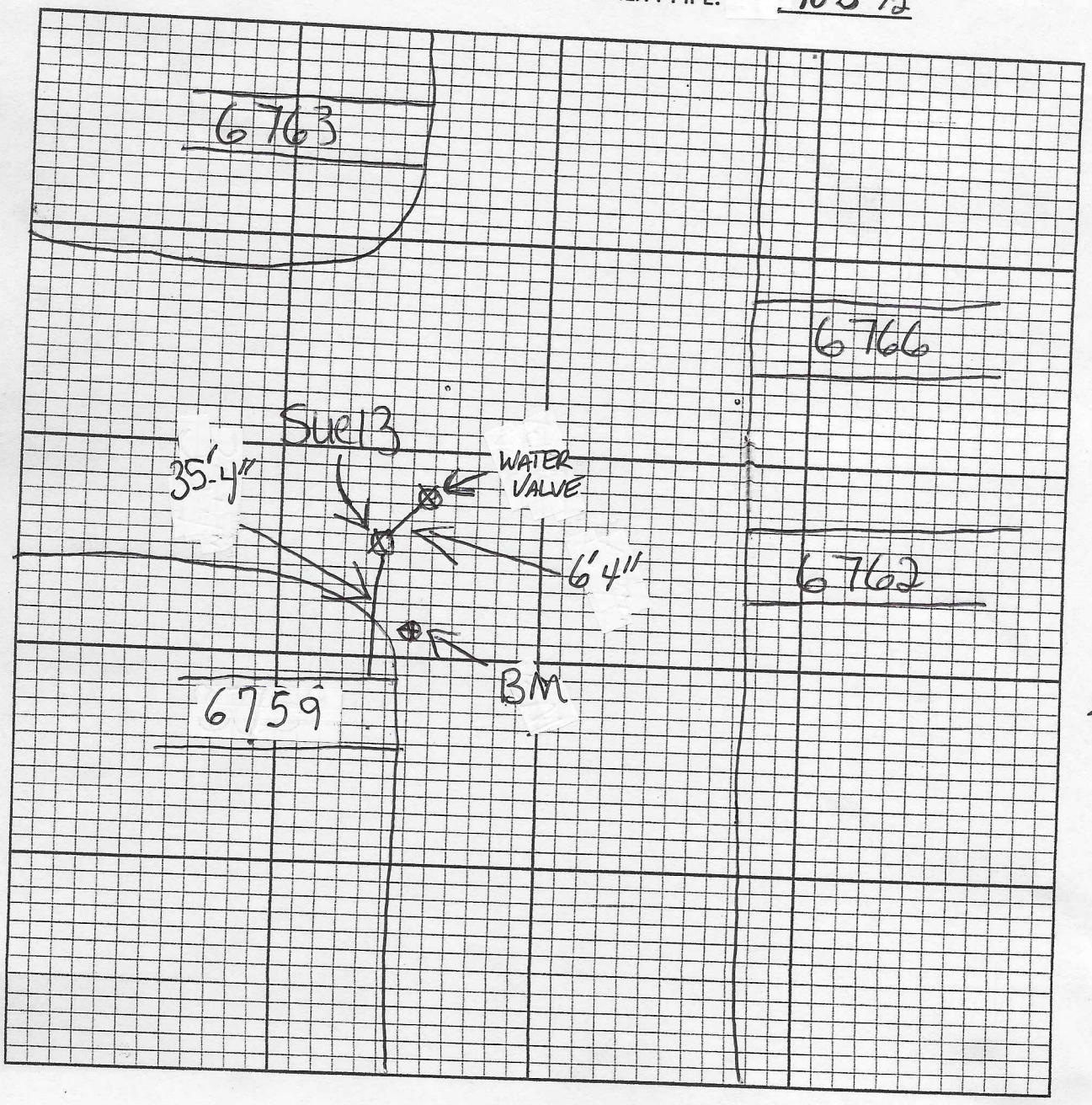


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 13
PROJECT NAME: Area 24B
PREPARED BY: JGH II INC
DATE: 3/18/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Electric
PIPE DIAMETER: 2"
ROD READING ON MARK: 4'8"3/4
ROD READING ON TOP
UTILITY PIPE: 10'3"1/2

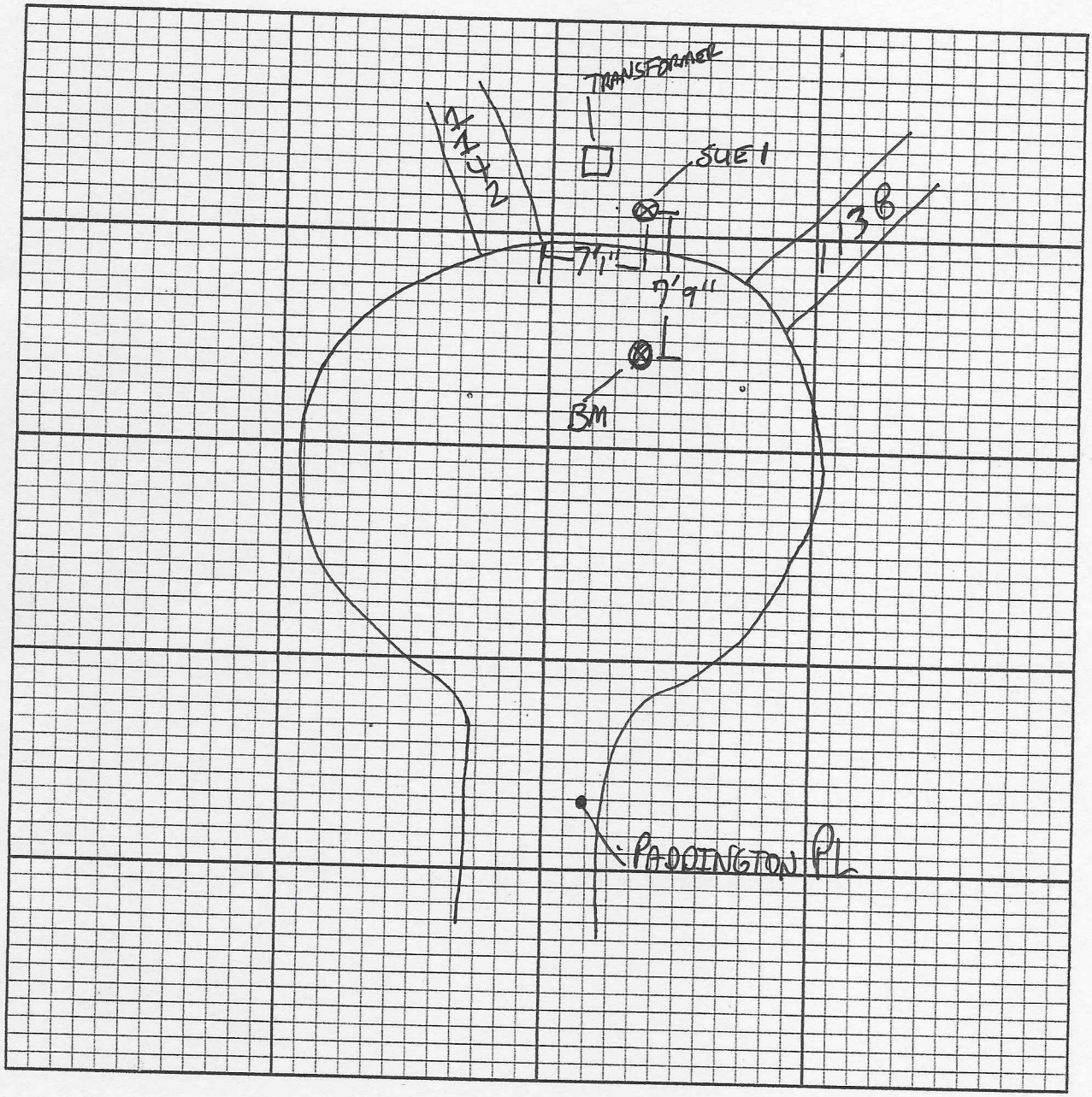


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 1
PROJECT NAME: AREA 24 C
PREPARED BY: JGH II INC
DATE: 1/21/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Electric
PIPE DIAMETER: _____
ROD READING ON MARK: 5'4 1/2"
ROD READING ON TOP
UTILITY PIPE: 8'10"

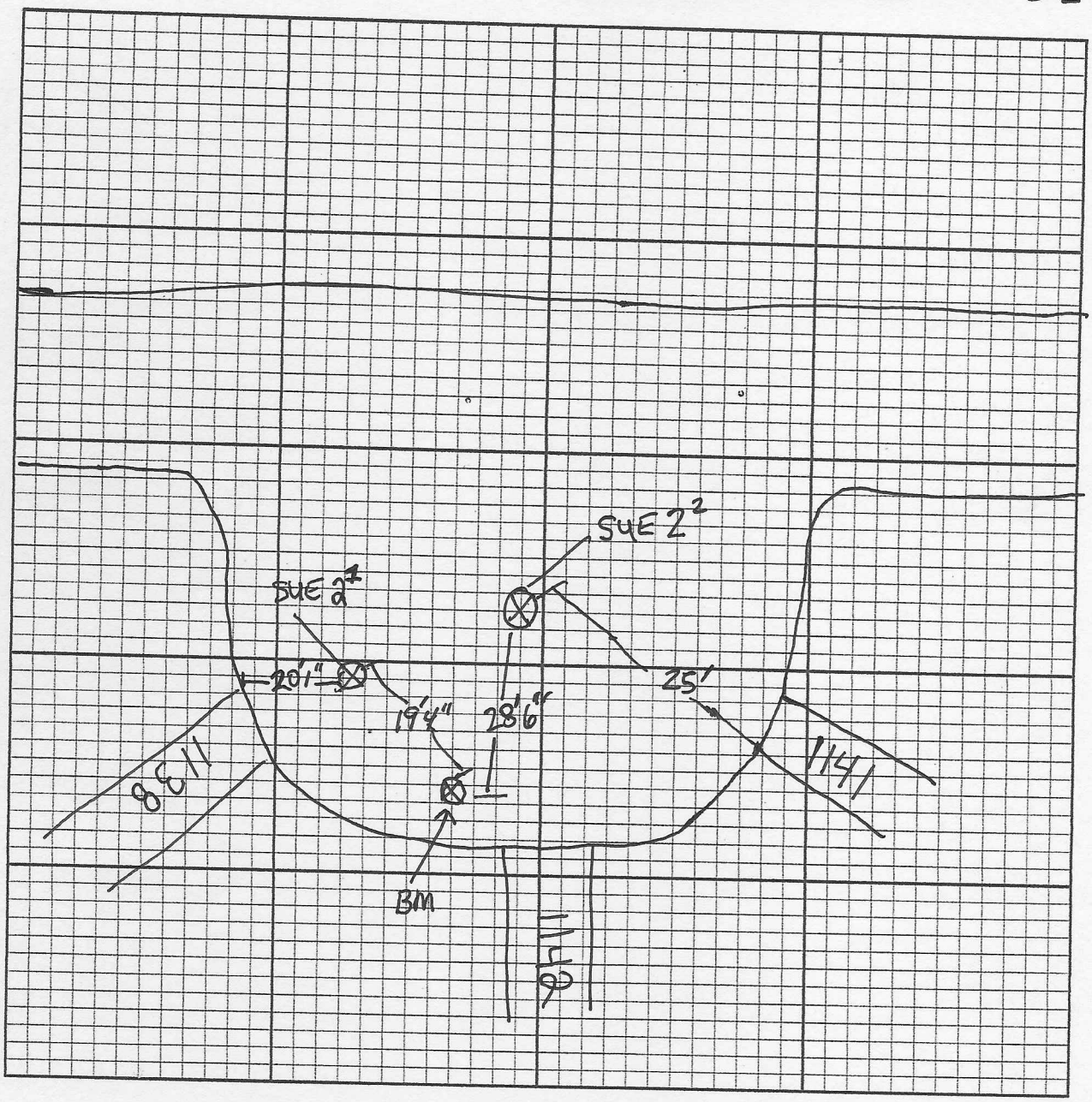


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 2
PROJECT NAME: AREA 24C
PREPARED BY: JGH II INC
DATE: 3/13/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: WATER
PIPE DIAMETER: SUE 2^2 - 2" SUE 2^2 - 1"
ROD READING ON MARK: 5' 2 1/4"
ROD READING ON TOP
UTILITY PIPE: SUE 2^2 - 6' 6 1/4" SUE 2^2 - 5' 2"

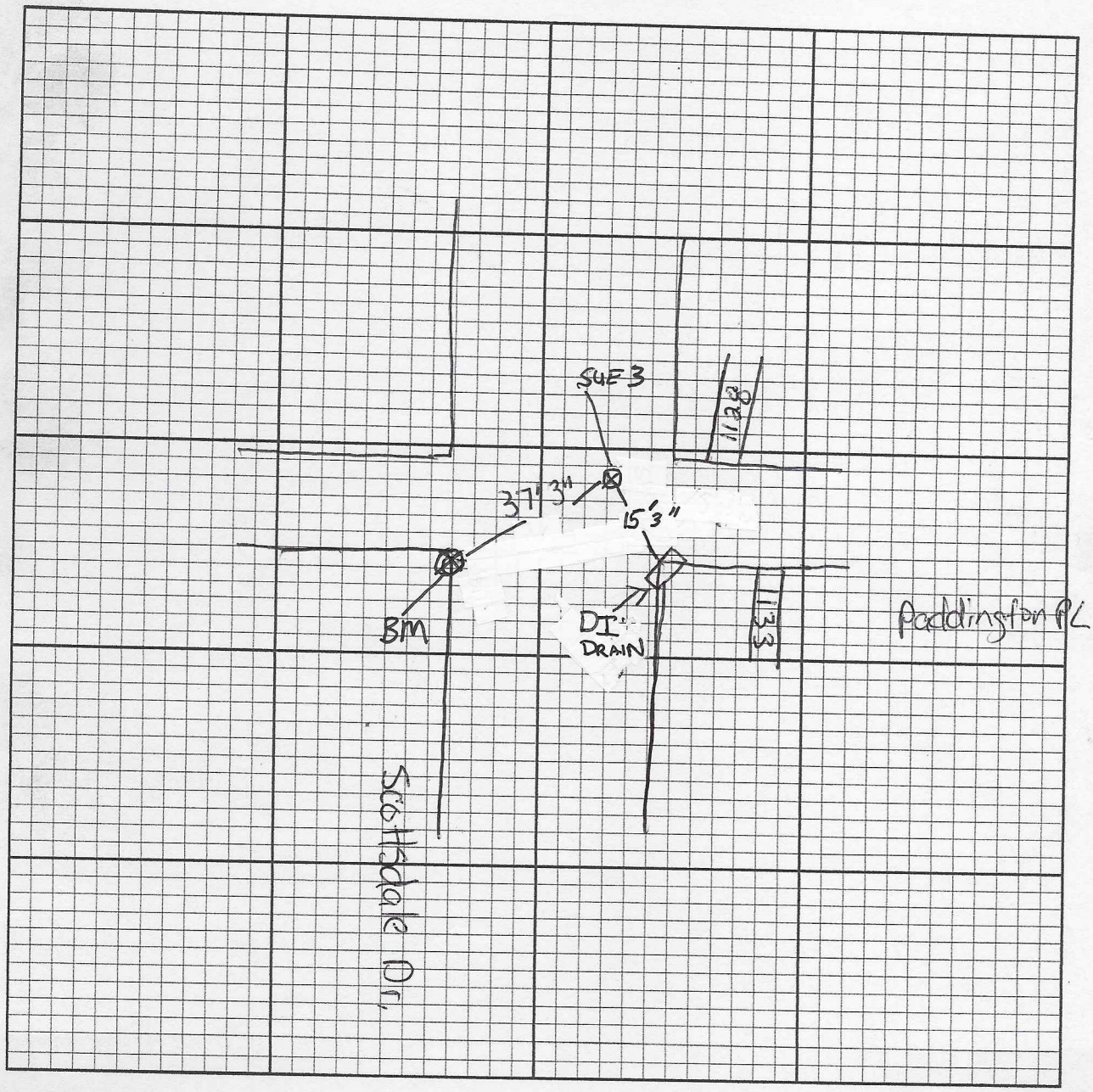


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 3
PROJECT NAME: Area 24C
PREPARED BY: JGH II INC
DATE: 1/4/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Water
PIPE DIAMETER: 6"
ROD READING ON MARK: 6'1"
ROD READING ON TOP
UTILITY PIPE: 7'8½"



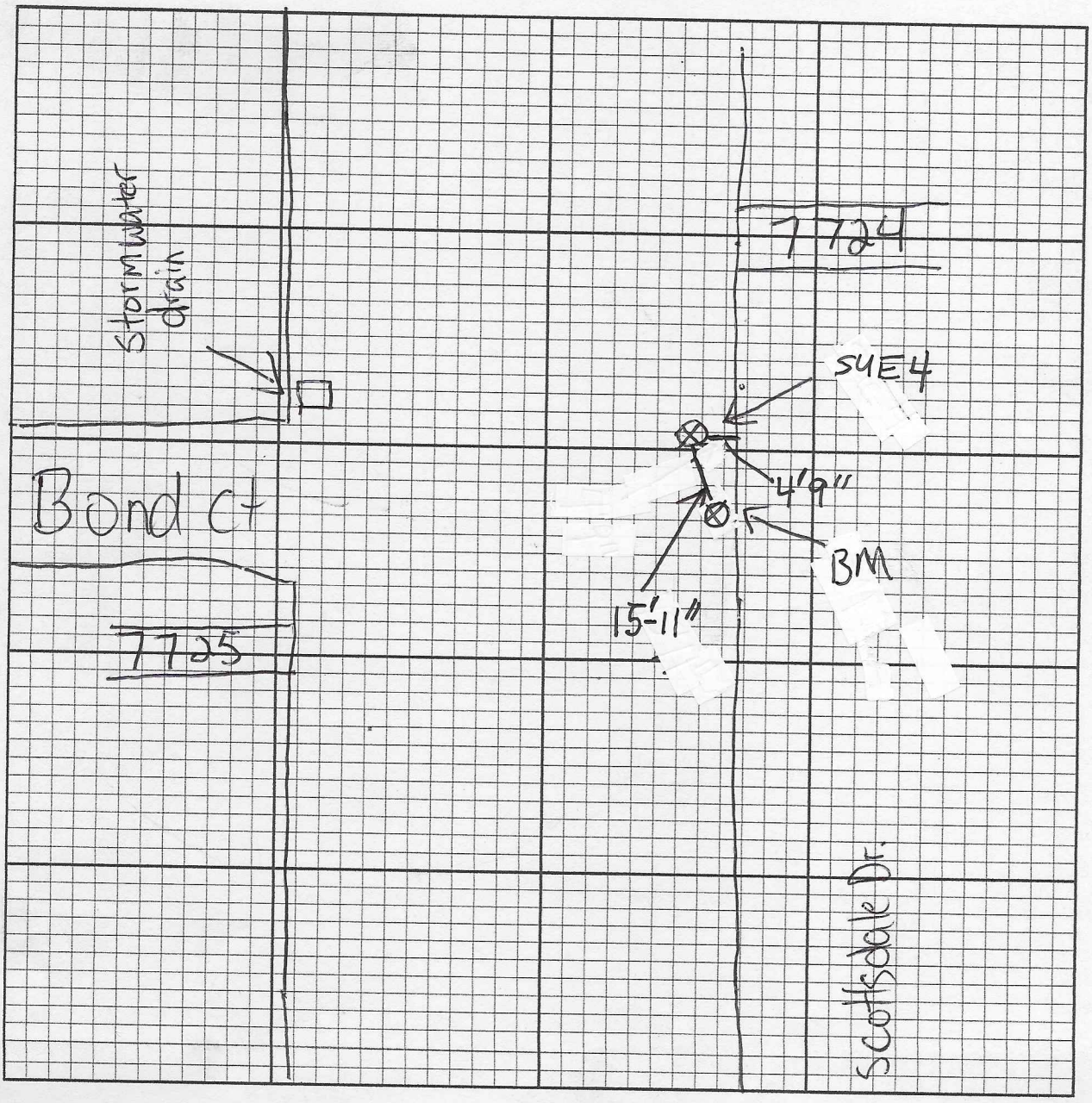
15'3" 37'3"

SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 4
PROJECT NAME: Area 24 C
PREPARED BY: JGH II INC
DATE: _____ TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Water
PIPE DIAMETER: 2" PVC
ROD READING ON MARK: 4'9"
ROD READING ON TOP
UTILITY PIPE: 7'8" 1/4

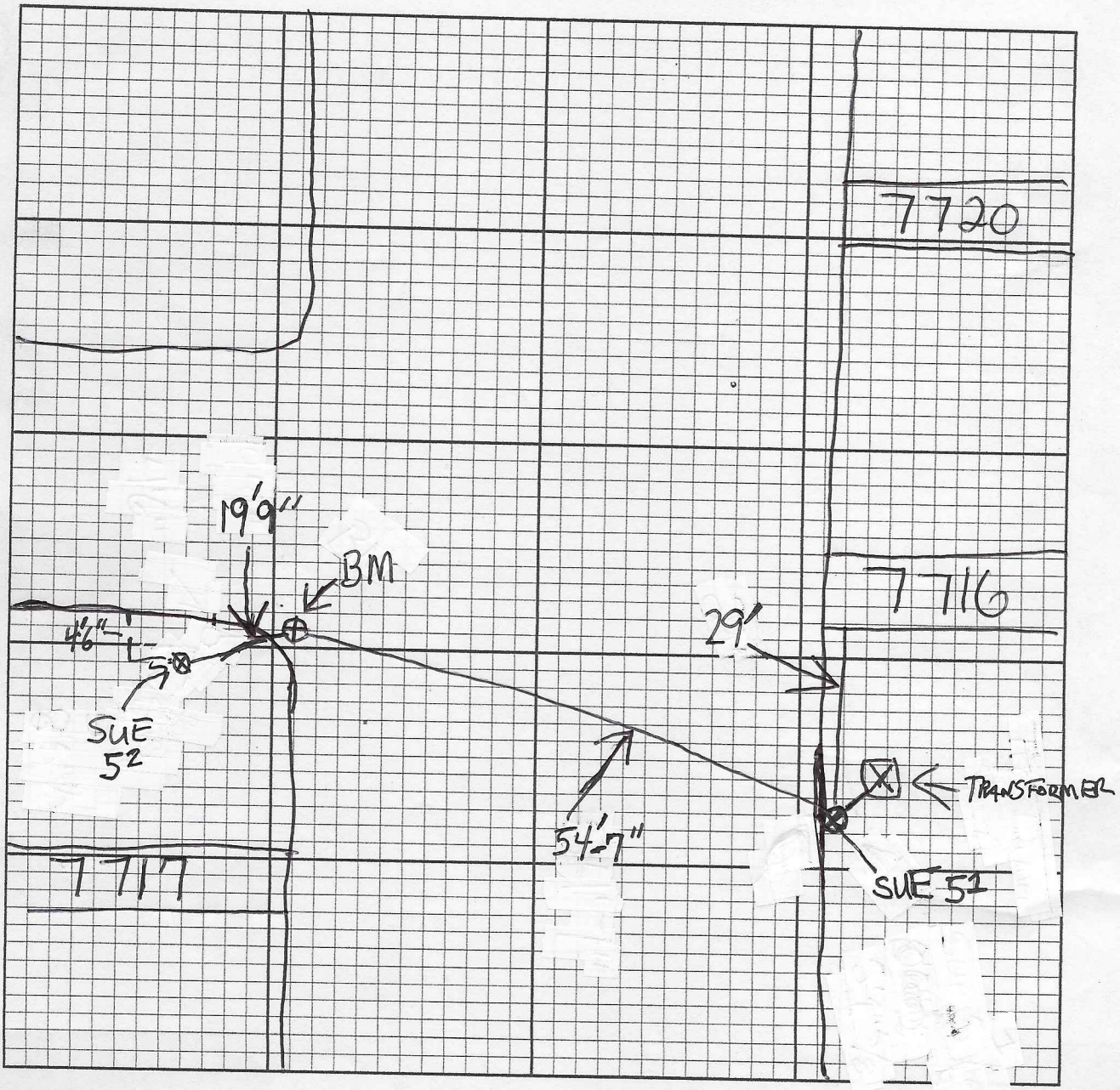


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 5
PROJECT NAME: Area 24C
PREPARED BY: JGH II INC
DATE: 3/13/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Cable
PIPE DIAMETER: _____
ROD READING ON MARK: 5'10½
ROD READING ON TOP
UTILITY PIPE: SUE 5¹ 5'-1⅝" 8'5"½-(SUE 5²)

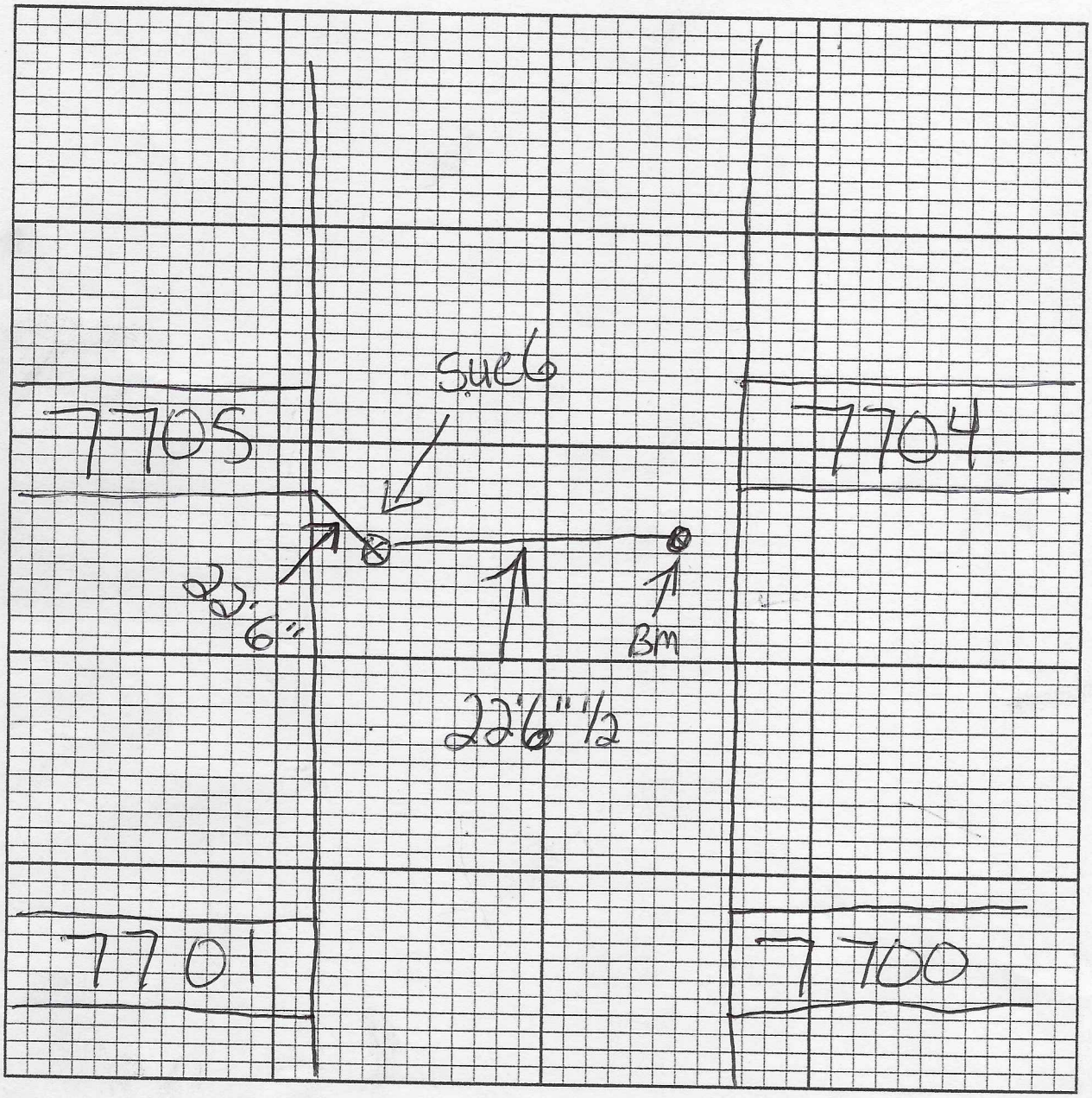


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 6
PROJECT NAME: Area 24 C
PREPARED BY: JGH II INC
DATE: 3/18/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Electric
PIPE DIAMETER: 3"
ROD READING ON MARK: 4'7"5/8
ROD READING ON TOP
UTILITY PIPE: 10'7"1/4



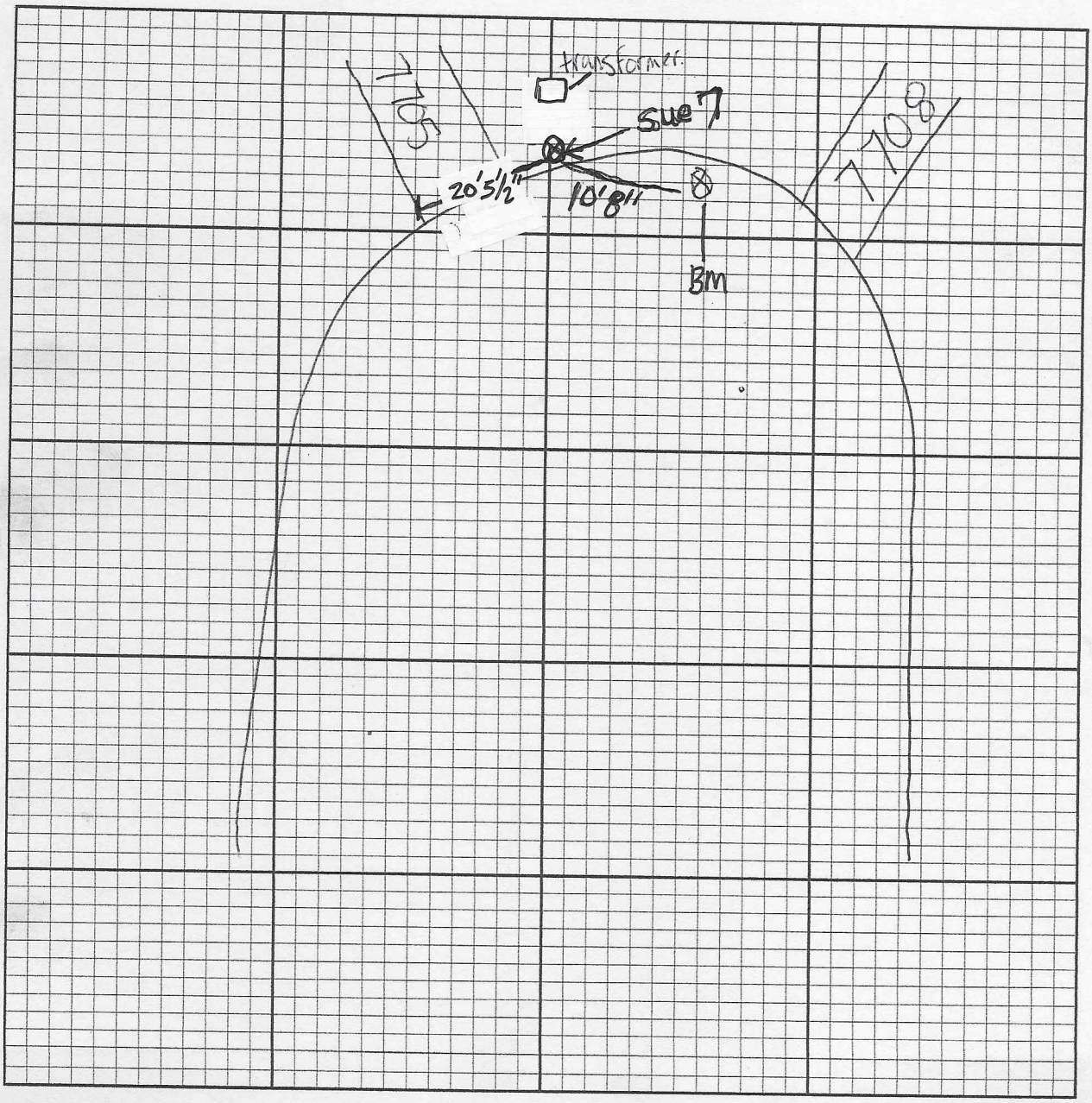
0

SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 7
PROJECT NAME: Area 24 Area C
PREPARED BY: JGH II INC
DATE: 1/24/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Electric
PIPE DIAMETER: _____
ROD READING ON MARK: 5'1"
ROD READING ON TOP
UTILITY PIPE: 8'5 5/8"

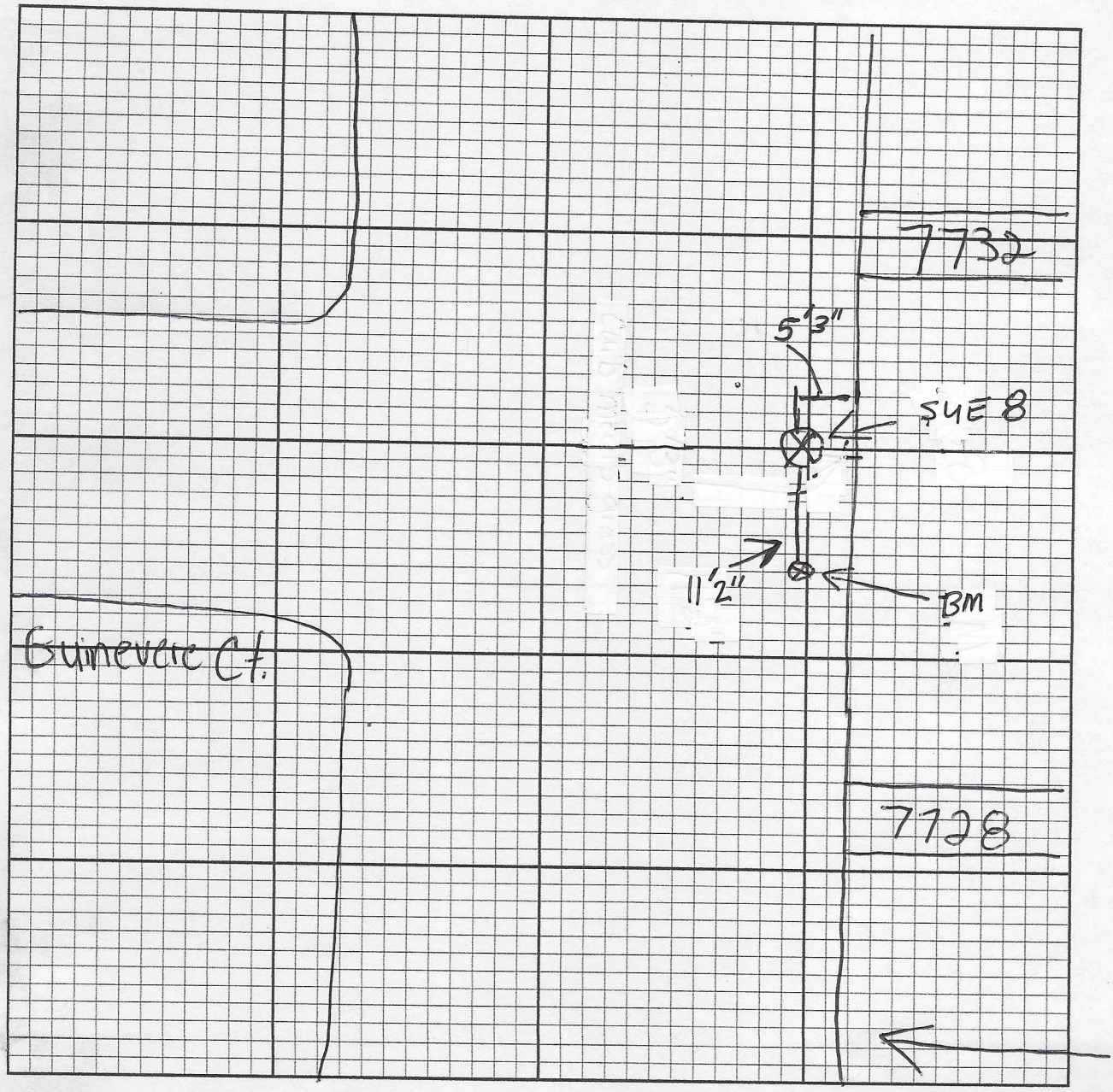


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 8
PROJECT NAME: Area 24C
PREPARED BY: JGH II INC
DATE: 3/12/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Water
PIPE DIAMETER: 2" PVC
ROD READING ON MARK: 5'5" 3/4
ROD READING ON TOP
UTILITY PIPE: 8'1" 1/2

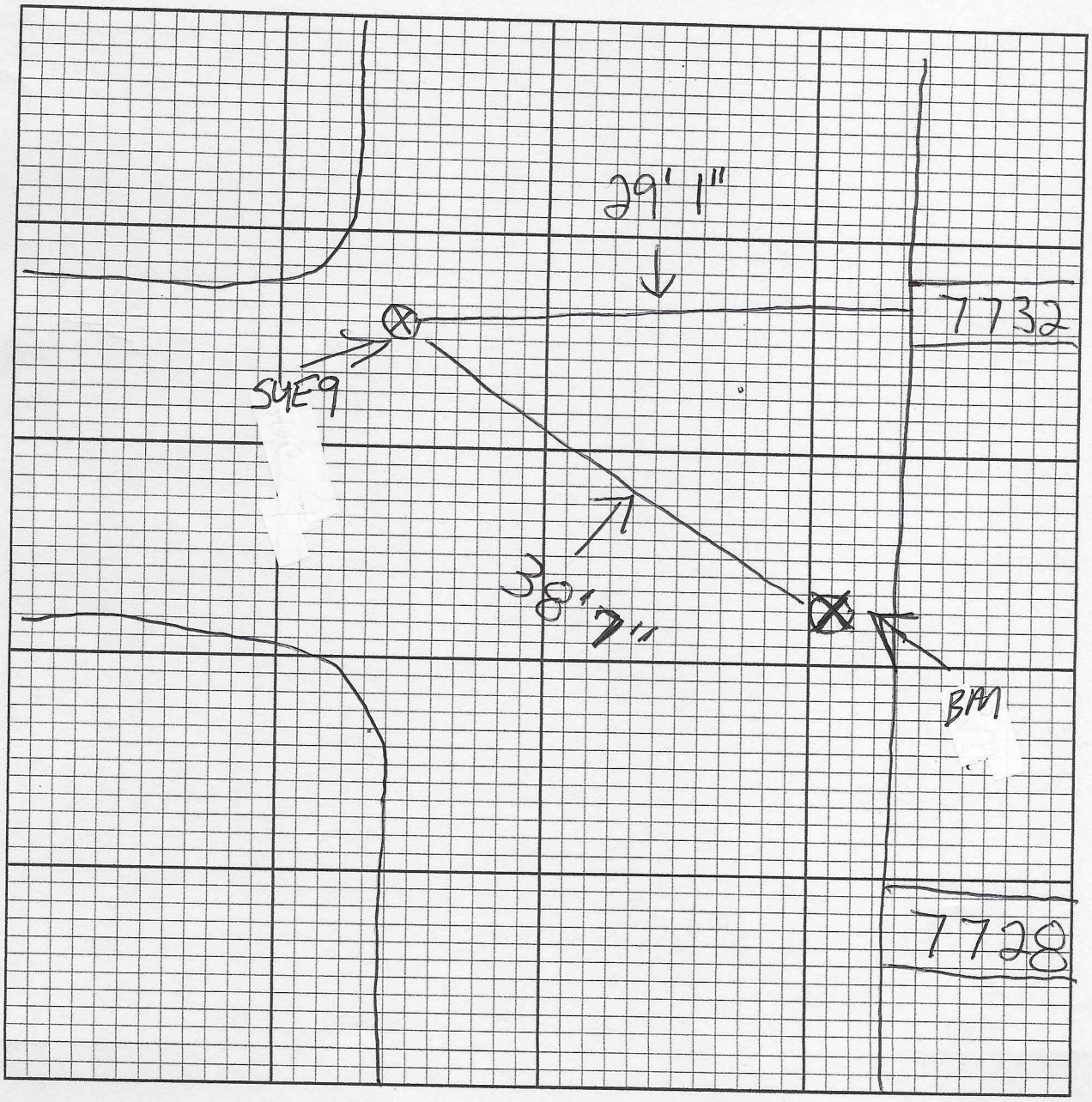


SUE DATA WORKSHEET

JGH II INC.
3334 Beard Road
Eastover, NC 28312
910-237-3523

SUE-BORE # 9
PROJECT NAME: Area 24C
PREPARED BY: JGH II INC
DATE: 3/12/20 TECH INITIALS: _____
CHEKCED BY: _____ PAGE ___ OF ___

UTILITY TYPE: Electric
PIPE DIAMETER: 2"
ROD READING ON MARK: 5'9"
ROD READING ON TOP
UTILITY PIPE: 11' 1/4"



APPENDIX H-VARIOUS CONSTRUCTION RELATED FORMS

PUBLIC WORKS COMMISSION
OF THE CITY OF FAYETTEVILLE, NC

INDEMNIFICATION AGREEMENT

I, _____, Resident/Owner of _____ (Address) agree to release and hold harmless _____ (Contractor), the Public Works Commission (PWC) of the City of Fayetteville, NC, the City of Fayetteville and _____ (Engineering Firm) including all officials, agents, and employees of these agencies from and against any and all liability, loss, damages (including indirect/consequential), fines, costs, claims, damages to existing property of whatever type and nature as a result of water or sewer main installation construction during the Phase V Annexation _____ Project.

The Contractor _____ (Contractor) has successfully addressed my concerns regarding:

_____

_____

_____

I, _____, (Resident/Owner) further understand by signing this document pertaining to the concerns listed above that any future claims involving/stemming from this issue will not be reviewed. The following resolution has met my expectations and I am satisfied with the results:

_____

_____

_____

_____ _____
Resident/Property Owner Date

_____ _____
Contractor Representative Date

_____ _____
Project Coordinator Date

Lateral Relocation Release Form

Project: _____

Contractor: _____

I, _____ property owner of _____

(address), requested my proposed sewer/water lateral location be relocated from sta.

_____ to sta. _____. I _____ release and hold harmless,

_____ (contractor), The City of Fayetteville, the Public Works Commission,

and _____ (engineering firm) any and all liability stemming from the above

agreement.

_____ _____

Property Owner Date

_____ _____

Contractor Representative Date

_____ _____

Project Coordinator Date

WELL ABANDONMENT RECORD

For Internal Use ONLY:

1. Well Contractor Information:

Well Contractor Name (or well owner personally abandoning well on his/her property)

NC Well Contractor Certification Number

Company Name

2. Well Construction Permit #: _____
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.) if known

3. Well use (check well use):

Water Supply Well:	
☐Agricultural	☐Municipal/Public
☐Geothermal (Heating/Cooling Supply)	☐Residential Water Supply (single)
☐Industrial/Commercial	☐Residential Water Supply (shared)
☐Irrigation	
Non-Water Supply Well:	
☐Monitoring	☐Recovery
Injection Well:	
☐Aquifer Recharge	☐Groundwater Remediation
☐Aquifer Storage and Recovery	☐Salinity Barrier
☐Aquifer Test	☐Stormwater Drainage
☐Experimental Technology	☐Subsidence Control
☐Geothermal (Closed Loop)	☐Tracer
☐Geothermal (Heating/Cooling Return)	☐Other (explain under 7g)

4. Date well(s) abandoned: _____

5a. Well location:

Facility/Owner Name

Facility ID# (if applicable)

Physical Address, City, and Zip

County

Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

_____ **N** _____ **W**

CONSTRUCTION DETAILS OF WELL(S) BEING ABANDONED
*Attach well construction record(s) if available. For multiple injection or non-water supply wells **ONLY** with the same construction/abandonment, you can submit one form.*

6a. Well ID#: _____

6b. Total well depth: _____**(ft.)**

6c. Borehole diameter: _____**(in.)**

6d. Water level below ground surface: _____**(ft.)**

6e. Outer casing length (if known): _____**(ft.)**

6f. Inner casing/tubing length (if known): _____**(ft.)**

6g. Screen length (if known): _____**(ft.)**

WELL ABANDONMENT DETAILS

7a. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same well construction/depth, only 1 GW-30 is needed. Indicate TOTAL NUMBER of wells abandoned: _____

7b. Approximate volume of water remaining in well(s): _____**(gal.)**

FOR WATER SUPPLY WELLS ONLY:

7c. Type of disinfectant used: _____

7d. Amount of disinfectant used: _____

7e. Sealing materials used (check all that apply):

☐ Neat Cement Grout	☐ Bentonite Chips or Pellets
☐ Sand Cement Grout	☐ Dry Clay
☐ Concrete Grout	☐ Drill Cuttings
☐ Specialty Grout	☐ Gravel
☐ Bentonite Slurry	☐ Other (explain under 7g)

7f. For each material selected above, provide amount of materials used:

_____ _____

_____ _____

7g. Provide a brief description of the abandonment procedure:

_____

_____

_____

_____

8. Certification:

Signature of Certified Well Contractor or Well Owner

Date

By signing this form, I hereby certify that the well(s) was (were) abandoned in accordance with 15A NCAC 02C .0100 or 2C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

9. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well abandonment details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

10a. For All Wells: Submit this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

10b. For Injection Wells: In addition to sending the form to the address in 10a above, also submit one copy of this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

10c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well abandonment to the county health department of the county where abandoned.

APPENDIX I-EXISTING CONDITIONS
STRUCTURAL SURVEYS

CITY OF FAYETTEVILLE ANNEXATION PHASE V AREA 24

PARTS B & C

FAYETTEVILLE, NORTH CAROLINA

GENERAL STRUCTURAL SURVEY OF EXISTING RESIDENCES

For

W. K. Dickson & Co., Inc.

Performed by

FLEMING & ASSOCIATES, PA
1004 Hay Street
Fayetteville, North Carolina 28305
(910) 433-2825
Our Job No. 19-63

Submitted

February 27, 2020

TABLE OF CONTENTS

SUMMARY

Fleming & Associates, PA was retained by W. K. Dickson & Co., Inc. to perform a limited visual structural inspection of foundation walls and exteriors of structures potentially affected by the **City of Fayetteville Annexation Phase V Area 24 Annexation Parts B and C**. The structures inspected were determined by W. K. Dickson & Co., Inc.

The inspections were conducted on February 10, 2020 and February 17, 2020. A total of sixteen (16) structures were inspected. Fleming & Associates, PA visually inspected the exterior elevation facing the future utility easements and noted pre-existing deficiencies. The deficiencies are documented in the following report.

Should any further inspections or assistance be required, please let us know.

Submitted by:

Stephen Fleming, PE

ADDRESS:
605 Bangor Ct.
Fayetteville, NC 28314

DATE OBSERVED:
February 10, 2020

Photo 1
Area of residence observed – front elevation

Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation

ADDRESS:
605 Bangor Ct.
Fayetteville, NC 28314

DATE OBSERVED:
February 10, 2020

Photo 5
Cracks in concrete driveway

Photo 6
Cracks in concrete driveway

Photo 7
Vertical crack

Photo 8
Horizontal crack

ADDRESS:
605 Bangor Ct.
Fayetteville, NC 28314

DATE OBSERVED:
February 10, 2020

Photo 9
Broken window

Photo 1
Area of residence observed – front elevation

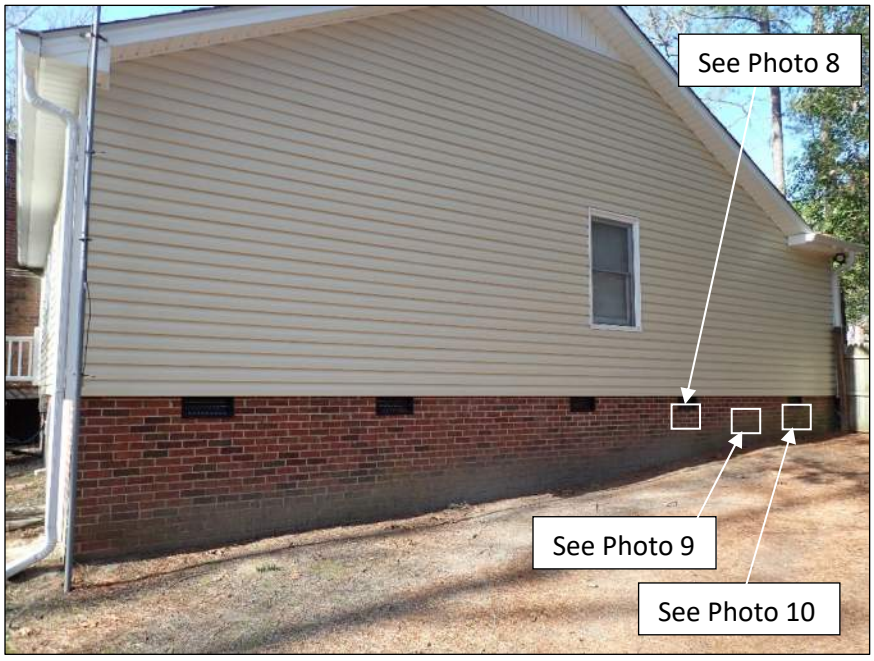


Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation

Photo 5
Cracks in concrete driveway

Photo 6
Cracks in concrete driveway

Photo 7
Crack in crawl space vent wells (typical)

Photo 8
Step crack

Photo 9
Step crack

Photo 10
Step crack

Photo 11
Step crack

Photo 1
Area of residence observed – front elevation

Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation (partial)

Photo 5
Area of residence observed – side elevation (partial)

Photo 6
Cracks in concrete driveway

Photo 7
Cracks in concrete driveway

Photo 8
Horizontal crack

Photo 9
Damaged overhead garage door

Photo 10
Step crack

Photo 11
Vertical crack

Photo 12
Horizontal crack

ADDRESS:
6940 Bostick Dr.
Fayetteville, NC 28314

DATE OBSERVED:
February 10, 2020

Photo 13
Horizontal crack

Photo 1
Area of residence observed – front elevation

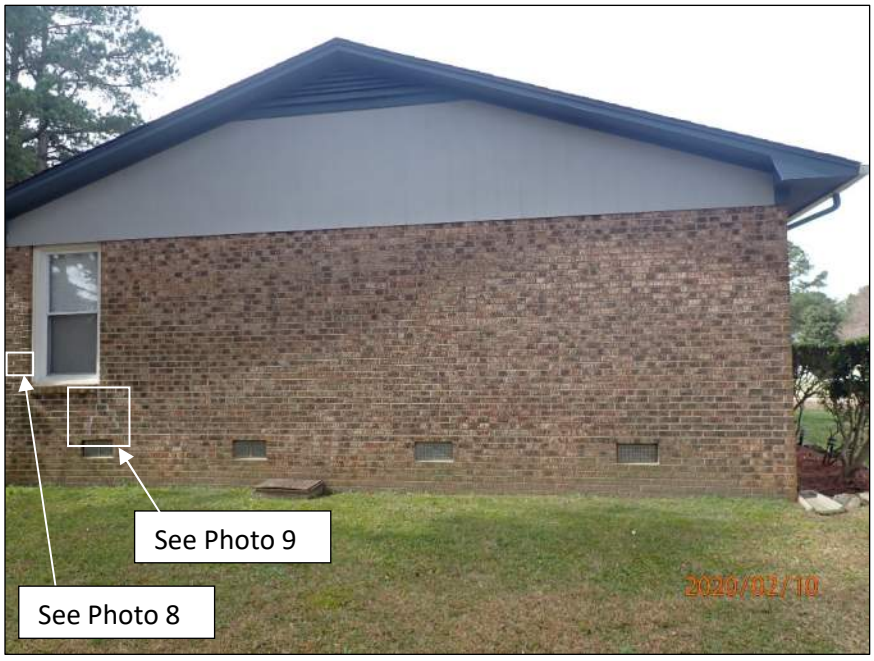


Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation

Photo 5
Cracks in concrete driveway

Photo 6
Cracks in concrete driveway

Photo 7
Horizontal crack

Photo 8
Horizontal crack

Photo 9
Previously repaired step crack

Photo 10
Vertical crack

Photo 11
Step crack

ADDRESS:
6970 Bostick Dr.
Fayetteville, NC 28314

DATE OBSERVED:
February 10, 2020

Photo 1
Area of structure observed

Photo 2
Area of structure observed

Photo 3
Area of structure observed

Photo 4
Area of structure observed

ADDRESS:
6970 Bostick Dr.
Fayetteville, NC 28314

DATE OBSERVED:
February 10, 2020

Photo 5
Broken window

Photo 1
Area of residence observed – front elevation

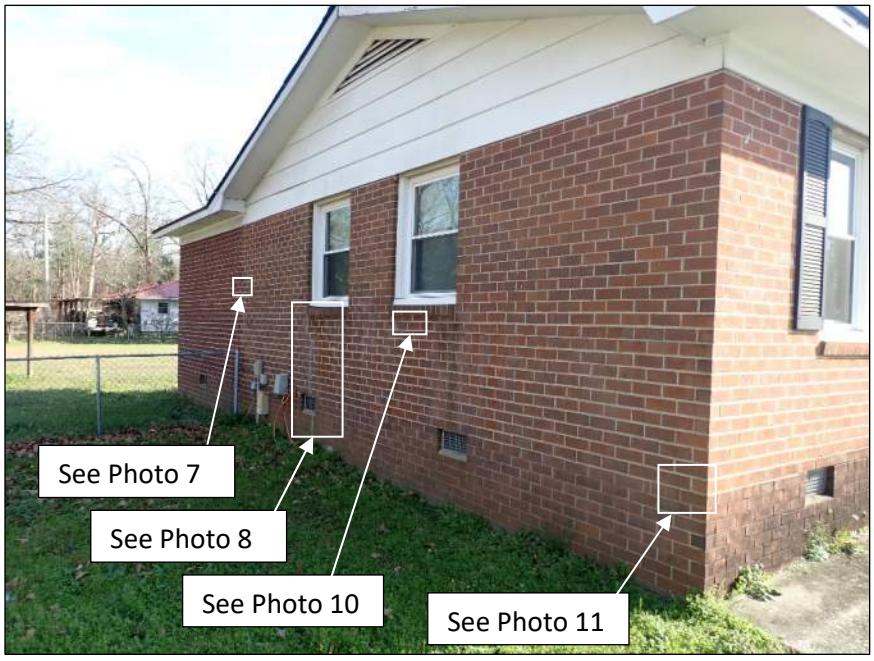


Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation

Photo 5
Cracks in driveway

Photo 6
Cracks in concrete slab

Photo 7
Individual cracked brick

Photo 8
Previously repaired step crack

Photo 9
Step crack

Photo 10
Step crack

Photo 11
Step crack

Photo 12
Step crack

Photo 13
Separation crack

Photo 14
Previously repaired step crack

Photo 15
Separation crack

Photo 1
Area of residence observed – front elevation

Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation

Photo 1
Area of residence observed – front elevation

Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Undermined slab on grade

Photo 5
Undermined foundation

Photo 1
Area of residence observed – front elevation

Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation

Photo 5
Cracks in concrete driveway

Photo 6
Cracks in concrete driveway

Photo 7
Vertical crack

Photo 8
Separation crack

Photo 9
Chimney leaning outward

Photo 10
Vertical crack

ADDRESS:
1138 Paddington Pl.
Fayetteville, NC 28314

DATE OBSERVED:
February 17, 2020

Photo 11
Vertical crack

Photo 1
Area of residence observed – front elevation

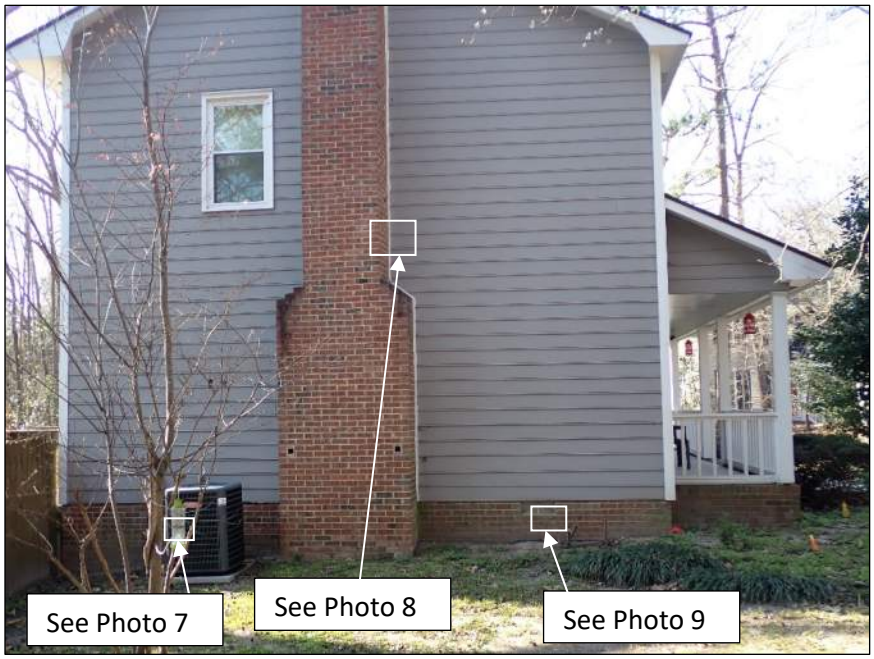


Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation (observed from outside fence)

Photo 4
Area of residence observed – side elevation

Photo 5
Cracks in concrete driveway

Photo 6
Cracks in concrete driveway

Photo 7
Vertical crack

Photo 8
Chimney leaning outward

Photo 9
Step crack

Photo 10
Cracks in concrete slab

Photo 11
Vertical crack

Photo 12
Vertical crack

ADDRESS:
7721 Scottsdale Dr.
Fayetteville, NC 28314

DATE OBSERVED:
February 17, 2020
Pool only

Photo 1
Area of pool observed

Photo 2
Area of pool observed

Photo 3
Area of pool observed

Photo 4
Cracks in concrete slab

ADDRESS:
7721 Scottsdale Dr.
Fayetteville, NC 28314

DATE OBSERVED:
February 17, 2020

Photo 5
Previously repaired cracks in concrete slab

Photo 1
Area of residence observed – front elevation

Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation

Photo 5
Cracks in concrete driveway

Photo 6
Cracks in concrete driveway

Photo 7
Vertical crack

Photo 8
Chimney leaning outward

Photo 9
Vertical crack

Photo 10
Vertical crack

Photo 11
Vertical crack

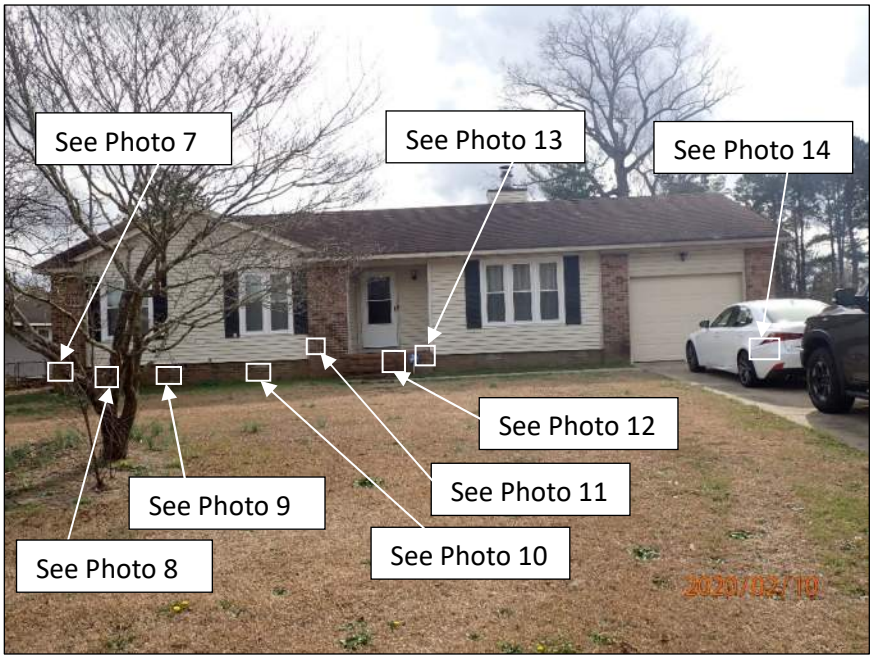


Photo 1
Area of residence observed – front elevation

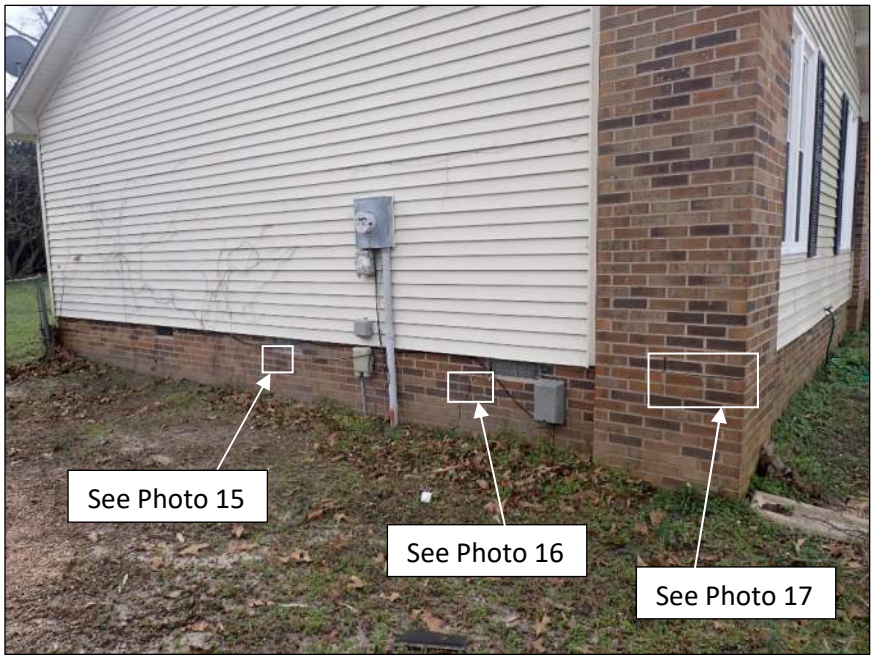


Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation

ADDRESS:
6705 Seaford Dr.
Fayetteville, NC 28314

DATE OBSERVED:
February 10, 2020

Photo 5
Cracks in concrete driveway

Photo 6
Cracks in concrete driveway

Photo 7
Horizontal crack

Photo 8
Step crack

Photo 9
Vertical crack

Photo 10
Vertical crack

Photo 11
Horizontal crack

Photo 12
Separation crack

Photo 13
Separation crack

Photo 14
Horizontal crack

Photo 15
Step crack

Photo 16
Step crack

Photo 17
Horizontal crack

Photo 18
Cracks in concrete slab

Photo 19
Horizontal crack

Photo 20
Hole in vinyl siding (typical)

Photo 1
Area of residence observed – front elevation

Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation

Photo 5
Cracks in concrete driveway

Photo 6
Cracks in concrete driveway

Photo 7
Previously repaired vertical crack

Photo 8
Vertical crack

Photo 9
Horizontal crack

Photo 10
Vertical crack

Photo 11
Vertical crack

Photo 12
Horizontal crack (typical this elevation)

Photo 13
Horizontal crack

Photo 14
Vertical crack

Photo 1
Area of residence observed – front elevation

Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation

Photo 5
Cracks in concrete driveway

Photo 6
Cracks in concrete driveway

Photo 7
Separation crack

Photo 8
Horizontal crack

Photo 9
Horizontal crack

Photo 10
Step crack

Photo 11
Horizontal crack

Photo 12
Missing siding

Photo 13
Vertical crack

Photo 14
Vertical crack

Photo 15
Horizontal crack

Photo 16
Cracks in concrete slab

Photo 1
Area of residence observed – front elevation

Photo 2
Area of residence observed – side elevation

Photo 3
Area of residence observed – rear elevation

Photo 4
Area of residence observed – side elevation

Photo 5
Cracks in concrete driveway

Photo 6
Cracks in concrete driveway

Photo 7
Previously repaired vertical crack

Photo 8
Horizontal crack

Photo 9
Horizontal crack

Photo 10
Displaced crawl space vents (typical)

APPENDIX J-US Army Corps of Engineers Nationwide Permit

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2020-00562** County: **Cumberland** U.S.G.S. Quad: **NC-Clifdale**

GENERAL PERMIT (REGIONAL AND NATIONWIDE) VERIFICATION

Permittee: **City of Fayetteville Public Works Commission**
Misty Manning
Address: **955 Old Wilmington Road**
Fayetteville, NC 28301
Telephone Number: **910.223.4736**
E-mail: **misty.manning@faypwc.com**

Size (acres) **2.9**
Nearest Waterway **Bones Creek**
USGS HUC **03030004**
Nearest Town **Fayetteville**
River Basin **Cape Fear**
Coordinates Latitude: **35.052987**
Longitude: **-79.069524**

Location description: **The utility lines are located in Fayetteville, Cumberland County, NC. Specifically, the northern utility line is located east of Hoke Loop Road, west of Cliffdale Road, south of Christina Street, and north of Butterwood Circle beginning at approximate latitude 35.053279N and longitude -79.070180W and ending at approximate 35.052713N latitude and longitude -79.069442W. The southern line is located east of Adolphus Drive, west of Cliffdate Road, north of Loxley Drive, and south of Scottsdale Drive beginning at approximate latitude 35.043223N and longitude -79.06861W and ending at approximate latitude 35.041063N and longitude -79.064871W.**

Description of projects area and activity: **This verification authorizes the permanent conversion of 0.10-acre of wetland and temporary impacts to 0.08-acre of wetland and 147 linear feet of stream for the purpose of installing a utility line.**

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

Authorization: **NWP 12. Utility Line Activities**

SEE ATTACHED NWP GENERAL, REGIONAL, AND/OR SPECIAL CONDITIONS

Your work is authorized by the above referenced permit provided it is accomplished in strict accordance with the enclosed Conditions, your application signed and dated 2/18/2020, and the enclosed plans Sheets C8-G8 and Figures 2-5 dated 4/1/2019 and 2/18/2020, respectively. 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 910.251.4567or emily.c.greer@usace.army.mil**.

Corps Regulatory Official: GREER.EMILY.C.1385325300 Digitally signed by GREER.EMILY.C.1385325300 Date: 2020.04.14 23:09:25 -04'00' Date: **04/14/2020**

Expiration Date of Verification: **03/18/2022**

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 the Customer Satisfaction Survey located at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0

Copy furnished:

Agent: **George K Lankford, LLC**
George Lankford
E-mail: **gklankford91@gmail.com**

CERTIFICATE OF COMPLETION

Action ID Number: SAW-2020-00562 County: Cumberland

Permittee: City of Fayetteville Public Works Commission, Misty Manning

Project Name: Fayetteville Annex Area 24-New Sewer Connection

Date Verification Issued: 04/14/2020

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
Wilmington Regulatory Office
U.S Army Corps of Engineers
69 Darlington Avenue
Wilmington, North Carolina 28403
or
emily.c.greer@usace.army.mil

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**

WK DICKSON
community infrastructure consultants

N
W E
S

Figure 2: Project Overview
Fayetteville Public Works Commission
Annexation Phase V, Area 24

2/18/2020

0 400 800 1,600 Feet
1 inch = 800 feet

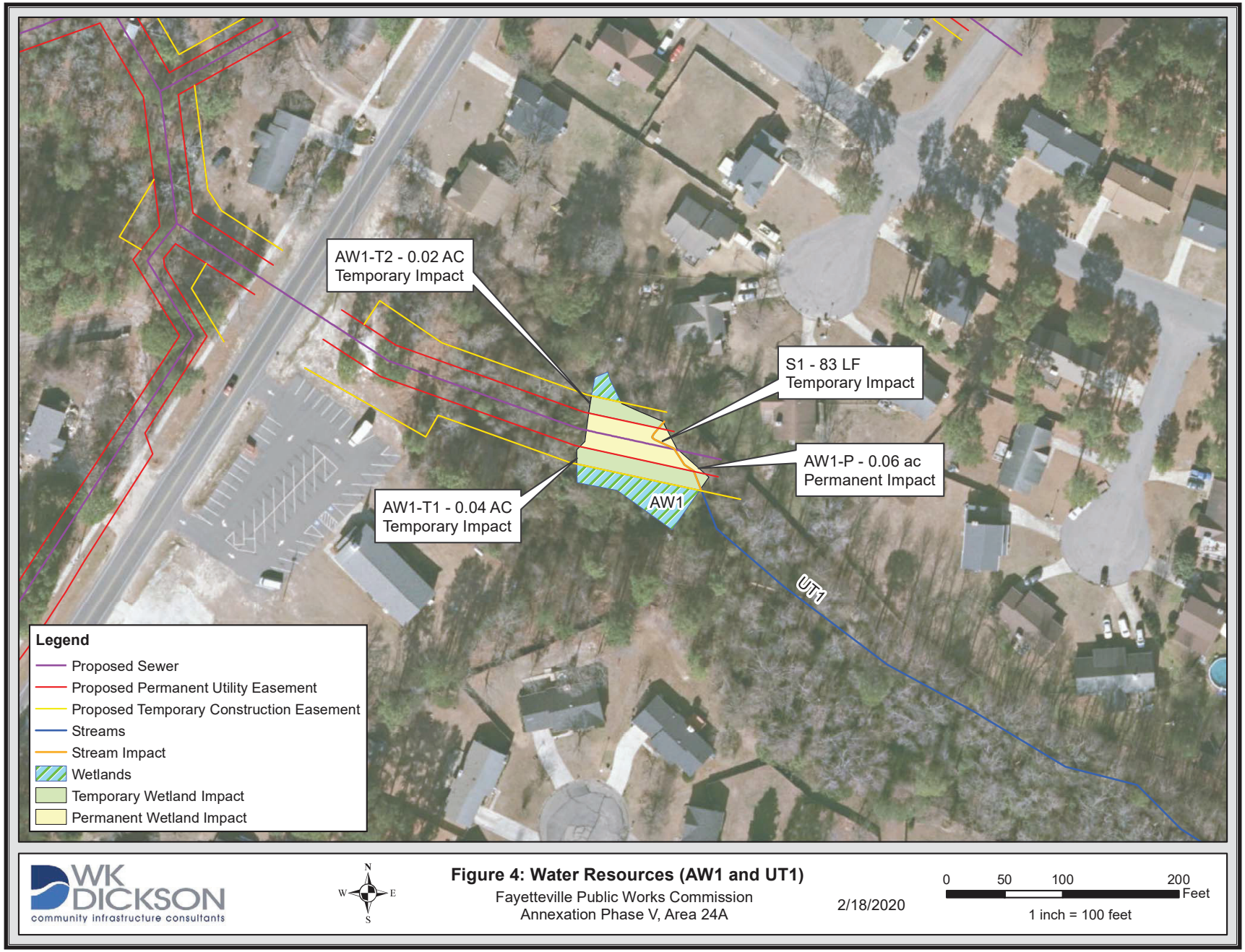


Figure 4: Water Resources (AW1 and UT1)

Fayetteville Public Works Commission
Annexation Phase V, Area 24A

2/18/2020

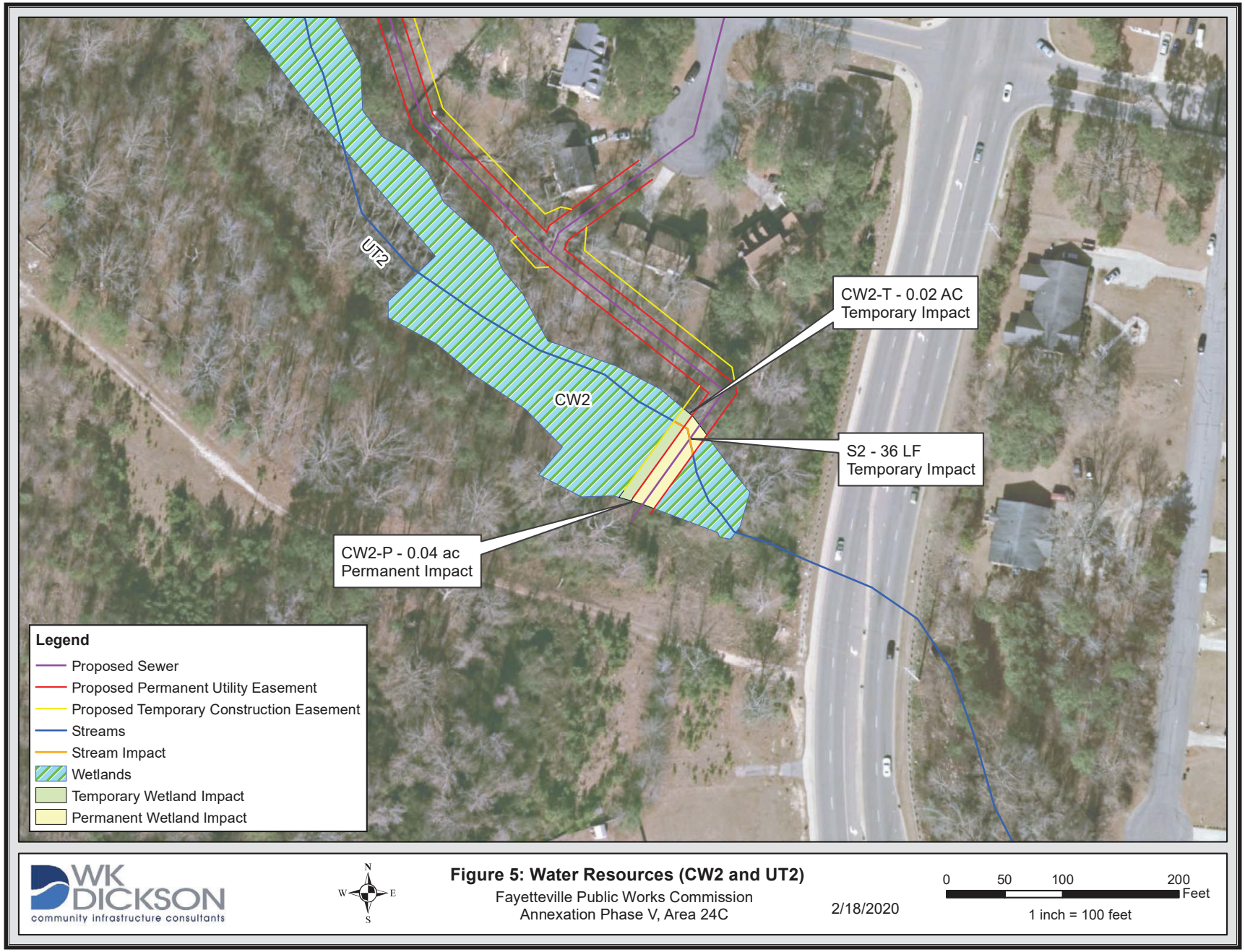
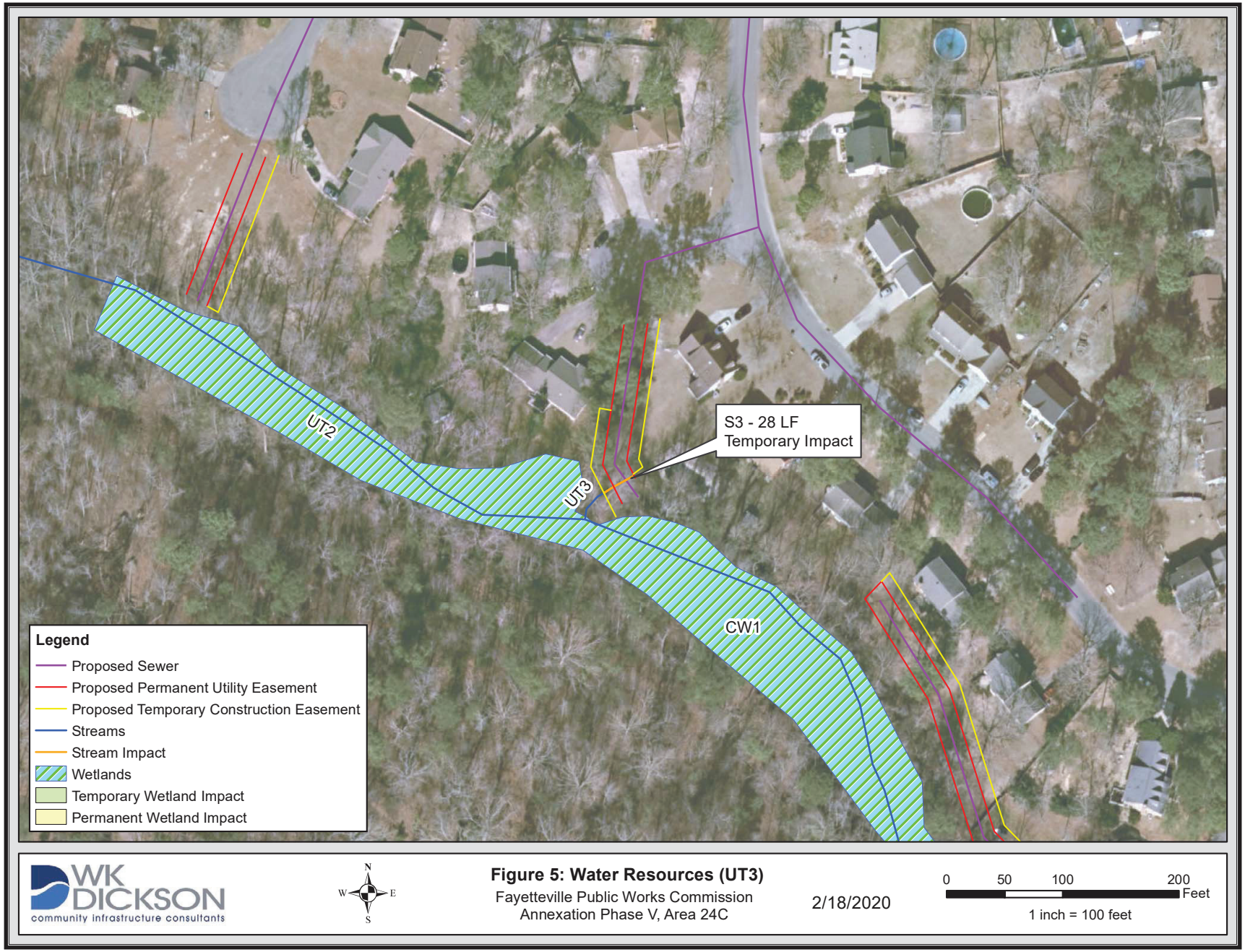


Figure 5: Water Resources (CW2 and UT2)

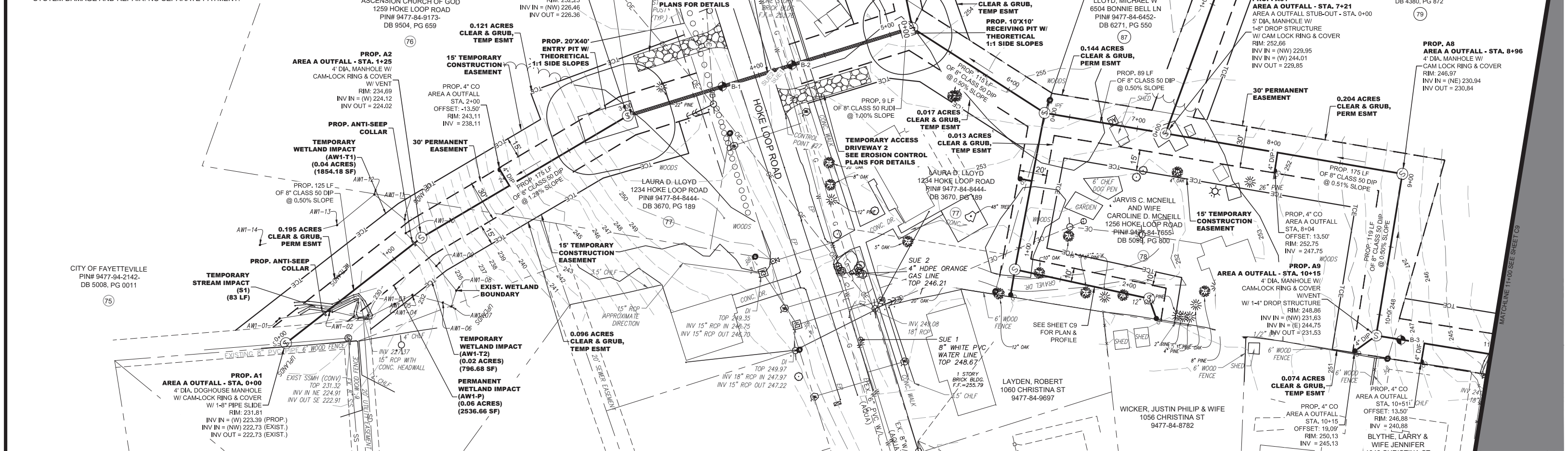
Fayetteville Public Works Commission
Annexation Phase V, Area 24C

2/18/2020


S3 - 28 LF
Temporary Impact
UT2
UT3
CW1
Legend
Proposed Sewer
Proposed Permanent Utility Easement
Proposed Temporary Construction Easement
Streams
Stream Impact
Wetlands
Temporary Wetland Impact
Permanent Wetland Impact
WK DICKSON
community infrastructure consultants
N
W
E
S
Figure 5: Water Resources (UT3)
Fayetteville Public Works Commission
Annexation Phase V, Area 24C
2/18/2020
0
50
100
200
Feet
1 inch = 100 feet

SEPTIC TANK NOTE:

1. CONTRACTOR SHALL REPAIR ANY DAMAGE TO SEPTIC TANK AND/OR DRAIN FIELD, TO EXISTING OR BETTER CONDITION IN ACCORDANCE WITH ALL LOCAL AND STATE REGULATIONS, IMMEDIATELY UPON OCCURRENCE OF DAMAGE DURING CONSTRUCTION OF SEWER IMPROVEMENTS. CONTRACTOR SHALL PUMP AND HAUL SEPTIC CONTENTS AS NECESSARY DURING THE INTERIM BETWEEN SEPTIC SYSTEM DAMAGE AND REPAIR. NO SEPARATE PAYMENT.



LEGEND

PROP. EASEMENT	PROP. TEMPORARY CONSTRUCTION EASEMENT	WATER METER	
PROP. SEWER, CLEAN OUT & MANHOLE	PROP. SAFETY FENCE	IRRIGATION VALVE	
PROP. STORM DRAINAGE	SOIL BORING LOCATION SEE GEOTECHNICAL REPORT	ELECTRIC TRANSFORMER	
PROP. WATER LINE & METER	PROP. REVERSE PLUMBING	TELEPHONE PEDESTAL	
SANITARY SEWER LINE & MANHOLE	PROP. BACKWATER VALVE	TELEVISION PEDISTAL	
WATER LINE & VALVE	PROP. GRINDER PUMP	DRAINAGE MANHOLE	
UNDERGROUND GAS (APPROX. LOCATION)	APPROX EXIST SEPTIC TANK	FIRE HYDRANT	
COMMUNICATION LINE (APPROX. LOCATION)	ELECTRIC PEDESTAL	MAILBOX	
UNDERGROUND ELECTRIC	CONCRETE MONUMENT	LIGHT POLE	POST
UNDERGROUND TELEPHONE	IRON PIPE FOUND	DROP INLET	LAMP
UNDERGROUND FIBER OPTIC LINE		FINISH FLOOR	BUSH
UNDERGROUND TELEVISION CABLE LINE		INVERT	SIGN

GENERAL NOTE:

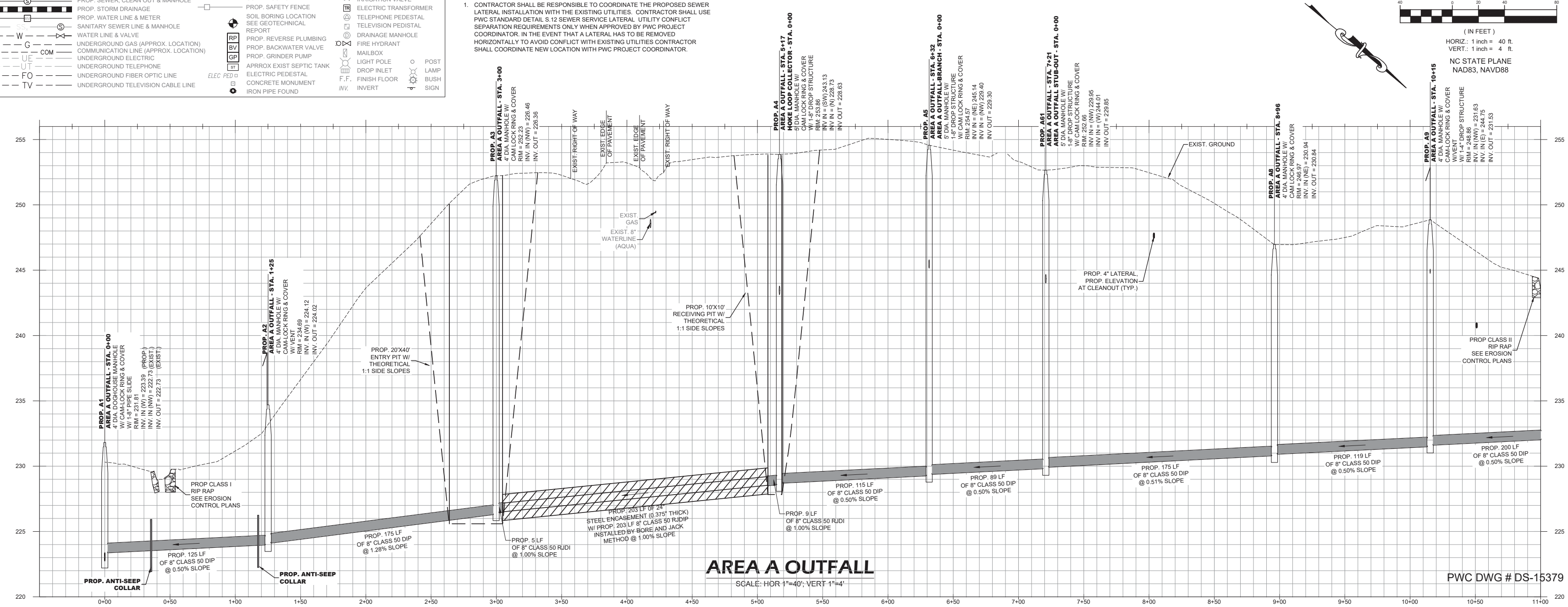
1. CONTRACTOR SHALL BE RESPONSIBLE TO COORDINATE THE PROPOSED SEWER LATERAL INSTALLATION WITH THE EXISTING UTILITIES. CONTRACTOR SHALL USE PWC STANDARD DETAIL S.12 SEWER SERVICE LATERAL UTILITY CONFLICT SEPARATION REQUIREMENTS ONLY WHEN APPROVED BY PWC PROJECT COORDINATOR. IN THE EVENT THAT A LATERAL HAS TO BE REMOVED HORIZONTALLY TO AVOID CONFLICT WITH EXISTING UTILITIES CONTRACTOR SHALL COORDINATE NEW LOCATION WITH PWC PROJECT COORDINATOR.

GRAPHIC SCALE

(IN FEET)

HORIZ.: 1 inch = 40 ft.
VERT.: 1 inch = 4 ft.

NC STATE PLANE NAD83, NAVD88



AREA A OUTFALL

SCALE: HOR 1"=40'; VERT 1"=4'

PWC DWG # DS-15379

SHEET SERIES-FINAL DESIGN FOR REVIEW

DATE: 4/11/2019
SURVEY/GPS BY: STEWART
DRAWN BY: AMH/HP
CHECKED BY: DKP
SCALE: HOR 1"=40' VERT 1"=4'

WK DICKSON
720 Corporate Center Drive Raleigh, North Carolina 27607

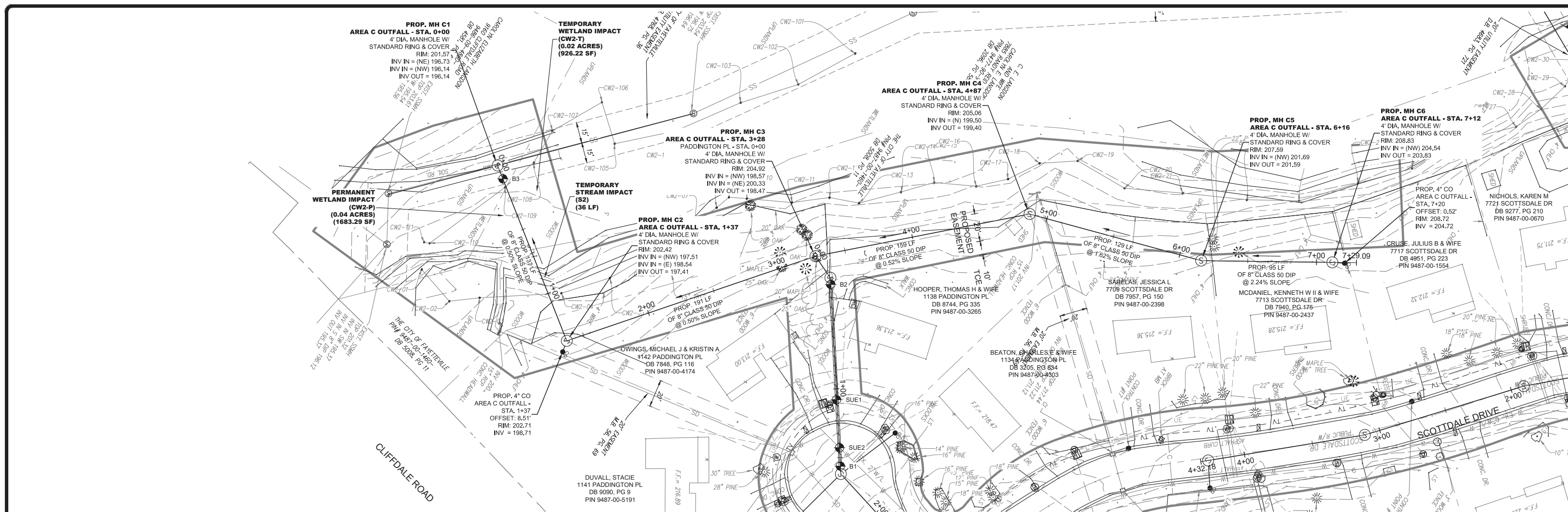
SHEET # C8

SEAL 29430 DANIEL K. PEPIN

AREA A OUTFALL
ANNEXATION PHASE V, AREA 24
FAYETTEVILLE, NORTH CAROLINA

PUBLIC WORKS COMMISSION OF THE CITY OF FAYETTEVILLE
WATER RESOURCES ENGINEERING
P.O. Box 1089, Fayetteville, NC 28302
955 Old Wilmington Road, Fayetteville, NC 28301

20190126.00.RA



LEGEND

PROP. EASEMENT	PROP. TEMPORARY CONSTRUCTION EASEMENT	WATER METER
PROP. SEWER, CLEAN OUT & MANHOLE	PROP. SAFETY FENCE	IRRIGATION VALVE
PROP. STORM DRAINAGE	SOIL BORING LOCATION SEE GEOTECHNICAL REPORT	ELECTRIC TRANSFORMER
PROP. WATER LINE & METER	RP PROP. REVERSE PLUMBING	TELEPHONE PEDESTAL
SANITARY SEWER LINE & MANHOLE	BV PROP. BACKWATER VALVE	TELEVISION PEDISTAL
WATER LINE & VALVE	GP PROP. GRINDER PUMP	DRAINAGE MANHOLE
UNDERGROUND GAS (APPROX. LOCATION)	ST APRROX EXIST SEPTIC TANK	FIRE HYDRANT
COMMUNICATION LINE (APPROX. LOCATION)	ELEC PED ELECTRIC PEDESTAL	MAILBOX
UNDERGROUND ELECTRIC	CONCRETE MONUMENT	LIGHT POLE / POST
UNDERGROUND TELEPHONE	IRON PIPE FOUND	DROP INLET / LAMP
UNDERGROUND FIBER OPTIC LINE		F.F. FINISH FLOOR / BUSH
UNDERGROUND TELEVISION CABLE LINE		INV. INVERT / SIGN

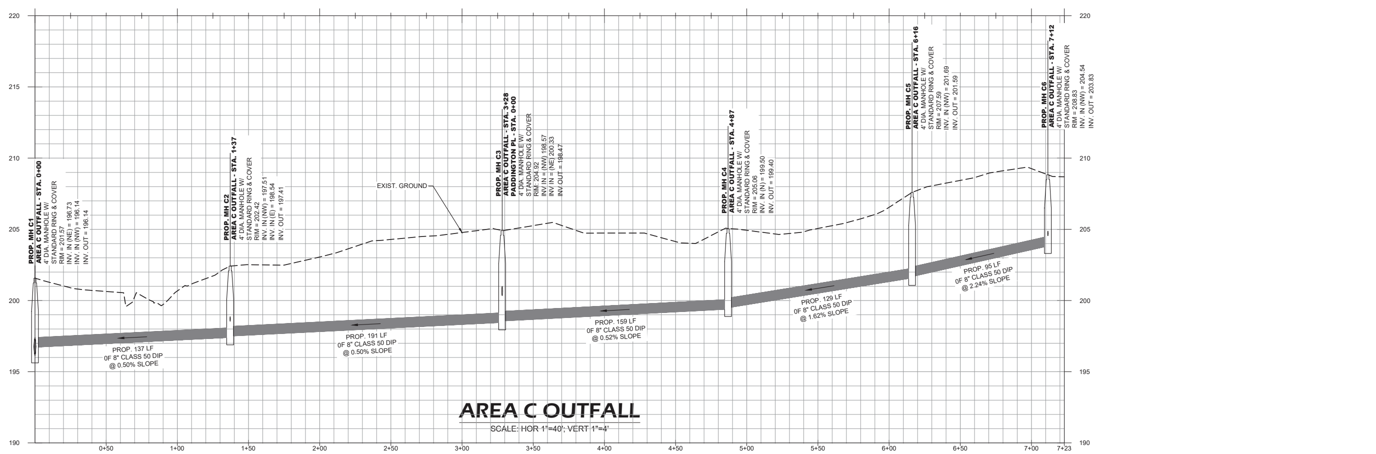
GENERAL NOTE:

1. CONTRACTOR SHALL BE RESPONSIBLE TO COORDINATE THE PROPOSED SEWER LATERAL INSTALLATION WITH THE EXISTING UTILITIES. CONTRACTOR SHALL USE PWC STANDARD DETAIL S.12 SEWER SERVICE LATERAL UTILITY CONFLICT SEPARATION REQUIREMENTS ONLY WHEN APPROVED BY PWC PROJECT COORDINATOR.

GRAPHIC SCALE

(IN FEET)
HORIZ.: 1 inch = 40 ft.
VERT.: 1 inch = 4 ft.

NC STATE PLANE
NAD83, NAVD88



AREA C OUTFALL

SCALE: HOR 1"=40'; VERT 1"=4'

REVISIONS | DATE | BY

SHEET SERIES-PRELIMINARY DRAWINGS

DATE: 4/1/2019
SURVEY/GPS BY: STEWART
DRAWN BY: AMH/MP
CHECKED BY: MWF
SCALE: HOR: 1"=40 VERT: 1"=4

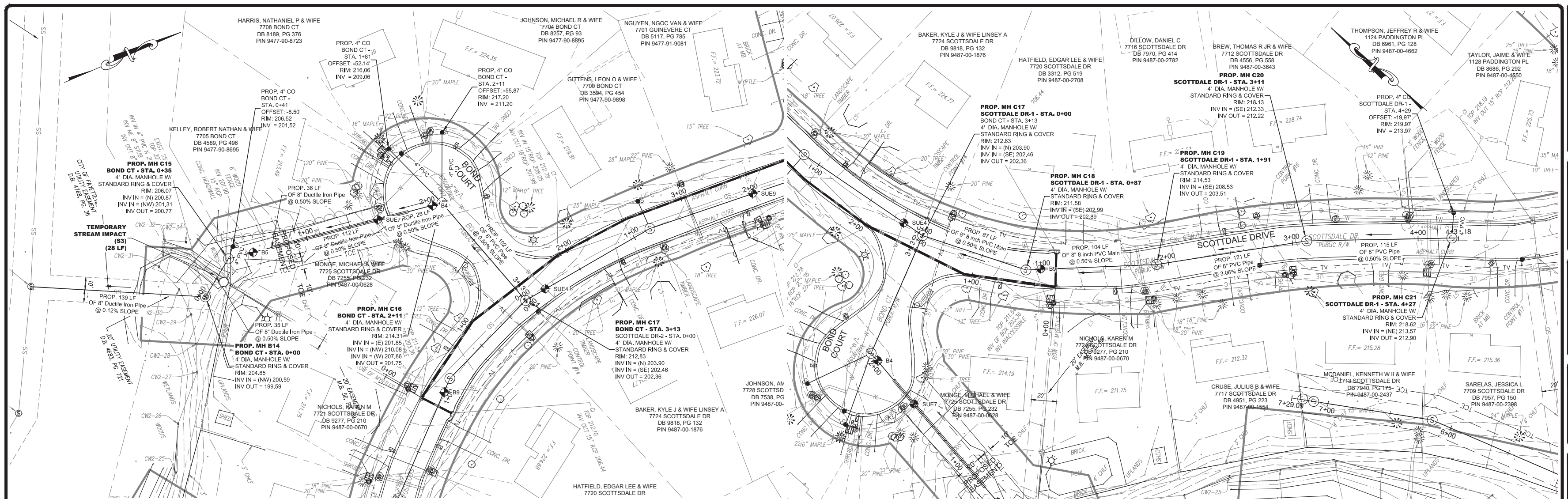
WK DICKSON
community infrastructure consultants
Transportation • Water Resources
Urban Development • Geomatics
720 Corporate Center Drive
Raleigh, North Carolina 27607
(v) 919.782.0495
(f) 919.782.9672
www.wkdickson.com

SHEET # C40

SCOTTSDALE OUTFALL
ANNEXATION PHASE V, AREA 24
FAYETTEVILLE, NORTH CAROLINA

PUBLIC WORKS COMMISSION
OF THE CITY OF FAYETTEVILLE
WATER RESOURCES ENGINEERING
P.O. Box 1089, Fayetteville, NC 28302
955 Old Wilmington Road, Fayetteville, NC 28301
Electric & Water Utilities

20190126.00.RA



LEGEND

PROP. EASEMENT	PROP. TEMPORARY CONSTRUCTION EASEMENT
PROP. SEWER, CLEAN OUT & MANHOLE	PROP. SAFETY FENCE
PROP. STORM DRAINAGE	SOIL BORING LOCATION SEE GEOTECHNICAL REPORT
PROP. WATER LINE & METER	PROP. REVERSE PLUMBING
SANITARY SEWER LINE & MANHOLE	PROP. BACKWATER VALVE
WATER LINE & VALVE	PROP. GRINDER PUMP
UNDERGROUND GAS (APPROX. LOCATION)	APPROX EXIST SEPTIC TANK
COMMUNICATION LINE (APPROX. LOCATION)	ELECTRIC PEDESTAL
UNDERGROUND ELECTRIC	CONCRETE MONUMENT
UNDERGROUND TELEPHONE	IRON PIPE FOUND
UNDERGROUND FIBER OPTIC LINE	
UNDERGROUND TELEVISION CABLE LINE	

WATER METER	POST
IRRIGATION VALVE	LAMP
ELECTRIC TRANSFORMER	BUSH
TELEPHONE PEDESTAL	SIGN
TELEVISION PEDISTAL	
DRAINAGE MANHOLE	
FIRE HYDRANT	
MAILBOX	
LIGHT POLE	
DROP INLET	
F.F. FINISH FLOOR	
INV. INVERT	

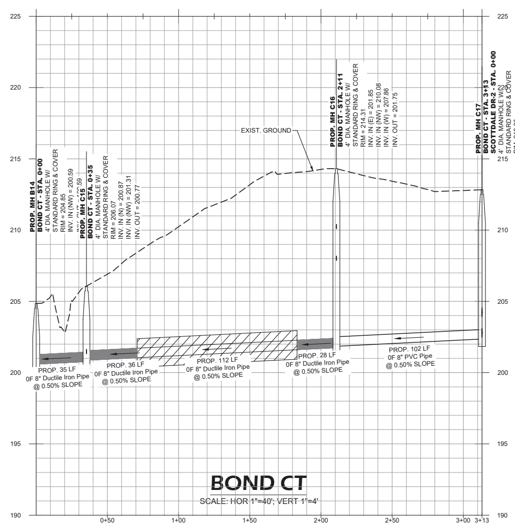
GENERAL NOTE:

1. CONTRACTOR SHALL BE RESPONSIBLE TO COORDINATE THE PROPOSED SEWER LATERAL INSTALLATION WITH THE EXISTING UTILITIES. CONTRACTOR SHALL USE PWC STANDARD DETAIL S.12 SEWER SERVICE LATERAL UTILITY CONFLICT SEPARATION REQUIREMENTS ONLY WHEN APPROVED BY PWC PROJECT COORDINATOR.

GRAPHIC SCALE

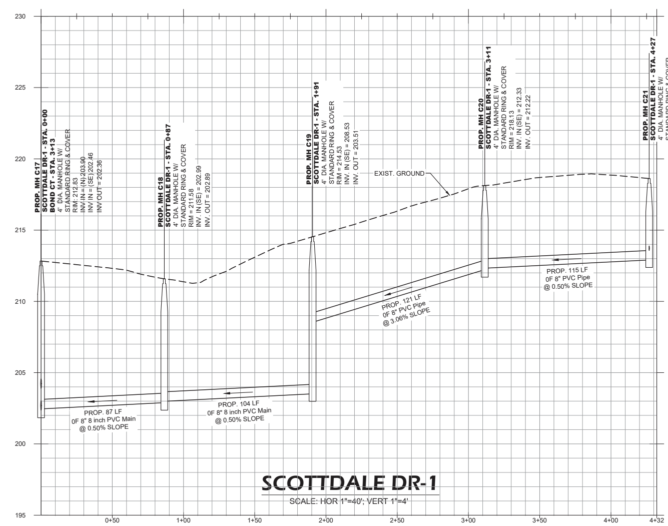
(IN FEET)
HORIZ.: 1 inch = 40 ft.
VERT.: 1 inch = 4 ft.

NC STATE PLANE
NAD83, NAVD88



BOND CT

SCALE: HOR 1"=40'; VERT 1"=4'



SCOTTDALE DR-1

SCALE: HOR 1"=40'; VERT 1"=4'

DATE	REVISIONS	BY

SHEET SERIES-PRELIMINARY DRAWINGS

DATE: 4/11/2019
SURVEY/GPS BY: STEWART
DRAWN BY: AMH/MP
CHECKED BY: MWF
SCALE: HOR: 1"=40 VERT: 1"=4

WK DICKSON
community infrastructure consultants
Transportation + Water Resources
Urban Development + Geomatics
720 Corporate Center Drive
Raleigh, North Carolina 27607
(v) 919.782.0495
(f) 919.782.9672
www.wkdickson.com
NC LICENSE NO. F-0374

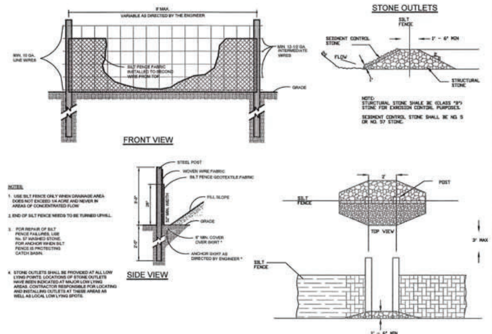
SHEET # C42

BOND CT OUTFALL & SCOTTSDALE DR-1

ANNEXATION PHASE V, AREA 24
FAYETTEVILLE, NORTH CAROLINA

PUBLIC WORKS COMMISSION OF THE CITY OF FAYETTEVILLE
WATER RESOURCES ENGINEERING
P.O. Box 1089, Fayetteville, NC 28302
955 Old Wilmington Road, Fayetteville, NC 28301
PWC Electric & Water Utilities

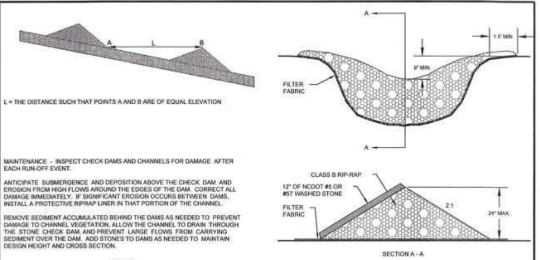
20190126.00.RA



NOTES:

1. USE SILT FENCE ONLY WHEN DRAINAGE AREA DOES NOT EXCEED 1/4 ACRE AND NEVER IN AREAS OF CONCENTRATED FLOW.
2. END OF SILT FENCE NEEDS TO BE TURNED UPHILL.
3. FOR REPAIR OF SILT FENCE FAILURES, USE No. 57 WASHED STONE. FOR ANCHOR WHEN SILT FENCE IS PROTECTING CATCH BASIN.
4. STONE OUTLETS SHALL BE PROVIDED AT ALL LOW LYING POINTS. LOCATIONS OF STONE OUTLETS HAVE BEEN INDICATED AT MAJOR LOW LYING AREAS. CONTRACTOR RESPONSIBLE FOR LOCATING AND INSTALLING OUTLETS AT THESE AREAS AS WELL AS LOCAL LOW LYING SPOTS.

1/G5 TEMPORARY SILT FENCE
NOT TO SCALE



L = THE DISTANCE SUCH THAT POINTS A AND B ARE OF EQUAL ELEVATION

MAINTENANCE - INSPECT CHECK DAMS AND CHANNELS FOR DAMAGE AFTER EACH RUN-OFF EVENT.

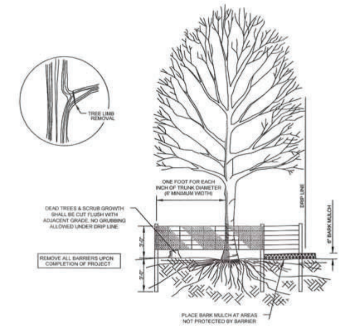
ANTICIPATE SUBMERGENCE AND DEPOSITION ABOVE THE CHECK DAM AND EROSION FROM HIGH FLOWS AROUND THE EDGES OF THE DAM. CORRECT ALL DAMAGE IMMEDIATELY. IF SIGNIFICANT EROSION OCCURS BETWEEN DAMS, INSTALL A PROTECTIVE RIPRAP LINER IN THAT PORTION OF THE CHANNEL.

REMOVE SEDIMENT ACCUMULATED BEHIND THE DAMS AS NEEDED TO PREVENT DAMAGE TO CHANNEL VEGETATION, ALLOW THE CHANNEL TO DRAIN THROUGH THE STONE CHECK DAM, AND PREVENT LARGE FLOWS FROM CARRYING SEDIMENT OVER THE DAM. ADD STONES TO DAMS AS NEEDED TO MAINTAIN DESIGN HEIGHT AND CROSS SECTION.

NOTES:

1. PLACE STONE TO THE LINES AND DIMENSIONS SHOWN IN THE PLAN ON A FILTER FABRIC FOUNDATION.
2. KEEP THE CENTER STONE SECTION AT LEAST 9 INCHES BELOW NATURAL GROUND LEVEL WHERE THE DAM ABUTS THE CHANNEL BANKS.
3. EXTEND STONE AT LEAST 1.5 FT BEYOND THE DITCH BANKS TO KEEP OVERFLOW WATER FROM UNDERCUTTING THE DAM AS IT RE-ENTERS THE CHANNEL.

2/G5 TEMPORARY CHECK DAM
NOT TO SCALE



GENERAL NOTES:

TREES LOCATED WITHIN THE STREET RIGHT OF WAY AND THOSE IDENTIFIED IN PERMANENT SANITARY SEWER EASEMENT TO BE PROTECTED SHALL BE PROTECTED FROM DAMAGE AND/OR REMOVAL. THIS INCLUDES THE FOLLOWING ACTIVITIES: STORM DRAINAGE, UNDERGROUND UTILITIES, DRIVEWAYS, SIDEWALKS, ETC. UTILITIES MAY BE TUNNELED IN THE ROOT ZONE AT A 24" MINIMUM PROVIDING THAT PLANS ARE APPROVED SHOWING THE LOCATION AND METHOD.

BARRIERS SHALL EXTEND AROUND TRUNK AS SHOWN. THEY SHALL ENCOMPASS THE TREES WITH A RADIUS OF NO LESS THAN ONE FOOT (1') FOR EVERY ONE INCH (1") OF TRUNK DIAMETER UNLESS OTHERWISE DETAILED. DEVIATIONS FROM THIS MUST BE APPROVED ON AN INDIVIDUAL BASIS BY THE ENGINEERING DEPARTMENT. ALL TREE PROTECTION BARRIERS SHALL BE INSTALLED PRIOR TO ANY GRADING OR OTHER LAND DISTURBING ACTIVITY. THEY SHALL BE CONSTRUCTED FROM ANY MATERIAL SUBSTANTIAL ENOUGH TO DESIGNATE THE PROTECTED AREA AND PROTECT THE ROOTS, TRUNK, AND CROWN OF THE TREE. EXAMPLE: 2x4 STANDARDS AND 1x4 RAILS; SILT FENCING, ETC.

IN SOME CASES PERMITS MAY BE ISSUED TO ALLOW TEMPORARY (30 DAYS) ACCESS ACROSS THE PROTECTED AREA. MULCH, 4" TO 6" DEEP WILL BE REQUIRED IN THESE AREAS TO ACT AS A CUSHION TO PREVENT SOIL COMPACTION. DO NOT STORE MATERIALS OR PARK MACHINERY IN ANY PORTION OF THE PROTECTED ROOT ZONE.

FILL DIRT NO DEEPER THAN TWO INCHES SHALL BE ALLOWED WITHIN THE DRIP LINE OF THE TREE.

IN THE PROTECTED ROOT ZONE, STUMPS, DEAD TREES, AND SHRUB GROWTH SHALL BE CUT FLUSH OR GROUND OUT. NO GRUBBING IS PERMITTED.

REMOVE ALL BARRIERS UPON COMPLETION OF PROJECT AND FILL THE HOLES.

TREES THAT DIE AS A RESULT OF THE CONTRACTOR'S NEGLIGENCE TO THESE SPECIFICATIONS SHALL BE REMOVED AND REPLACED UNDER THE DIRECTION OF THE CITY AND APPLICABLE CITY STANDARDS.

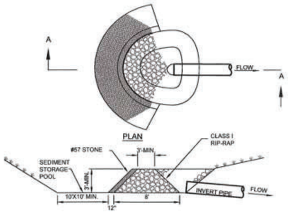
DEAD OR DYING TREE	NEW TREE
LESS THAN 12" DBH	1-4" CALIPER TREES
12-20" DBH	2-4" CALIPER TREES
20-28" DBH	3-4" CALIPER TREES
28-30" DBH	4-4" CALIPER TREES
ABOVE 30" DBH	5-4" CALIPER TREES

ROOT PRUNING: ROOT PRUNING SHALL BE KEPT TO AN ABSOLUTE MINIMUM ROOT PRUNING SHALL BE STARTED WITHIN FIFTEEN DAYS AFTER THE AWARD OF THE CONTRACT AND SHALL BE COMPLETED WITHIN FIFTEEN DAYS AFTER STARTING WORK. THE CUT IS TO BE MADE NO MORE THAN 6" BEHIND THE BACK OF THE CURB OR WHERE DIRECTED BY ENGINEER. THE CUT SHALL BE MADE TO A DEPTH OF TWO FEET BELOW THE SOIL SURFACE. THE ROOTS SHALL BE CUT CLEANLY LEAVING A SMOOTH SURFACE. ALL CUT SURFACES OF ROOTS TWO INCHES OR LARGER IN DIAMETER SHALL BE COVERED IMMEDIATELY WITH TREE WOUND DRESSING. ROOT PRUNING EQUIPMENT SHALL BE KEPT SHARP TO ENSURE THAT ROOTS ARE CUT CLEANLY AND ARE NOT BROKEN OR TORN BY DULL OR UNSUITABLE EQUIPMENT.

PRUNING AND THINNING OR EXISTING TREES: ALL BRANCHES OVERHANGING THE ROADWAY OR EASEMENT SHALL BE REMOVED TO A HEIGHT OF SEVENTEEN FEET. DEAD WOOD AND CROSSED BRANCHES SHALL BE REMOVED FROM THE TREES WITHIN THE CONTRACT AREA. THE PRUNING SHALL BE DONE IN A MANNER WHICH PRESERVES THE NATURAL CHARACTER OF THE CROWN.

FERTILIZATION: A FORMULATION OF 31-10-8 ANALYSIS FERTILIZER OR OTHER AS APPROVED BY THE CITY AND THE ENGINEER SHALL BE USED. TREES SHALL BE FERTILIZED WITHIN THE PROTECTED ROOT ZONE AT THE RATE OF 8 LBS. NITROGEN PER 1000 SF. SOURCE OF NITROGEN SHALL BE NO LESS THAN 50% UREA FORMALDEHYDE (SLOW RELEASE LOW SALT INDEX). THIS LIQUID FERTILIZER IS USED WITH A TREE FEEDING NEEDLE. AN EQUIVALENT DOSAGE SHALL BE APPLIED USING THE SAME PATTERN OF HOLE.

5/G5 TREE PROTECTION DETAIL
NOT TO SCALE

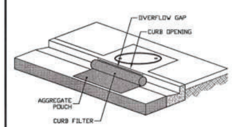


STONE PILE INLET PROTECTION
FOR DRIVEWAY CULVERTS LARGER THAT 24"

NOTES:

1. PLYWOOD INLET PROTECTION SHALL BE AN ACCEPTABLE ALTERNATE. IT SHALL BE USED WHERE PERMITTED BY EROSION CONTROL.
2. ROCK PILE INLETS HAVE BEEN SHOWN ON THE DRAWINGS FOR BIDDING PURPOSES.

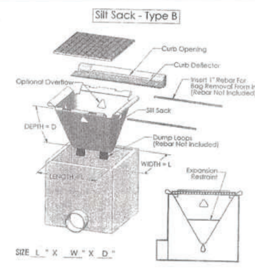
3/G5 TEMPORARY ROCK PIPE INLET PROTECTION
NOT TO SCALE



SILT BAG CURB INLET FILTER
NOT TO SCALE

NOTES:

1. OTHER ALTERNATIVE CURB INLET PROTECTION METHODS MAY BE ACCEPTABLE. CONTRACTOR SHALL COORDINATE WITH PWC PROJECT COORDINATOR, IF OTHER METHOD IS PREFERRED.
2. SILT SACK METHOD SHALL NOT BE USED IN ROADWAY SAG CONDITIONS.

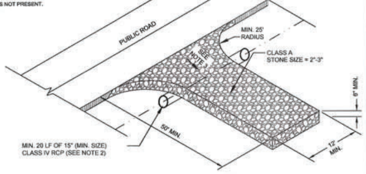


SILT SACK
NOT TO SCALE

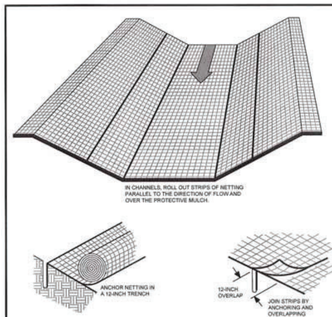
4/G5 CURB INLET PROTECTION
NOT TO SCALE

NOTES:

1. CONTRACTOR RESPONSIBLE FOR REMOVAL AND REPLACEMENT OF TEMPORARY GRAVEL CONSTRUCTION ENTRANCE WHEN WORK DICTATES THAT ENTRANCE BE DISTURBED FOR SEWER REALIGNMENT, REPLACEMENT, ETC.
2. MINIMUM DRAINAGE DIAMETER OF 15-INCHES IS REQUIRED UNLESS OTHERWISE NOTED ON PLANS. MINIMUM CLASS IV IS REQUIRED UNLESS OTHERWISE NOTED ON PLANS.
3. DRIVEWAY SHALL HAVE A GRADE THAT SLOPES AWAY FROM HIGHWAY SURFACE AT A RATE EQUAL TO THE SLOPE OF THE SHOULDER, BUT NOT LESS THAN 1/4" PER FOOT NOR GREATER THAN 1" PER FOOT IN A NORMAL CROWN SECTION. THE SLOPE SHALL CONTINUE FOR A DISTANCE EQUAL TO THE PREVAILING SHOULDER WIDTH OR LONGER SO AS NOT TO CAUSE A HUMP OR A DEPRESSION IN THE SHOULDER AREA.
4. THE ENTRANCE SHALL HAVE AN ADEQUATE RADIUS TO PREVENT TRACKING OF MUD AT THE EDGE OF THE ENTRANCE AND SO THAT LONG VEHICLES DO NOT LEAVE THE STABILIZED AREA WHEN TURNING ONTO OR OFF OF THE PAVED ROADWAY.
5. PROPERLY GRADE ENTRANCE TO PREVENT RUNOFF FROM LEAVING THE SITE. PLACE A MOUNDED BERM OF MATERIAL IF REQUIRED TO PREVENT STORMWATER RUN ON/RUNOFF AND/OR PROVIDE COVER FOR DRAIN PIPE.
6. PIPE CULVERT NOT REQUIRED WHEN DITCH IS NOT PRESENT.



6/G5 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT
NOT TO SCALE

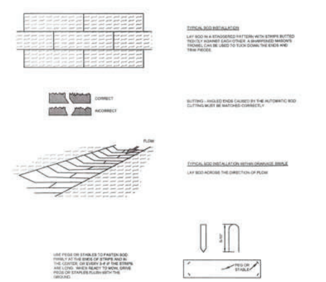


NOTES:

PRODUCTS DESIGNED TO CONTROL EROSION SHOULD BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. ANY MAT OR BLANKET-TYPE PRODUCT USED AS A PROTECTIVE MULCH SHOULD PROVIDE COVER OF AT LEAST 30% OF THE SURFACE WHERE IT IS APPLIED.

1. APPLY LIME, FERTILIZER, AND SEED BEFORE LAYING THE NET OR MAT.
2. START LAYING THE NET FROM THE TOP OF THE CHANNEL OR SLOPE, AND UNROLL IT DOWN THE GRADE. ALLOW NETTING TO LAY LOOSELY ON THE SOIL OR MULCH COVER BUT WITHOUT WRINKLES - DO NOT STRETCH.
3. TO SECURE THE NET, BURY THE UPSLOPE END IN A SLOT OR TRENCH NO LESS THAN 6 INCHES DEEP, COVER WITH SOIL, AND TAMP FIRMLY. STAPLE THE NET EVERY 12 INCHES ACROSS THE TOP END AND EVERY 3 FEET AROUND THE EDGES AND BOTTOM. WHERE 2 STRIPS OF NET ARE LAID SIDE BY SIDE, THE ADJACENT EDGES SHOULD BE OVERLAPPED 3 INCHES AND STAPLED TOGETHER. EACH STRIP OF NETTING SHOULD ALSO BE STAPLED DOWN THE CENTER, EVERY 3 FEET. DO NOT STRETCH THE NET WHEN APPLYING STAPLES.
4. TO JOIN 2 STRIPS, CUT A TRENCH TO ANCHOR THE END OF THE NEW NET. OVERLAP THE END OF THE PREVIOUS ROLL 18 INCHES AND STAPLE EVERY 12 INCHES JUST BELOW THE ANCHOR SLOT.

7/G5 INSTALLATION OF NETTING AND MATTING
NOT TO SCALE



8/G5 SOD INSTALLATION
NOT TO SCALE

PWC DWG # DS-15379

EROSION CONTROL (1)
ANNEXATION PHASE V, AREA 24
FAYETTEVILLE, NORTH CAROLINA

PUBLIC WORKS COMMISSION OF THE CITY OF FAYETTEVILLE
WATER RESOURCES ENGINEERING
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955 Old Wilmington Road, Fayetteville, NC 28301
Electric & Water Utilities

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 29430 DANIEL K. PEPLINSKI

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SHEET # G5

DATE: 4/1/2019
SURVEY/GPS BY: STEWART
DRAWN BY: AMH/MP
CHECKED BY: DKP
SCALE: HOR: 1"=NTS VERT: 1"=NTS

DATE	REVISIONS	BY

SHEET SERIES-FINAL

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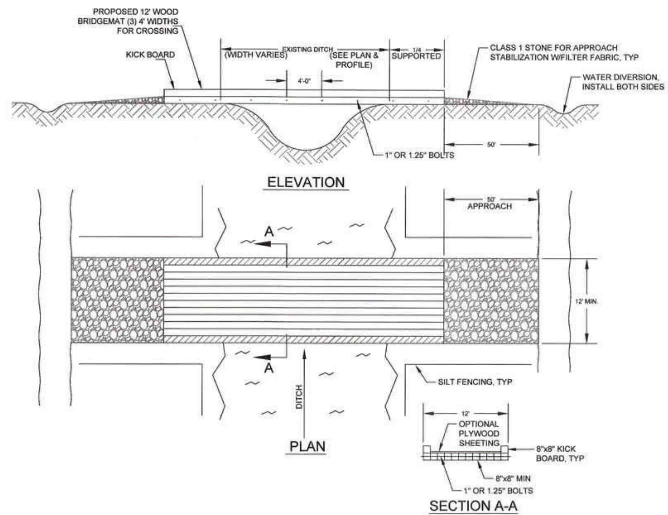


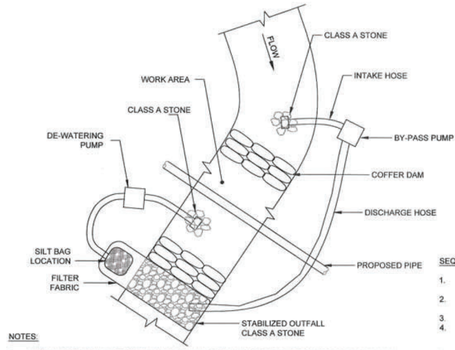
GENERAL NOTES:

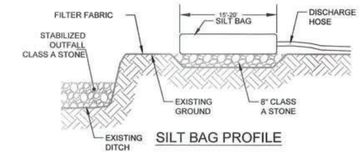
1. INSTALL TO CREATE A MINIMUM 12 FT CROSSING WIDTH OR LARGER WIDTH FOR CONSTRUCTION EQUIPMENT.
2. PERIODICALLY CHECK MAT HARDWARE, RETIGHTEN AS REQUIRED TO MAINTAIN STRENGTH AND INTEGRITY.
3. REMOVE ANY DEBRIS THAT ENTERS DRAINAGE WAY.
4. CONTRACTOR RESPONSIBLE FOR SIZING STRUCTURAL COMPONENTS OF MAT TO CARRY ALL CONSTRUCTION LOADS INCLUDING EQUIPMENT AND MATERIAL.

SEQUENCE NOTES:

1. MAT SHALL BE INSTALLED PRIOR TO CONSTRUCTION. LOCATION OF MAT AT EACH CROSSING SHALL BE COORDINATED BY CONTRACTOR SO IT DOES NOT CONFLICT WITH SEWER EXCAVATION AND IT RESIDES WITHIN LIMITS OF DISTURBANCE (LOD).
2. MAT SHALL REMAIN IN PLACE UNTIL ALL DOWNSTREAM (IN TERMS OF SEWER FLOW) WORK HAS BEEN COMPLETED, RESTORED AND DEEMED ACCEPTABLE AND CONTRACTOR NO LONGER NEEDS ACCESS OVER DITCH.

(1/##) TEMPORARY DITCH CROSSING (BRIDGE MAT)
NOT TO SCALE





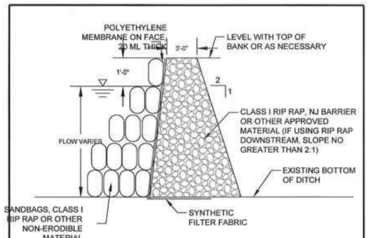
NOTES:

1. EXCAVATION SHALL BE PERFORMED ONLY IN DRY AND/OR ISOLATED SECTIONS OF CHANNEL.
2. IMPERVIOUS DIKES SHOULD BE USED TO ISOLATE WORK AREAS FROM DITCH FLOW.
3. THE CONTRACTOR SHALL NOT DISTURB MORE AREA THAN CAN BE STABILIZED IN ONE WORKING DAY. A MAXIMUM OF 1000 FEET MAY BE DISTURBED AT ANY ONE TIME.
4. THE BY-PASS PUMP SHOULD ADEQUATELY CONVEY MINIMUM 450 GALLONS / MINUTE UNLESS OTHERWISE SPECIFIED.
5. DIKE MUST BE CONSTRUCTED OF NON-ERODIBLE MATERIALS SUCH AS SANDBAGS, SEE COFFER DAM DETAIL.

SEQUENCE OF CONSTRUCTION FOR TYPICAL PUMP AROUND

1. INSTALL STILLING BASIN AND STABILIZED OUTFALL USING CLASS A RIP RAP AT THE DOWNSTREAM END OF THE DESIGNATED PROJECT WORKING AREA.
2. THE CONTRACTOR WILL INSTALL THE PUMP AROUND PUMP AND THE TEMPORARY PIPING THAT WILL CONVEY THE BASE FLOW FROM UPSTREAM OF THE WORK AREA TO THE STABILIZED OUTFALL.
3. INSTALL UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR DITCH DIVERSION.
4. INSTALL THE DOWNSTREAM IMPERVIOUS DIKE AND DEWATERING PUMPING APPARATUS IF NEEDED TO DEWATER THE ENTRAPPED AREA. THE PUMP AND HOSE FOR THIS PURPOSE SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA. THIS WATER WILL ALSO BE PUMPED TO AN OUTFALL STABILIZED WITH CLASS A RIP RAP.
5. THE CONTRACTOR WILL PERFORM DITCH RESTORATION AND/ OR UTILITY CROSSING WORK IN ACCORDANCE WITH THE PLAN AND FOLLOWING THE GENERAL CONSTRUCTION SEQUENCE.
6. THE CONTRACTOR WILL EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF THE IMPERVIOUS DIKE. WHEN DEWATERING AREA, ALL DIRTY WATER MUST BE PUMPED THROUGH A SILT BAG. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE/PIPING STARTING WITH THE DOWNSTREAM DIKE FIRST.
7. ONCE THE WORKING AREA IS COMPLETED, REMOVE ALL RIP RAP AND IMPERVIOUS DIKES AND STABILIZE DISTURBED AREAS IN ACCORDANCE WITH DITCH STABILIZATION REQUIREMENTS AS INDICATED ON EROSION/ SEDIMENTATION PLANS.
8 ALL WORK IN DITCH MUST BE COMPLETED BEFORE REMOVING IMPERVIOUS DIKE.

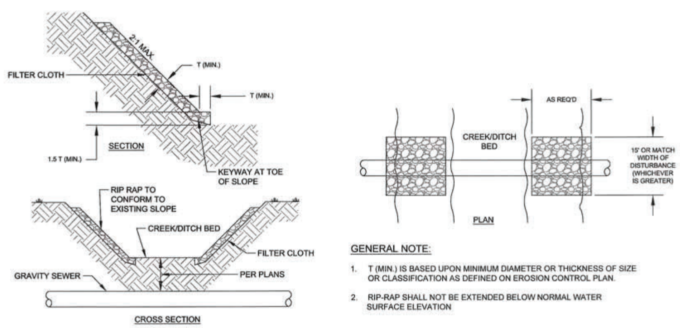
(2/##) DITCH PUMP AROUND
NOT TO SCALE



NOTES:

1. CONTRACTOR SHALL INSTALL COFFER DAM WITH BYPASS ARRANGEMENTS ALONG DITCH PRIOR TO SEWER INSTALLATION TO ENSURE DRY CONDITIONS. SEE DITCH PUMP AROUND DETAIL.
2. CONTRACTOR SHALL FOLLOW CONSTRUCTION SEQUENCE AS NOTED ON CONTRACT DRAWINGS.

(3/##) COFFER DAM
NOT TO SCALE



GENERAL NOTE:

1. T (MIN.) IS BASED UPON MINIMUM DIAMETER OR THICKNESS OF SIZE OR CLASSIFICATION AS DEFINED ON EROSION CONTROL PLAN.
2. RIP-RAP SHALL NOT BE EXTENDED BELOW NORMAL WATER SURFACE ELEVATION

(4/##) STREAM BANK STABILIZATION
NOT TO SCALE

PWC DWG # DS-15379

DATE	REVISIONS	BY

SHEET SERIES-FINAL

DATE: 4/1/2019
SURVEY/GPS BY: STEWART
DRAWN BY: AMH/MP
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SCALE: HOR: 1"=NTS VERT: 1"=NTS

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SHEET # G6

NORTH CAROLINA PROFESSIONAL SEAL 29430 ENGINEER DANIEL K. PEPLINSKI

EROSION CONTROL (2)
ANNEXATION PHASE V, AREA 24
FAYETTEVILLE, NORTH CAROLINA

PUBLIC WORKS COMMISSION OF THE CITY OF FAYETTEVILLE
PWC Electric & Water Utilities
WATER RESOURCES ENGINEERING
P.O. Box 1089, Fayetteville, NC 28302
955 Old Wilmington Road, Fayetteville, NC 28301

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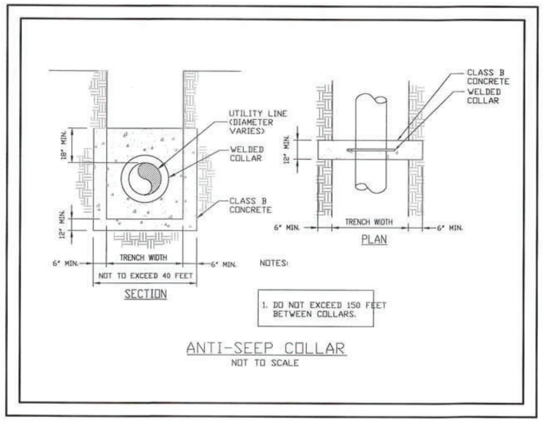
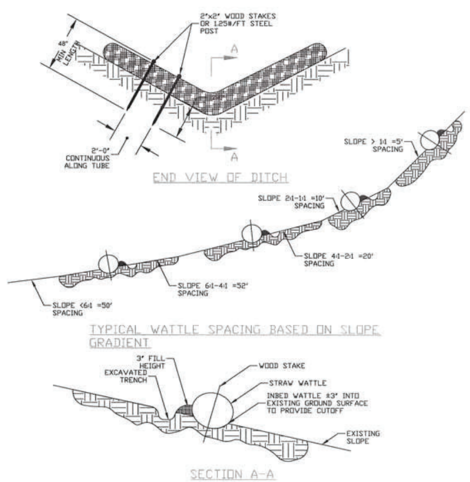


ANTI-SEEP COLLAR
NOT TO SCALE



STRAW WATTLE
NOT TO SCALE

WATTLE DESCRIPTION

WATTLES ARE ELONGATED TUBES OF COMPACTED GEOTEXTILES, CURLED EXCELSIOR WOOD, NATURAL COCONUT FIBER OR HARDWOOD MULCH. STRAW, PINE NEEDLE AND LEAF MULCH-FILLED SEDIMENT TUBES ARE NOT PERMITTED UNDER THIS SPECIFICATION.

WHEN AND WHERE TO USE IT:

INSTALL SEDIMENT TUBES ALONG CONTOURS, IN DRAINAGE CONVEYANCE SWALES, AND AROUND INLETS TO HELP REDUCE THE EFFECTS OF SOIL EROSION BY ENERGY DISSIPATION AND RETAIN SEDIMENT.

MATERIALS

WATTLES FOR DITCH CHECKS AND TYPE A INLET STRUCTURE FILTERS EXHIBIT THE FOLLOWING PROPERTIES:
PRODUCED BY A MANUFACTURER EXPERIENCED IN WATTLE MANUFACTURING.
COMPOSED OF COMPACTED GEOTEXTILES, CURLED EXCELSIOR WOOD, NATURAL COCONUT FIBERS, HARDWOOD MULCH OR A MIX OF THESE MATERIALS ENCLOSED BY A FLEXIBLE NETTING MATERIAL. STRAW, STRAW FIBER, STRAW BALES, PINE NEEDLES AND LEAF MULCH ARE NOT ALLOWED UNDER THIS SPECIFICATION. UTILIZES OUTER NETTING THAT CONSISTS OF SEAMLESS, HIGH-DENSITY POLYETHYLENE PHOTODEGRADABLE MATERIALS TREATED WITH ULTRAVIOLET STABILIZERS OR A SEAMLESS, HIGH-DENSITY POLYETHYLENE NON-DEGRADABLE MATERIALS. DIAMETER RANGING FROM 18-INCHES TO 24-INCHES. CURLED EXCELSIOR WOOD, OR NATURAL COCONUT ROLLED EROSION CONTROL PRODUCTS (RECPS) THAT ARE ROLLED UP TO CREATE A SEDIMENT TUBE ARE **NOT** ALLOWED UNDER THIS SPECIFICATION.

INSTALLATION:

1. INSTALL OVER BARE SOIL, MULCHED AREAS OR EROSION CONTROL BLANKETS. THE MINIMUM DIAMETER SHOULD BE 18 INCHES.
2. BEGIN AT THE LOCATION WHERE THE WATTLE IS TO BE INSTALLED BY EXCAVATING A TRENCH 20% OF TUBE DIAMETER x 9" WIDE TRENCH ALONG THE CONTOUR OF THE SLOPE. EXCAVATED SOIL SHOULD BE PLACED UP-SLOPE FROM THE ANCHOR TRENCH. AVOID DAMAGE TO SEDIMENT TUBES WHILE INSTALLING THEM. IF THE SEDIMENT TUBE BECOMES DAMAGED DURING INSTALLATION, A STAKE SHOULD BE PLACED ON BOTH SIDES OF THE DAMAGED AREA TERMINATING THE TUBE SEGMENT AND A NEW TUBE SEGMENT SHOULD BE INSTALLED.
3. PLACE THE WATTLE IN THE TRENCH SO THAT IT CONTOURS TO THE SOIL SURFACE. COMPACT THE SOIL FROM THE EXCAVATED TRENCH AGAINST THE WATTLE ON THE UPHILL SIDE. ADJACENT WATTLES SHOULD TIGHTLY ABUT.
4. SECURE THE WATTLE WITH 48" STAKES EVERY 2'-0" WITH A STAKE ON EACH END. STAKES SHOULD BE INTERTWINED WITH THE OUTER MESH ON THE DOWNSTREAM SIDE AND DRIVEN IN THE GROUND TO A MINIMUM DEPTH OF 1.5 FEET LEAVING AT LEAST 3" OF STAKE EXTENDING ABOVE. THE WATTLE STAKES SHOULD BE DRIVEN PERPENDICULAR TO THE SLOPE FACE. STAKES SHOULD BE 2"x2" WOODEN STAKES OR STEEL POSTS (STANDARD "U" OR "T" SECTIONS WITH A MINIMUM WEIGHT OF 1.25 POUNDS PER FOOT). ALWAYS REFER TO THE MANUFACTURER'S RECOMMENDATIONS FOR THE STAKING DETAIL.
5. INSTALL ALL TUBES INSURING THAT NO GAPS EXIST BETWEEN THE SOIL AND THE BOTTOM OF THE TUBE. THE ENDS OF ADJACENT WATTLES SHOULD BE LAPPED 6-INCH TO PREVENT FLOW AND SEDIMENT FROM PASSING THROUGH THE FIELD JOINT IN NO SITUATIONS SHOULD SEDIMENT TUBES BE STACKED ON TOP OF ONE ANOTHER. IN SWALES OR DRAINAGE DITCHES PERPENDICULAR TO THE FLOW OF WATER. SEDIMENT TUBES SHOULD CONTINUE UP THE SIDE SLOPES A MINIMUM OF 1 FOOT ABOVE THE DESIGN FLOW DEPTH.
6. SEDIMENT TUBE LENGTH SELECTED SHOULD MINIMIZE THE NUMBER OF SEDIMENT TUBES NEEDED TO SPAN THE WIDTH OF THE DRAINAGE CONVEYANCE. IF THE DITCH CHECK LENGTH (PERPENDICULAR TO THE WATER FLOW) IS 15 FEET, THEN ONE 15 FOOT SEDIMENT TUBE IS PREFERRED COMPARED TO TWO OVERLAPPING 10 FOOT SEDIMENT TUBES.
7. WATTLES FOR DITCH CHECKS SHOULD REMAIN IN PLACE UNTIL FULLY ESTABLISHED VEGETATION AND ROOT SYSTEMS HAVE COMPLETELY DEVELOPED AND CAN SURVIVE ON THEIR OWN.

INSPECTION AND MAINTENANCE:

CHECK DAMS SHOULD BE INSPECTED EVERY 7 CALENDAR DAYS AND WITHIN 24-HOURS AFTER EACH STORM THAT PRODUCES ½-INCHES OR MORE OF RAIN TO ENSURE CONTINUED EFFECTIVENESS.

LARGE DEBRIS, TRASH, AND LEAVES SHOULD BE REMOVED.

IF EROSION CAUSES THE EDGES TO FALL TO A HEIGHT EQUAL TO OR BELOW THE HEIGHT OF THE CENTER, REPAIRS SHOULD BE MADE IMMEDIATELY.

REMOVE ACCUMULATED SEDIMENT FROM THE UPSTREAM SIDE OF THE SEDIMENT TUBE WHEN THE SEDIMENT HAS REACHED A HEIGHT OF APPROXIMATELY ONE-THIRD OF THE EXPOSED HEIGHT OF THE TUBE (MEASURED AT THE CENTER).

ACCUMULATED SEDIMENT SHOULD BE REMOVED PRIOR TO REMOVING SEDIMENT TUBES.

WATTLE REMOVAL SHOULD BE COMPLETED ONLY AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN COMPLETELY STABILIZED. PERMANENT VEGETATION SHOULD REPLACE AREAS FROM WHICH GRAVEL, STONE, SEDIMENT TUBES, OR OTHER MATERIALS HAVE BEEN REMOVED.

PWC DWG # DS-15379

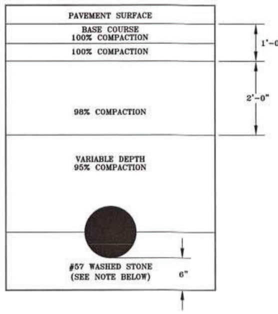
EROSION CONTROL (3)
ANNEXATION PHASE V, AREA 24
FAYETTEVILLE, NORTH CAROLINA

PUBLIC WORKS COMMISSION OF THE CITY OF FAYETTEVILLE
WATER RESOURCES ENGINEERING
P.O. Box 1089, Fayetteville, NC 28302
955 Old Wilmington Road, Fayetteville, NC 28301

DATE: 4/11/2019
SURVEY/GPS BY: STEWART
DRAWN BY: AMH/MP
CHECKED BY: DKP
SCALE: HOR: 1"=NTS VERT: 1"=NTS

SHEET # G7

20190126.00.RA

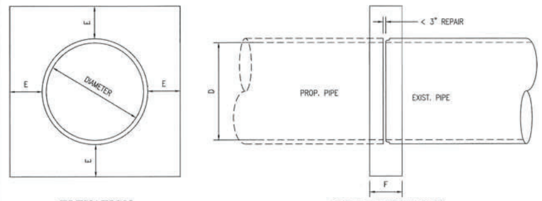


NOTES:
1. STONE BEDDING FOR PIPE IS REQUIRED UNLESS OTHERWISE APPROVED BY CITY ENGINEER OR THEIR DESIGNEE,

Fayetteville North Carolina — ENGINEERING & INFRASTRUCTURE DEPARTMENT, 433 HAY ST. 28301, (910) 433-1656

TYPICAL STORM DRAIN COMPACTION

CAD FILE: STMSCOMP	DR-1	DATE 5/11/2016	DRAWN BY CSA
		SCALE N.T.S.	CK'D BY CSA



ELEVATION

SIDE ELEVATION

GENERAL NOTES:

1) DIMENSION "F" SHALL BE 12" + WIDTH OF DAMAGE.
2) EXISTING PIPE REMOVED SHALL BE REPLACED WITH NEW RCP.
3) COLLARS NOT TO BE USED IF DAMAGE IS 16' OR CLOSER TO EXISTING STRUCTURE. IF DAMAGE IS THIS CLOSE NEW PIPE TO BE RELAID TO NEAREST STRUCTURE.
4) ALL WORK TO BE INSPECTED BY SENIOR ENGINEER OR DESIGNATE PRIOR TO CONCRETE PLACEMENT.
5) CONSTRUCT COLLAR WITH FORMED 3000 PSI CONCRETE WITH AIR ENTRAINMENT.
6) DAMAGED PIPE WITH MORE THAN 3" OF DAMAGE SHALL BE REPLACED WITH NEW PIPE.
7) METAL FLASHING SHALL BE USED TO SEAL JOINT PRIOR TO CONCRETE PLACEMENT. GAP AT JOINT MAY NOT EXCEED 3".

D	E	F	CU. YD.
15"	8"	12"+	.03990
18"	8"	12"+	0.4465
24"	12"	12"+	0.5526
30"	12"	12"+	0.6560
36"	12"	12"+	0.7640
42"	12"	12"+	0.8856
48"	12"	12"+	1.0126
54"	18"	18"+	2.5793
60"	18"	18"+	2.8506
66"	18"	18"+	3.1307
72"	18"	18"+	3.4176

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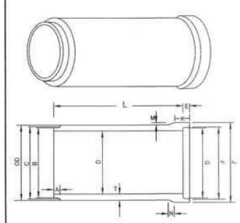
CONCRETE PIPE COLLAR FOR REPAIRING STORM DRAIN PIPES ADOPTED FROM NCDOT STANDARD 840.72

CAD FILE : ConcretePipeCollar	DR-10	DATE 3/19/2008	DRAWN BY C.W.
		SCALE N.T.S.	CK'D BY C.A.

SIZE D	T	L	POUNDS PER FOOT	ASTM SPEC. & CLASS	OD	A	B	C	E	F	G	J	K	M	N	PLANT
15	B2$\frac{1}{4}$	8'	134	ASTM C76 III IV V	$19\frac{1}{2}$	2	$16\frac{15}{16}$	$17\frac{1}{4}$	2	$17\frac{3}{4}$	17	$21\frac{3}{8}$	$4\frac{1}{2}$	$\frac{7}{16}$	$1\frac{1}{4}$	SR VN-KN
18	B2$\frac{1}{2}$	8'	173	ASTM C76 III IV V	23	2	20	$20\frac{3}{4}$	2	$21\frac{1}{4}$	$20\frac{1}{2}$	$23\frac{1}{2}$	$6\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{4}$	SR VN-KN
24	B3	8'	268	ASTM C76 III IV V	30	$2\frac{1}{2}$	$26\frac{3}{16}$	$26\frac{7}{8}$	$2\frac{13}{16}$	$27\frac{3}{4}$	27	$31\frac{1}{32}$	$4\frac{1}{4}$	$\frac{1}{2}$	$1\frac{1}{2}$	VN-KN SR
30	B3$\frac{1}{2}$	8'	396	ASTM C76 III IV V	37	$2\frac{15}{16}$	$32\frac{1}{16}$	$33\frac{1}{8}$	3	$34\frac{1}{32}$	$33\frac{1}{32}$	$38\frac{1}{2}$	$5\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	SR-K
36	B4	8'	543	ASTM C76 III IV V	44	$3\frac{3}{4}$	$39\frac{1}{4}$	$39\frac{29}{32}$	$3\frac{13}{16}$	$40\frac{19}{32}$	$40\frac{5}{16}$	$46\frac{1}{2}$	6	$1\frac{1}{4}$	$2\frac{11}{16}$	SR-K



A MINIMUM OF 6" OF #57 WASHED STONE IS REQUIRED FOR ALL PIPE INSTALLATION. SEE CITY CITY OF FAYETTEVILLE STANDARD DETAIL DR-1.

MODIFIED TONGUE AND GROOVE

8 FOOT LENGTH

MORTAR OF FLEXIBLE PLASTIC TYPE JOINT

SPECIFICATIONS:
ASTM C 76-LATEST
NCDOT
REINFORCED IN ACCORDANCE WITH APPLICABLE SPECIFICATIONS

LIFT HOLES STANDARD ON 36" AS ALLOWED PER ASTM SPECIFICATIONS

MINIMUM FILL UNDER ROADWAYS	
PIPE CLASS	MINIMUM FILL
CLASS III	2'
CLASS IV	1'
CLASS V	1'

FILL HEIGHT IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT STRUCTURE.

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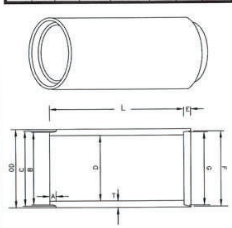
REINFORCED CONCRETE SEWER, STORM DRAIN AND CULVERT PIPE (15"-36")

CAD FILE : PIPESECT	DR-19	DATE 4/10/2014	DRAWN BY C.A.
		SCALE N.T.S.	CK'D BY C.A.

SIZE D	T	L	POUNDS PER FOOT	ASTM SPEC. & CLASS	OD	A	B	C	E	F	G	PLANT
42	C5$\frac{1}{4}$	8'	807	ASTM C76 III IV V	$52\frac{1}{2}$	$4\frac{1}{4}$	$45\frac{15}{32}$	$46\frac{17}{32}$	$4\frac{5}{16}$	$47\frac{3}{16}$	$46\frac{7}{8}$	SR
48	C5$\frac{3}{4}$	8'	1018	ASTM C76 III IV V	$59\frac{1}{2}$	$4\frac{1}{4}$	$51\frac{3}{4}$	$52\frac{1}{2}$	$4\frac{5}{16}$	$53\frac{3}{16}$	$52\frac{7}{8}$	SR
54	C6$\frac{1}{4}$	8'	1228	ASTM C76 III IV V	$66\frac{1}{2}$	$4\frac{1}{4}$	$57\frac{1}{2}$	$58\frac{1}{4}$	$4\frac{5}{16}$	$58\frac{19}{32}$	$58\frac{19}{32}$	SR
60	C6$\frac{3}{4}$	8'	1488	ASTM C76 III IV V	$73\frac{1}{2}$	$4\frac{3}{4}$	$63\frac{15}{16}$	$64\frac{25}{32}$	$4\frac{13}{16}$	$65\frac{3}{32}$	$65\frac{7}{8}$	SR
66	C7$\frac{1}{4}$	8'/12'	1791	ASTM C76 III IV V	$80\frac{1}{2}$	5	71	$71\frac{11}{16}$	$5\frac{1}{16}$	$71\frac{7}{8}$	$71\frac{19}{32}$	SR
72	C7$\frac{3}{4}$	8'/12'	2052	ASTM C76 III IV V	$87\frac{1}{2}$	5	$77\frac{9}{32}$	$77\frac{15}{16}$	$5\frac{1}{16}$	$78\frac{1}{8}$	$77\frac{7}{8}$	SR

MINIMUM FILL UNDER ROADWAYS	
PIPE CLASS	MINIMUM FILL
CLASS III	2'
CLASS IV	1'
CLASS V	1'

FILL HEIGHT IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT STRUCTURE.



A MINIMUM OF 6" OF #57 WASHED STONE IS REQUIRED FOR ALL PIPE INSTALLATION. SEE CITY CITY OF FAYETTEVILLE STANDARD DETAIL DR-1.

TONGUE AND GROOVE

8 FOOT LENGTH (66" OR 72" MAY BE 12FT)

MORTAR OF FLEXIBLE PLASTIC TYPE JOINT

SPECIFICATIONS:
ASTM C 76-LATEST
NCDOT
REINFORCED IN ACCORDANCE WITH APPLICABLE SPECIFICATIONS

LIFT HOLES STANDARD ON AS ALLOWED PER ASTM SPECIFICATIONS

Fayetteville North Carolina — ENGINEERING & INFRASTRUCTURE DEPT., CIVIL ENGINEERING DIVISION, 433 HAY ST. 28301, (910) 433-1656

REINFORCED CONCRETE SEWER, STORM DRAIN AND CULVERT PIPE (42"-72")

CAD FILE : PIPESECT2	DR-19.1	DATE 4/10/2014	DRAWN BY C.A.
		SCALE N.T.S.	CK'D BY C.A.

SIZE D IN.	MIN. SLOPE (FT)		CLEARANCE DIST. (FT)	
	RCP	CMP	RCP	CMP
15	0.00325	0.01107	2.4	2.3
18	0.00255	0.00868	2.7	2.6
24	0.00174	0.00592	3.3	3.1
30	0.00129	0.00439	3.8	3.6
36	0.00101	0.00345	4.3	4.1
42	0.00082	0.00281	4.9	4.6
48	0.00069	0.00235	5.4	5.1

MINIMUM FILL UNDER ROADWAYS	
PIPE CLASS	MINIMUM FILL
CLASS III	2'
CLASS IV	1'
CLASS V	1'

FILL HEIGHT IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT STRUCTURE.

NOTES:
1. THE MAXIMUM PIPE VELOCITY SHALL NOT EXCEED 20 FT PER SEC., BUT SHALL NOT CAUSE SCOUR OR OTHER EROSION PROBLEMS IN THE RECEIVING CHANNEL.

2. SLOPES REQUIRED TO MAINTAIN MINIMUM VELOCITY OF 3 FT PER SEC. AT FULL FLOW.

3. THE MINIMUM SIZE STORM DRAIN PIPE SHALL BE 15 IN.

4. ALL STORM DRAINAGE PIPE USED WITHIN CITY RIGHT-OF-WAY SHALL BE REINFORCED CONCRETE PIPE (RCP). ALL RCP SHALL BE CLASS III OR HIGHER.

5. CLEARANCE DISTANCE IS DETERMINED FROM THE PIPE INVERT ELEVATION UP.

A MINIMUM OF 6" OF #57 WASHED STONE IS REQUIRED FOR ALL PIPE INSTALLATION. SEE CITY CITY OF FAYETTEVILLE STANDARD DETAIL DR-1.

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MINIMUM SLOPE & COVER FOR STORM DRAIN AND CULVERT PIPE

CAD FILE : PIPESECT3	DR-19.2	DATE 4/10/2014	DRAWN BY C.A.
		SCALE N.T.S.	CK'D BY C.A.

PWC DWG # DS-15379

DATE	REVISIONS	BY

SHEET SERIES-FINAL

DATE: 4/1/2019
SURVEY/GPS BY: STEWART
DRAWN BY: AMH/MP
CHECKED BY: DKP
SCALE: HOR: 1"=NTS VERT: 1"=NTS

WK DICKSON — community infrastructure consultants, Transportation • Water Resources, Urban Development • Geomatics, 720 Corporate Center Drive, Raleigh, North Carolina 27607, (v) 919.782.0495, (f) 919.782.9672, www.wkdickson.com

SHEET # G8

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 29430 DANIEL K. PEPLINSKI

STORM DRAINAGE (1)
ANNEXATION PHASE V, AREA 24
FAYETTEVILLE, NORTH CAROLINA

PWC — PUBLIC WORKS COMMISSION OF THE CITY OF FAYETTEVILLE
WATER RESOURCES ENGINEERING
P.O. Box 1089, Fayetteville, NC 28302
955 Old Wilmington Road, Fayetteville, NC 28301
Electric & Water Utilities

20190126.00.RA

NATIONWIDE PERMIT 12
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
FINAL NOTICE OF ISSUANCE AND MODIFICATION OF NATIONWIDE PERMITS
FEDERAL REGISTER
AUTHORIZED MARCH 19, 2017

Utility Line Activities. Activities required for the construction, maintenance, repair, and removal of utility lines and associated facilities in waters of the United States, provided the activity does not result in the loss of greater than 1/2-acre of waters of the United States for each single and complete project.

Utility lines: This NWP authorizes discharges of dredged or fill material into waters of the United States and structures or work in navigable waters for crossings of those waters associated with the construction, maintenance, or repair of utility lines, including outfall and intake structures. There must be no change in pre-construction contours of waters of the United States. A "utility line" is defined as any pipe or pipeline for the transportation of any gaseous, liquid, liquescent, or slurry substance, for any purpose, and any cable, line, or wire for the transmission for any purpose of electrical energy, telephone, and telegraph messages, and internet, radio, and television communication. The term "utility line" does not include activities that drain a water of the United States, such as drainage tile or french drains, but it does apply to pipes conveying drainage from another area.

Material resulting from trench excavation may be temporarily sidecast into waters of the United States for no more than three months, provided the material is not placed in such a manner that it is dispersed by currents or other forces. The district engineer may extend the period of temporary side casting for no more than a total of 180 days, where appropriate. In wetlands, the top 6 to 12 inches of the trench should normally be backfilled with topsoil from the trench. The trench cannot be constructed or backfilled in such a manner as to drain waters of the United States (e.g., backfilling with extensive gravel layers, creating a french drain effect). Any exposed slopes and stream banks must be stabilized immediately upon completion of the utility line crossing of each waterbody.

Utility line substations: This NWP authorizes the construction, maintenance, or expansion of substation facilities associated with a power line or utility line in non-tidal waters of the United States, provided the activity, in combination with all other activities included in one single and complete project, does not result in the loss of greater than 1/2-acre of waters of the United States. This NWP does not authorize discharges into non-tidal wetlands adjacent to tidal waters of the United States to construct, maintain, or expand substation facilities.

Foundations for overhead utility line towers, poles, and anchors: This NWP authorizes the construction or maintenance of foundations for overhead utility line towers, poles, and anchors in all waters of the United States, provided the foundations are the minimum size necessary and separate footings for each tower leg (rather than a larger single pad) are used where feasible.

Access roads: This NWP authorizes the construction of access roads for the construction and maintenance of utility lines, including overhead power lines and utility line substations, in non-tidal waters of the United States, provided the activity, in combination with all other activities included in one single and complete project, does not cause the loss of greater than 1/2-acre of non-tidal waters of the United States. This NWP does not authorize discharges into non-tidal wetlands adjacent to tidal waters for access roads. Access roads must be the minimum width necessary (see Note 2, below). Access roads must be constructed so that the length of the road minimizes any adverse effects on waters of the United States and must be as near as possible to pre-construction contours and elevations (e.g., at grade corduroy roads or geotextile/gravel roads). Access roads constructed above pre-construction contours and elevations in waters of the United States must be properly bridged or culverted to maintain surface flows.

This NWP may authorize utility lines in or affecting navigable waters of the United States even if there is no associated discharge of dredged or fill material (See 33 CFR part 322). Overhead utility lines constructed over section 10 waters and utility lines that are routed in or under section 10 waters without a discharge of dredged or fill material require a section 10 permit.

This NWP authorizes, to the extent that Department of the Army authorization is required, temporary structures, fills, and work necessary for the remediation of inadvertent returns of drilling fluids to waters of the United States through sub-soil fissures or fractures that might occur during horizontal directional drilling activities conducted for the purpose of installing or replacing utility lines. These remediation activities must be done as soon as practicable, to restore the affected waterbody. District engineers may add special conditions to this NWP to require a remediation plan for addressing inadvertent returns of drilling fluids to waters of the United States during horizontal directional drilling activities conducted for the purpose of installing or replacing utility lines.

This NWP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to conduct the utility line activity. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. After construction, temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity if any of the following criteria are met: (1) the activity involves mechanized land clearing in a forested wetland for the utility line right-of-way; (2) a section 10 permit is required; (3) the utility line in waters of the United States, excluding overhead lines, exceeds 500 feet; (4) the utility line is placed within a jurisdictional area (i.e., water of the United States), and it runs parallel to or along a stream bed that is within that jurisdictional area; (5) discharges that result in the loss of greater than 1/10-acre of waters of the United States; (6) permanent access roads are constructed above

grade in waters of the United States for a distance of more than 500 feet; or (7) permanent access roads are constructed in waters of the United States with impervious materials. (See general condition 32.) (Authorities: Sections 10 and 404)

Note 1: Where the utility line is constructed or installed in navigable waters of the United States (i.e., section 10 waters) within the coastal United States, the Great Lakes, and United States territories, a copy of the NWP verification will be sent by the Corps to the National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), for charting the utility line to protect navigation.

Note 2: For utility line activities crossing a single waterbody more than one time at separate and distant locations, or multiple waterbodies at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. Utility line activities must comply with 33 CFR 330.6(d).

Note 3: Utility lines consisting of aerial electric power transmission lines crossing navigable waters of the United States (which are defined at 33 CFR part 329) must comply with the applicable minimum clearances specified in 33 CFR 322.5(i).

Note 4: Access roads used for both construction and maintenance may be authorized, provided they meet the terms and conditions of this NWP. Access roads used solely for construction of the utility line must be removed upon completion of the work, in accordance with the requirements for temporary fills.

Note 5: Pipes or pipelines used to transport gaseous, liquid, liquescent, or slurry substances over navigable waters of the United States are considered to be bridges, not utility lines, and may require a permit from the U.S. Coast Guard pursuant to section 9 of the Rivers and Harbors Act of 1899. However, any discharges of dredged or fill material into waters of the United States associated with such pipelines will require a section 404 permit (see NWP 15).

Note 6: This NWP authorizes utility line maintenance and repair activities that do not qualify for the Clean Water Act section 404(f) exemption for maintenance of currently serviceable fills or fill structures.

Note 7: For overhead utility lines authorized by this NWP, a copy of the PCN and NWP verification will be provided to the Department of Defense Siting Clearinghouse, which will evaluate potential effects on military activities.

Note 8: For NWP 12 activities that require pre-construction notification, the PCN must include any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings that require Department of the Army authorization but do not require pre-construction notification (see paragraph (b) of general condition 32). The district engineer will evaluate the PCN in accordance with Section D, "District Engineer's Decision." The district engineer may require mitigation to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see general condition 23).

NATIONWIDE PERMIT GENERAL CONDITIONS

The following General Conditions must be followed in order for any authorization by a NWP to be valid:

1. Navigation. (a) No activity may cause more than a minimal adverse effect on navigation.

(b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.

(c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. Aquatic Life Movements. No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3. Spawning Areas. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. Migratory Bird Breeding Areas. Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. Shellfish Beds. No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. Suitable Material. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

7. Water Supply Intakes. No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. Adverse Effects From Impoundments. If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. Management of Water Flows. To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. Fills Within 100-Year Floodplains. The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. Equipment. Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. Soil Erosion and Sediment Controls. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow, or during low tides.

13. Removal of Temporary Fills. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. Proper Maintenance. Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. Single and Complete Project. The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. Wild and Scenic Rivers. (a) No NWP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status,

unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status.

(b) If a proposed NWP activity will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, the permittee must submit a pre-construction notification (see general condition 32). The district engineer will coordinate the PCN with the Federal agency with direct management responsibility for that river. The permittee shall not begin the NWP activity until notified by the district engineer that the Federal agency with direct management responsibility for that river has determined in writing that the proposed NWP activity will not adversely affect the Wild and Scenic River designation or study status.

(c) Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: http://www.rivers.gov/.

17. Tribal Rights. No NWP activity may cause more than minimal adverse effects on tribal rights (including treaty rights), protected tribal resources, or tribal lands.

18. Endangered Species. (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless ESA section 7 consultation addressing the effects of the proposed activity has been completed. Direct effects are the immediate effects on listed species and critical habitat caused by the NWP activity. Indirect effects are those effects on listed species and critical habitat that are caused by the NWP activity and are later in time, but still are reasonably certain to occur.

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. If pre-construction notification is required for the proposed activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that

might be affected by the proposed activity or that utilize the designated critical habitat that might be affected by the proposed activity. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non- Federal applicant of the Corps' determination within 45 days of receipt of a complete pre- construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the activity, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification that the proposed activity will have "no effect" on listed species or critical habitat, or until ESA section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species-specific permit conditions to the NWPs.

(e) Authorization of an activity by an NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

(f) If the non-federal permittee has a valid ESA section 10(a)(1)(B) incidental take permit with an approved Habitat Conservation Plan for a project or a group of projects that includes the proposed NWP activity, the non-federal applicant should provide a copy of that ESA section 10(a)(1)(B) permit with the PCN required by paragraph (c) of this general condition. The district engineer will coordinate with the agency that issued the ESA section 10(a)(1)(B) permit to determine whether the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation conducted for the ESA section 10(a)(1)(B) permit. If that coordination results in concurrence from the agency that the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation for the ESA section 10(a)(1)(B) permit, the district engineer does not need to conduct a separate ESA section 7 consultation for the proposed NWP activity. The district engineer will notify the non-federal applicant within 45 days of receipt of a complete pre-construction notification whether the ESA section 10(a)(1)(B) permit covers the proposed NWP activity or whether additional ESA section 7 consultation is required.

(g) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the FWS and NMFS or their world wide web pages at http://www.fws.gov/ or http://www.fws.gov/ipac and http://www.nmfs.noaa.gov/pr/species/esa/ respectively.

19. Migratory Birds and Bald and Golden Eagles. The permittee is responsible for ensuring their action complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting appropriate local office of the U.S. Fish and Wildlife Service to determine applicable measures to reduce impacts to migratory

birds or eagles, including whether "incidental take" permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

20. Historic Properties. (a) In cases where the district engineer determines that the activity may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of section 106 of the National Historic Preservation Act. If pre-construction notification is required for the proposed NWP activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation is not submitted, then additional consultation under section 106 may be necessary. The respective federal agency is responsible for fulfilling its obligation to comply with section 106.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the NWP activity might have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties might have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of, or potential for, the presence of historic properties can be sought from the State Historic Preservation Officer, Tribal Historic Preservation Officer, or designated tribal representative, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted in the PCN and these identification efforts, the district engineer shall determine whether the proposed NWP activity has the potential to cause effects on the historic properties. Section 106 consultation is not required when the district engineer determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). Section 106 consultation is required when the district engineer determines that the activity has the potential to cause effects on historic properties. The district engineer will conduct consultation with consulting parties identified under 36 CFR 800.2(c) when he or she makes any of the following effect determinations for the purposes of section 106 of the NHPA: no historic properties affected, no adverse effect, or adverse effect. Where the non-Federal applicant has identified historic properties on which the activity might have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects to historic properties or that NHPA section 106 consultation has been completed.

(d) For non-federal permittees, the district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA section 106 consultation is required. If NHPA section 106 consultation is required, the district engineer will notify the non-Federal applicant that he or she cannot begin the activity until section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(e) Prospective permittees should be aware that section 110k of the NHPA (54 U.S.C. 306113) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. Discovery of Previously Unknown Remains and Artifacts. If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. Designated Critical Resource Waters. Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.

(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38, and 54, notification is required in accordance with general condition 32, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. Mitigation. The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects.

(d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation to ensure that the activity results in no more than minimal adverse environmental effects. Compensatory mitigation for losses of streams should be provided, if practicable, through stream rehabilitation, enhancement, or preservation, since streams are difficult-to-replace resources (see 33 CFR 332.3(e)(3)).

(e) Compensatory mitigation plans for NWP activities in or near streams or other open waters will normally include a requirement for the restoration or enhancement, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, the restoration or maintenance/protection of riparian areas may be the only compensatory mitigation required. Restored riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to restore or maintain/protect a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or maintaining/protecting a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of minimization or compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(f) Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in no more than minimal adverse environmental effects. For the NWPs, the preferred mechanism for providing compensatory mitigation is mitigation bank credits or in-

lieu fee program credits (see 33 CFR 332.3(b)(2) and (3)). However, if an appropriate number and type of mitigation bank or in-lieu credits are not available at the time the PCN is submitted to the district engineer, the district engineer may approve the use of permittee-responsible mitigation.

(2) The amount of compensatory mitigation required by the district engineer must be sufficient to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). (See also 33 CFR 332.3(f)).

(3) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, aquatic resource restoration should be the first compensatory mitigation option considered for permittee-responsible mitigation.

(4) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) through (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)).

(5) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.

(6) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan (see 33 CFR 332.4(c)(1)(ii)).

(g) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any NWP activity resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that an NWP activity already meeting the established acreage limits also satisfies the no more than minimal impact requirement for the NWPs.

(h) Permittees may propose the use of mitigation banks, in-lieu fee programs, or permittee-responsible mitigation. When developing a compensatory mitigation proposal, the permittee must consider appropriate and practicable options consistent with the framework at 33 CFR 332.3(b). For activities resulting in the loss of marine or estuarine resources, permittee-responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(i) Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill

material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. Safety of Impoundment Structures. To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. Water Quality. Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. Coastal Zone Management. In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. Regional and Case-By-Case Conditions. The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. Use of Multiple Nationwide Permits. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. Transfer of Nationwide Permit Verifications. If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:
"When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To

validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."

_____
(Transferee)

_____
(Date)

30. Compliance Certification. Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

(a) A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;

(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and

(c) The signature of the permittee certifying the completion of the activity and mitigation.

The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. Activities Affecting Structures or Works Built by the United States. If an NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a "USACE project"), the prospective permittee must submit a pre-construction notification. See paragraph (b)(10) of general condition 32. An activity that requires section 408 permission is not authorized by NWP until the appropriate Corps office issues the section 408 permission to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. Pre-Construction Notification. (a) Timing. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the

prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Pre-Construction Notification: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed activity;

(3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposed activity;

(4) A description of the proposed activity; the activity's purpose; direct and indirect adverse environmental effects the activity would cause, including the anticipated amount of loss of wetlands, other special aquatic sites, and other waters expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; a description of any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed activity; and any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings for linear projects that require Department of the Army authorization but do not require pre-construction notification. The description of the proposed activity and any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the need for compensatory mitigation or other mitigation measures. For single and complete linear projects, the PCN must include the quantity of anticipated losses of wetlands, other special aquatic sites, and other waters for each single and complete crossing of those wetlands, other special aquatic sites, and other waters.

Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the activity and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(5) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(6) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(7) For non-Federal permittees, if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed activity or utilize the designated critical habitat that might be affected by the proposed activity. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with the Endangered Species Act;

(8) For non-Federal permittees, if the NWP activity might have the potential to cause effects to a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, the PCN must state which historic property might have the potential to be affected by the proposed activity or include a vicinity map indicating the location of the historic property. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with section 106 of the National Historic Preservation Act;

(9) For an activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, the PCN must identify the Wild and Scenic River or the "study river" (see general condition 16); and

(10) For an activity that requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, the pre-construction notification must include a statement confirming that the project proponent has submitted a written request for section 408 permission from the Corps office having jurisdiction over that USACE project.

(c) Form of Pre-Construction Notification: The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is an NWP PCN and must include all of the applicable information required in paragraphs (b)(1) through (10) of this general condition. A letter containing the required information may also be used. Applicants may provide electronic files of PCNs and

supporting materials if the district engineer has established tools and procedures for electronic submittals.

(d) Agency Coordination: (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the activity's adverse environmental effects so that they are no more than minimal.

(2) Agency coordination is required for: (i) all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States; (ii) NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of stream bed; (iii) NWP 13 activities in excess of 500 linear feet, fills greater than one cubic yard per running foot, or involve discharges of dredged or fill material into special aquatic sites; and (iv) NWP 54 activities in excess of 500 linear feet, or that extend into the waterbody more than 30 feet from the mean low water line in tidal waters or the ordinary high water mark in the Great Lakes.

(3) When agency coordination is required, the district engineer will immediately provide (e.g., via e-mail, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (FWS, state natural resource or water quality agency, EPA, and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to notify the district engineer via telephone, facsimile transmission, or e-mail that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse environmental effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects of the proposed activity are no more than minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(4) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(5) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

DISTRICT ENGINEER'S DECISION

1. In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal

individual or cumulative adverse environmental effects or may be contrary to the public interest. If a project proponent requests authorization by a specific NWP, the district engineer should issue the NWP verification for that activity if it meets the terms and conditions of that NWP, unless he or she determines, after considering mitigation, that the proposed activity will result in more than minimal individual and cumulative adverse effects on the aquatic environment and other aspects of the public interest and exercises discretionary authority to require an individual permit for the proposed activity. For a linear project, this determination will include an evaluation of the individual crossings of waters of the United States to determine whether they individually satisfy the terms and conditions of the NWP(s), as well as the cumulative effects caused by all of the crossings authorized by NWP. If an applicant requests a waiver of the 300 linear foot limit on impacts to streams or of an otherwise applicable limit, as provided for in NWPs 13, 21, 29, 36, 39, 40, 42, 43, 44, 50, 51, 52, or 54, the district engineer will only grant the waiver upon a written determination that the NWP activity will result in only minimal individual and cumulative adverse environmental effects. For those NWPs that have a waivable 300 linear foot limit for losses of intermittent and ephemeral stream bed and a 1/2-acre limit (i.e., NWPs 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52), the loss of intermittent and ephemeral stream bed, plus any other losses of jurisdictional waters and wetlands, cannot exceed 1/2-acre.

2. When making minimal adverse environmental effects determinations the district engineer will consider the direct and indirect effects caused by the NWP activity. He or she will also consider the cumulative adverse environmental effects caused by activities authorized by NWP and whether those cumulative adverse environmental effects are no more than minimal. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type of resource that will be affected by the NWP activity, the functions provided by the aquatic resources that will be affected by the NWP activity, the degree or magnitude to which the aquatic resources perform those functions, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic resource functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. If an appropriate functional or condition assessment method is available and practicable to use, that assessment method may be used by the district engineer to assist in the minimal adverse environmental effects determination. The district engineer may add case-specific special conditions to the NWP authorization to address site- specific environmental concerns.

3. If the proposed activity requires a PCN and will result in a loss of greater than 1/10-acre of wetlands, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for NWP activities with smaller impacts, or for impacts to other types of waters (e.g., streams). The district engineer will consider any proposed compensatory mitigation or other mitigation measures the applicant has included in the proposal in determining whether the net adverse environmental effects of the proposed activity are no more than minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse environmental effects are no more than minimal, after considering mitigation, the district engineer will notify the permittee and

include any activity-specific conditions in the NWP verification the district engineer deems necessary. Conditions for compensatory mitigation requirements must comply with the appropriate provisions at 33 CFR 332.3(k). The district engineer must approve the final mitigation plan before the permittee commences work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the proposed compensatory mitigation plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure the NWP activity results in no more than minimal adverse environmental effects. If the net adverse environmental effects of the NWP activity (after consideration of the mitigation proposal) are determined by the district engineer to be no more than minimal, the district engineer will provide a timely written response to the applicant. The response will state that the NWP activity can proceed under the terms and conditions of the NWP, including any activity-specific conditions added to the NWP authorization by the district engineer.

4. If the district engineer determines that the adverse environmental effects of the proposed activity are more than minimal, then the district engineer will notify the applicant either: (a) that the activity does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (b) that the activity is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal; or (c) that the activity is authorized under the NWP with specific modifications or conditions. Where the district engineer determines that mitigation is required to ensure no more than minimal adverse environmental effects, the activity will be authorized within the 45-day PCN period (unless additional time is required to comply with general conditions 18, 20, and/or 31, or to evaluate PCNs for activities authorized by NWPs 21, 49, and 50), with activity-specific conditions that state the mitigation requirements. The authorization will include the necessary conceptual or detailed mitigation plan or a requirement that the applicant submit a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal. When compensatory mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan or has determined that prior approval of a final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation.

FURTHER INFORMATION

1. District Engineers have authority to determine if an activity complies with the terms and conditions of an NWP.

2. NWPs do not obviate the need to obtain other federal, state, or local permits, approvals, or authorizations required by law.

3. NWPs do not grant any property rights or exclusive privileges.

4. NWPs do not authorize any injury to the property or rights of others.

5. NWPs do not authorize interference with any existing or proposed Federal project (see general condition 31).

DEFINITIONS

Best management practices (BMPs): Policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects on surface water quality resulting from development. BMPs are categorized as structural or non-structural.

Compensatory mitigation: The restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

Currently serviceable: Useable as is or with some maintenance, but not so degraded as to essentially require reconstruction.

Direct effects: Effects that are caused by the activity and occur at the same time and place.

Discharge: The term "discharge" means any discharge of dredged or fill material into waters of the United States.

Ecological reference: A model used to plan and design an aquatic habitat and riparian area restoration, enhancement, or establishment activity under NWP 27. An ecological reference may be based on the structure, functions, and dynamics of an aquatic habitat type or a riparian area type that currently exists in the region where the proposed NWP 27 activity is located. Alternatively, an ecological reference may be based on a conceptual model for the aquatic habitat type or riparian area type to be restored, enhanced, or established as a result of the proposed NWP 27 activity. An ecological reference takes into account the range of variation of the aquatic habitat type or riparian area type in the region.

Enhancement: The manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area.

Ephemeral stream: An ephemeral stream has flowing water only during, and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

Establishment (creation): The manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area.

High Tide Line: The line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm.

Historic Property: Any prehistoric or historic district, site (including archaeological site), building, structure, or other object included in, or eligible for inclusion in, the National

Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria (36 CFR part 60).

Independent utility: A test to determine what constitutes a single and complete non-linear project in the Corps Regulatory Program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility.

Indirect effects: Effects that are caused by the activity and are later in time or farther removed in distance, but are still reasonably foreseeable.

Intermittent stream: An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

Loss of waters of the United States: Waters of the United States that are permanently adversely affected by filling, flooding, excavation, or drainage because of the regulated activity. Permanent adverse effects include permanent discharges of dredged or fill material that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the United States is a threshold measurement of the impact to jurisdictional waters for determining whether a project may qualify for an NWP; it is not a net threshold that is calculated after considering compensatory mitigation that may be used to offset losses of aquatic functions and services. The loss of stream bed includes the acres or linear feet of stream bed that are filled or excavated as a result of the regulated activity. Waters of the United States temporarily filled, flooded, excavated, or drained, but restored to pre-construction contours and elevations after construction, are not included in the measurement of loss of waters of the United States. Impacts resulting from activities that do not require Department of the Army authorization, such as activities eligible for exemptions under section 404(f) of the Clean Water Act, are not considered when calculating the loss of waters of the United States.

Navigable waters: Waters subject to section 10 of the Rivers and Harbors Act of 1899. These waters are defined at 33 CFR part 329.

Non-tidal wetland: A non-tidal wetland is a wetland that is not subject to the ebb and flow of tidal waters. Non-tidal wetlands contiguous to tidal waters are located landward of the high tide line (i.e., spring high tide line).

Open water: For purposes of the NWPs, an open water is any area that in a year with normal patterns of precipitation has water flowing or standing above ground to the extent that an ordinary high water mark can be determined. Aquatic vegetation within the area of flowing or standing water is either non-emergent, sparse, or absent. Vegetated shallows are considered to be open waters. Examples of "open waters" include rivers, streams, lakes, and ponds.

Ordinary High Water Mark: An ordinary high water mark is a line on the shore established by the fluctuations of water and indicated by physical characteristics, or by other appropriate means that consider the characteristics of the surrounding areas.

Perennial stream: A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the

primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow.

Practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Pre-construction notification: A request submitted by the project proponent to the Corps for confirmation that a particular activity is authorized by nationwide permit. The request may be a permit application, letter, or similar document that includes information about the proposed work and its anticipated environmental effects. Pre-construction notification may be required by the terms and conditions of a nationwide permit, or by regional conditions. A pre-construction notification may be voluntarily submitted in cases where pre-construction notification is not required and the project proponent wants confirmation that the activity is authorized by nationwide permit.

Preservation: The removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

Protected tribal resources: Those natural resources and properties of traditional or customary religious or cultural importance, either on or off Indian lands, retained by, or reserved by or for, Indian tribes through treaties, statutes, judicial decisions, or executive orders, including tribal trust resources.

Re-establishment: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions.

Rehabilitation: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: re-establishment and rehabilitation.

Riffle and pool complex: Riffle and pool complexes are special aquatic sites under the 404(b)(1) Guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a course substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.

Riparian areas: Riparian areas are lands next to streams, lakes, and estuarine- marine shorelines. Riparian areas are transitional between terrestrial and aquatic ecosystems, through which surface and subsurface hydrology connects riverine, lacustrine, estuarine, and marine waters with their adjacent wetlands, non-wetland waters, or uplands. Riparian areas provide a variety of ecological functions and services and help improve or maintain local water quality. (See general condition 23.)

Shellfish seeding: The placement of shellfish seed and/or suitable substrate to increase shellfish production. Shellfish seed consists of immature individual shellfish or individual shellfish attached to shells or shell fragments (i.e., spat on shell). Suitable substrate may consist of shellfish shells, shell fragments, or other appropriate materials placed into waters for shellfish habitat.

Single and complete linear project: A linear project is a project constructed for the purpose of getting people, goods, or services from a point of origin to a terminal point, which often involves multiple crossings of one or more waterbodies at separate and distant locations. The term "single and complete project" is defined as that portion of the total linear project proposed or accomplished by one owner/developer or partnership or other association of owners/developers that includes all crossings of a single water of the United States (i.e., a single waterbody) at a specific location. For linear projects crossing a single or multiple waterbodies several times at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies, and crossings of such features cannot be considered separately.

Single and complete non-linear project: For non-linear projects, the term "single and complete project" is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers. A single and complete non-linear project must have independent utility (see definition of "independent utility"). Single and complete non-linear projects may not be "piecemealed" to avoid the limits in an NWP authorization.

Stormwater management: Stormwater management is the mechanism for controlling stormwater runoff for the purposes of reducing downstream erosion, water quality degradation, and flooding and mitigating the adverse effects of changes in land use on the aquatic environment.

Stormwater management facilities: Stormwater management facilities are those facilities, including but not limited to, stormwater retention and detention ponds and best management practices, which retain water for a period of time to control runoff and/or improve the quality (i.e., by reducing the concentration of nutrients, sediments, hazardous substances and other pollutants) of stormwater runoff.

Stream bed: The substrate of the stream channel between the ordinary high water marks. The substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed.

Stream channelization: The manipulation of a stream's course, condition, capacity, or location that causes more than minimal interruption of normal stream processes. A channelized stream remains a water of the United States.

Structure: An object that is arranged in a definite pattern of organization. Examples of structures include, without limitation, any pier, boat dock, boat ramp, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, artificial island, artificial reef, permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other manmade obstacle or obstruction.

Tidal wetland: A tidal wetland is a jurisdictional wetland that is inundated by tidal waters. Tidal waters rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water

surface can no longer be practically measured in a predictable rhythm due to masking by other waters, wind, or other effects. Tidal wetlands are located channelward of the high tide line.

Tribal lands: Any lands title to which is either: 1) held in trust by the United States for the benefit of any Indian tribe or individual; or 2) held by any Indian tribe or individual subject to restrictions by the United States against alienation.

Tribal rights: Those rights legally accruing to a tribe or tribes by virtue of inherent sovereign authority, unextinguished aboriginal title, treaty, statute, judicial decisions, executive order or agreement, and that give rise to legally enforceable remedies.

Vegetated shallows: Vegetated shallows are special aquatic sites under the 404(b)(1) Guidelines. They are areas that are permanently inundated and under normal circumstances have rooted aquatic vegetation, such as seagrasses in marine and estuarine systems and a variety of vascular rooted plants in freshwater systems.

Waterbody: For purposes of the NWPs, a waterbody is a jurisdictional water of the United States. If a wetland is adjacent to a waterbody determined to be a water of the United States, that waterbody and any adjacent wetlands are considered together as a single aquatic unit (see 33 CFR 328.4(c)(2)). Examples of "waterbodies" include streams, rivers, lakes, ponds, and wetlands.

FINAL REGIONAL CONDITIONS 2017

NOTICE ABOUT WEB LINKS IN THIS DOCUMENT:
The web links (both internal to our Wilmington District and any external links to collaborating agencies) in this document are valid at the time of publication. However, the Wilmington District Regulatory Program web page addresses, as with other agency web sites, may change over the timeframe of the five-year Nationwide Permit renewal cycle, in response to policy mandates or technology advances. While we will make every effort to check on the integrity of our web links and provide re-direct pages whenever possible, we ask that you report any broken links to us so we can keep the page information current and usable. We apologize in advanced for any broken links that you may encounter, and we ask that you navigate from the Regulatory home page (Regulatory Permit Program Wetlands and Streams) of the Wilmington District Corps of Engineers, to the "Permits" section of our web site to find links for pages that cannot be found by clicking directly on the listed web link in this document.

Final 2017 Regional Conditions for Nationwide Permits (NWP) in the Wilmington District

1.0 Excluded Waters

The Corps has identified waters that will be excluded from the use of all NWP's during certain timeframes. These waters are:

1.1 Anadromous Fish Spawning Areas

Waters of the United States identified by either the North Carolina Division of Marine Fisheries (NCDMF) or the North Carolina Wildlife Resources Commission (NCWRC) as anadromous fish spawning areas are excluded during the period between February 15 and June 30, without prior written approval from the Corps and either NCDMF or NCWRC.

1.2 Trout Waters Moratorium

Waters of the United States in the designated trout watersheds of North Carolina are excluded during the period between October 15 and April 15 without prior written approval from the NCWRC, or from the Eastern Band of Cherokee Indians (EBCI) Fisheries and Wildlife Management (FWM) office if the project is located on EBCI trust land. (See Section 2.7 for information on the designated trout watersheds).

1.3 Sturgeon Spawning Areas as Designated by the National Marine Fisheries Service (NMFS)

Waters of the United States designated as sturgeon spawning areas are excluded during the period between February 1 and June 30, without prior written approval from the NMFS.

2.0 Waters Requiring Additional Notification

The Corps has identified waters that will be subject to additional notification requirements for activities authorized by all NWPs. These waters are:

2.1 Western NC Counties that Drain to Designated Critical Habitat

For proposed activities within waters of the United States that require a Pre-Construction Notification (PCN) and are located in the sixteen counties listed below, permittees must provide a copy of the PCN to the U.S. Fish and Wildlife Service (USFWS), 160 Zillicoa Street, Asheville, North Carolina 28801. This PCN must be sent concurrently to the U.S. Fish and Wildlife Service and the Corps Asheville Regulatory Field Office. Please see General Condition 18 for specific notification requirements related to the Endangered Species Act and the below website for information on the location of designated critical habitat.

Counties with tributaries that drain to designated critical habitat that require notification to the Asheville U.S. Fish and Wildlife Service: Avery, Cherokee, Forsyth, Graham, Haywood, Henderson, Jackson, Macon, Mecklenburg, Mitchell, Stokes, Surry, Swain, Transylvania, Union and Yancey.

Website and office addresses for Endangered Species Act Information:

The Wilmington District has developed the following website for permittees which provides guidelines on how to review linked websites and maps in order to fulfill NWP General Condition 18 requirements:
http://www.saw.usace.army.mil/Missions/RegulatoryPermitProgram/AgencyCoordination/ESA.aspx

Permittees who do not have internet access may contact the appropriate U.S. Fish and Wildlife Service offices listed below or Corps at (910) 251-4633:

Asheville U.S. Fish and Wildlife Service Office counties: All counties west of and including Anson, Stanly, Davidson, Forsythe and Stokes Counties.

U.S. Fish and Wildlife Service
Asheville Field Office
160 Zillicoa Street
Asheville, NC 28801
Telephone: (828) 258-3939

Raleigh U.S. Fish and Wildlife Service Office counties: all counties east of and including Richmond, Montgomery, Randolph, Guilford, and Rockingham Counties.

U.S. Fish and Wildlife Service
Raleigh Field Office
Post Office Box 33726

Raleigh, NC 27636-3726
Telephone: (919) 856-4520

2.2 Special Designation Waters

Prior to the use of any NWP, except NWP 3, that involves a discharge of dredged or fill material in any of the following identified waters and/or adjacent wetlands in North Carolina, permittees shall submit a PCN to the District Engineer prior to commencing the activity (see General Condition 32). The North Carolina waters and wetlands that require additional notification requirements are:

"Outstanding Resource Waters" (ORW) or "High Quality Waters" (HQW) as designated by the North Carolina Environmental Management Commission; "Primary Nursery Areas" (PNA), including inland PNA, as designated by the North Carolina Marine Fisheries Commission and the NCWRC; or wetlands adjacent to these waters. Definitions of ORW, HQW and PNA waters can be found in the North Carolina State Administrative Code, Title 15A, Subchapters 2B and 10C (15A NCAC 02B, 15A NCAC 10C) and at the following World Wide Web page: http://reports.oah.state.nc.us/ncac.asp?folderName=\Title%2015A%20-%20Environmental%20Quality&lookUpError=15A%20NCAC%20000%20. Surface water classifications for waters in North Carolina can be viewed at the North Carolina Division of Water Resources website or at the following World Wide Web Page: https://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications

Permittees who do not have internet access may contact the Corps at (910) 251- 4633.

2.3 Coastal Area Management Act (CAMA) Areas of Environmental Concern

Non-federal permittees for any NWP in a designated "Area of Environmental Concern" (AEC) in the twenty (20) counties of Eastern North Carolina covered by the North Carolina Coastal Area Management Act (CAMA) must also obtain the required CAMA permit. Development activities for non-federal projects may not commence until a copy of the approved CAMA permit is furnished to the appropriate Wilmington District Regulatory Field Office (Wilmington Field Office – 69 Darlington Avenue, Wilmington, NC 28403, (910) 251-4802 or Washington Field Office – 2407 West 5th Street, Washington, NC 27889, (910) 251-4610).

2.4 Barrier Islands

Prior to the use of any NWP on a barrier island of North Carolina, permittees must submit a PCN to the District Engineer prior to commencing the activity (see General Condition 32).

2.5 Mountain or Piedmont Bogs

Prior to the use of any NWP in a Bog, as classified by the North Carolina Wetland Assessment Methodology (NCWAM), permittees shall submit a PCN to the District Engineer prior to commencing the activity (see General Condition 32). The latest version of NCWAM can be

viewed on the Corps RIBITS (Regulatory In-lieu Fee and Bank Information Tracking System) website or at the following World Wide Web Page: https://ribits.usace.army.mil/ribits_apex/f?p=107:27:0::NO:::

2.6 Animal Waste Facilities

Prior to use of any NWP for construction of animal waste facilities in waters of the United States, including wetlands, permittees shall submit a PCN to the District Engineer prior to commencing the activity (see General Condition 32).

2.7 Trout Waters

Prior to any discharge of dredge or fill material into streams, waterbodies or wetlands within the 294 designated trout watersheds of North Carolina, the permittee shall submit a PCN (see General Condition 32) to the District Engineer prior to commencing the activity, unless other thresholds are established in the Regional Conditions in Section 4 (Additional Regional Conditions for Specific Nationwide Permits). The permittee shall also provide a copy of the notification to the appropriate NCWRC office, or to the EBCI FWM Office (if the project is located on EBCI trust land), to facilitate the determination of any potential impacts to designated Trout Waters.

Notification to the Corps will include a statement with the name of the NCWRC or EBCI FWM biologist contacted, the date of the notification, the location of work, a delineation of wetlands and waters, a discussion of alternatives to working in the mountain trout waters, why alternatives were not selected, and, if applicable, a plan to provide compensatory mitigation for all unavoidable adverse impacts to mountain trout waters.

NCWRC and NC Trout Watersheds:

NCWRC Contact**	**Counties that are entirely within Trout Watersheds***		**Counties that are partially within Trout Watersheds***	
Mountain Coordinator Balsam Depot 20830 Great Smoky Mountain Expressway Waynesville, NC 28786 Telephone: (828) 558-6011 For NCDOT Projects: NCDOT Coordinator 206 Charter. Street Albemarle, NC 28001 Telephone: (704) 982-9181	Alleghany Ashe Avery Graham Haywood	Jackson Macon Swain Transylvania Watauga	Burke Buncombe Caldwell Cherokee Clay Henderson Madison	McDowell Mitchell Polk Rutherford Surry Wilkes Yancey

*NOTE: To determine notification requirements, contact the Corps Asheville Regulatory Field Office at (828) 271-7980 or view maps for each County at the following World Wide Web page: http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Agency-Coordination/Trout/.

**If a project is located on EBCI trust land, submit the PCN in accordance with Section 3.14. Contact the Corps Asheville Regulatory Field Office at (828) 271-7980 with questions.

2.8 Western NC Waters and Corridors

The permittee shall submit a PCN (see General Condition 32) to the District Engineer prior to commencing the activity in waters of the United States if the activity will occur within any of the following identified waters in western North Carolina, within 0.5 mile on either side of these waters, or within 0.75 mile of the Little Tennessee River, as measured from the top of the bank of the respective water (i.e., river, stream, or creek):

Brasstown Creek
Burningtown Creek
Cane River
Caney Fork
Cartoogechaye Creek
Chattooga River
Cheoah River
Cowee Creek
Cullasaja River
Deep Creek
Ellijay Creek
French Broad River
Garden Creek
Hiwassee River
Hominy Creek
Iotla Creek
Little Tennessee River (within the river or within 0.75 mile on either side of this river)
Nantahala River
Nolichucky River
North Fork French Broad River
North Toe River
Nottley River
Oconaluftee River (portion not located on trust/EBCI land)
Peachtree Creek
Shooting Creek
Snowbird Creek
South Toe River
Stecoah Creek
Swannanoa River
Sweetwater Creek

Tuckasegee River (also spelled Tuckaseegee or Tuckaseigee)
Valley River
Watauga Creek
Watauga River
Wayah Creek
West Fork French Broad River

To determine notification requirements, contact the Corps Asheville Regulatory Field Office at (828) 271-7980 or view maps for all corridors at the following World Wide Web page: http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Agency-Coordination/Designated-Special-Waters.aspx

3.0 List of Corps Regional Conditions for All Nationwide Permits

The following conditions apply to all Nationwide Permits in the Wilmington District:

3.1 Limitation of Loss of Stream Bed

NWPs may not be used for activities that may result in the loss or degradation of more than 300 total linear feet of stream bed, unless the District Engineer has waived the 300 linear foot limit for ephemeral and intermittent streams on a case-by-case basis and has determined that the proposed activity will result in minimal individual and cumulative adverse impacts to the aquatic environment. Waivers for the loss of ephemeral and intermittent streams must be in writing and documented by appropriate/accepted stream quality assessments*. This waiver only applies to the 300 linear feet threshold for NWPs.

This Regional Condition does not apply to NWP 23 (Approved Categorical Exclusions).

*NOTE: Permittees should utilize the most current methodology prescribed by Wilmington District to assess stream function and quality. Information can be found at: https://ribits.usace.army.mil/ribits_apex/f?p=107:27:0::NO:::

3.2 Mitigation for Loss of Stream Bed

For any NWP that results in a loss of more than 150 linear feet of stream, the permittee shall provide a mitigation proposal to compensate for more than minimal individual and cumulative adverse impacts to the aquatic environment. For stream losses of 150 linear feet or less that require a PCN, the District Engineer may determine, on a case-by-case basis, that compensatory mitigation is required to ensure that the activity results in minimal adverse effect on the aquatic environment.

3.3 Pre-construction Notification for Loss of Streambed Exceeding 150 Feet

Prior to use of any NWP for any activity which impacts more than 150 total linear feet of perennial stream, intermittent or ephemeral stream, the permittee shall submit a PCN to the District Engineer prior to commencing the activity (see General Condition 32). This applies to

NWPs that do not have specific notification requirements. If a NWP has specific notification requirements, the requirements of the NWP should be followed.

3.4 Restriction on Use of Live Concrete

For all NWPs which allow the use of concrete as a building material, live or fresh concrete, including bags of uncured concrete, may not come into contact with the water in or entering into waters of the United States. Water inside coffer dams or casings that has been in contact with wet concrete shall only be returned to waters of the United States after the concrete is set and cured and when it no longer poses a threat to aquatic organisms.

3.5 Requirements for Using Riprap for Bank Stabilization

For all NWPs that allow for the use of riprap material for bank stabilization, the following measures shall be applied:

3.5.1. Where bank stabilization is conducted as part of an activity, natural design, bioengineering and/or geoengineering methods that incorporate natural durable materials, native seed mixes, and native plants and shrubs are to be utilized to the maximum extent practicable.

3.5.2. Filter cloth must be placed underneath the riprap as an additional requirement of its use in North Carolina waters. The placement of filter fabric is not required if the riprap will be pushed or "keyed" into the bank of the waterbody. A waiver from the specifications in this Regional Condition may be requested in writing. The waiver will only be issued if it can be demonstrated that the impacts of complying with this Regional Condition would result in greater adverse impacts to the aquatic environment.

3.5.3. The placement of riprap shall be limited to the areas depicted on submitted work plan drawings.

3.5.4. The riprap material shall be clean and free from loose dirt or any pollutant except in trace quantities that would not have an adverse environmental effect.

3.5.5. It shall be of a size sufficient to prevent its movement from the authorized alignment by natural forces under normal conditions.

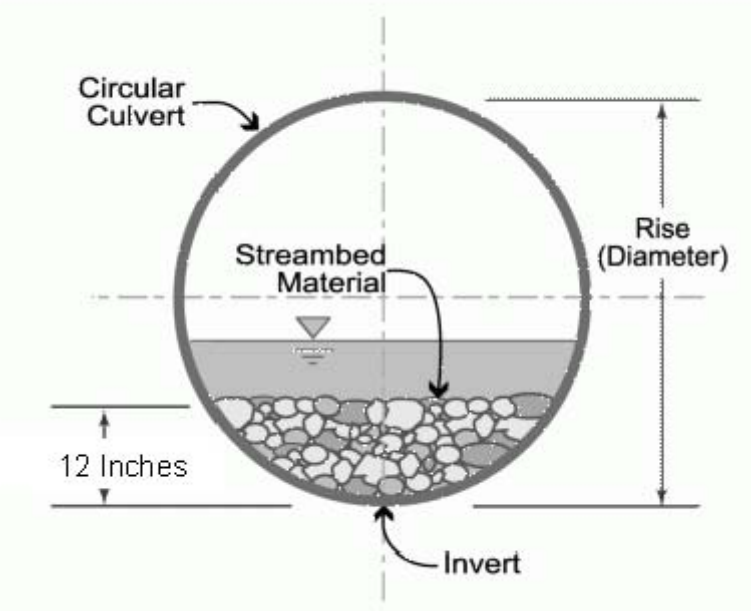
3.5.6. The riprap material shall consist of clean rock or masonry material such as, but not limited to, granite, marl, or broken concrete.

3.6 Requirements for Culvert Placement

3.6.1 For all NWPs that involve the construction/installation of culverts, measures will be included in the construction/installation that will promote the safe passage of fish and other aquatic organisms. The dimension, pattern, and profile of the stream above and below a pipe or culvert should not be modified by altering the width or depth of the stream profile in connection with the construction activity. The width, height, and gradient of a proposed culvert should be

sufficient to pass the average historical low flow and spring flow without adversely altering flow velocity. Spring flow is the seasonal sustained high flow that typically occurs in the spring. Spring flows should be determined from gage data, if available. In the absence of such data, bank-full flow can be used as a comparable indicator.

In Public Trust Areas of Environmental Concern (AEC) and/or the Estuarine Waters AEC as designated by the Coastal Area Management Act (CAMA): All pipes/culverts must be sufficiently sized to allow for the burial of the bottom of the culvert at least one foot below normal bed elevation.



In all other areas: Culverts greater than 48 inches in diameter will be buried at least one foot below the bed of the stream. Culverts 48 inches in diameter or less shall be buried to maintain aquatic passage and to maintain passage during drought or low flow conditions, and every effort shall be made to maintain the existing channel slope.

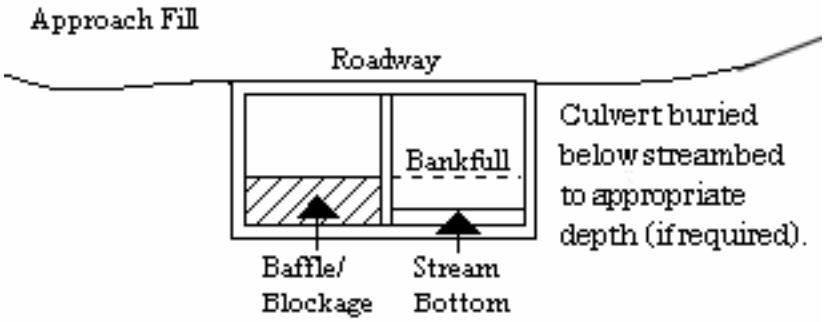
Culverts must be designed and constructed in a manner that minimizes destabilization and head cutting. Destabilizing the channel and head cutting upstream should be considered and appropriate actions incorporated in the design and placement of the culvert.

A waiver from the depth specifications in this condition may be requested, in writing, by the permittee and issued by the Corp; this request must be specific as to the reasons(s) for the request. The waiver will be issued if it can be demonstrated that the proposed design would result in less impacts to the aquatic environment.

All counties: Culverts placed within riparian and/or riverine wetlands must be installed in a manner that does not restrict the flow and circulation patterns of waters of the United States.

Culverts placed across wetland fills purely for the purposes of equalizing surface water do not have to be buried, but the culverts must be of adequate size and/or number to ensure unrestricted transmission of water.

3.6.2 Bank-full flows (or less) shall be accommodated through maintenance of the existing bank-full channel cross sectional area. Additional culverts or culvert barrels at such crossings shall be allowed only to receive bank-full flows.



3.6.3 Where adjacent floodplain is available, flows exceeding bank-full should be accommodated by installing culverts at the floodplain elevation. Additional culverts or culvert barrels at such crossings should not be buried, or if buried, must have sills at the inlets to ensure that they only receive flows exceeding bank-full.

3.6.4 Excavation of existing stream channels shall be limited to the minimum necessary to construct or install the proposed culvert. The final width of the impacted stream at the culvert inlet and outlet should be no greater than the original stream width. A waiver from this condition may be requested in writing; this request must be specific as to the reason(s) for the request. The waiver will be issued if the proposed design would result in less impacts to the aquatic environment and/or if it can be demonstrated that it is not practicable to restore the final width of the impacted stream at the culvert inlet and outlet to the width of the original stream channel.

3.6.5 The width of the culvert shall be comparable to the width of the stream channel. If the width of the culvert is wider than the stream channel, the culvert shall include baffles, benches and/or sills to maintain the width of the stream channel. A waiver from this condition may be requested in writing; this request must be specific as to the reason(s) for the request. The waiver will be issued if it can be demonstrated that it is not practicable or necessary to include baffles, benches or sills and the design would result in less impacts to the aquatic environment.

3.7 Notification to NCDEQ Shellfish Sanitation Section

Permittees shall notify the NCDEQ Shellfish Sanitation Section prior to dredging in or removing sediment from an area closed to shell fishing where the effluent may be released to an area open for shell fishing or swimming in order to avoid contamination from the disposal area and cause a temporary shellfish closure to be made. Such notification shall also be provided to the appropriate Corps Regulatory Field Office. Any disposal of sand to the ocean beach should occur between November 1 and April 30 when recreational usage is low. Only clean sand

should be used and no dredged sand from closed shell fishing areas may be used. If beach disposal were to occur at times other than stated above or if sand from a closed shell fishing area is to be used, a swimming advisory shall be posted, and a press release shall be issued by the permittee.

3.8 Submerged Aquatic Vegetation

Impacts to Submerged Aquatic Vegetation (SAV) are not authorized by any NWP, except NWP 48, unless EFH Consultation has been completed pursuant to the Magnuson-Stevens Fisheries Conservation and Management Act (Magnuson-Stevens Act). Permittees shall submit a PCN (See NWP General Condition 32) to the District Engineer prior to commencing the activity if the project would affect SAV. The permittee may not begin work until notified by the Corps that the requirements of the Magnuson-Stevens Act have been satisfied and that the activity is authorized.

3.9 Sedimentation and Erosion Control Structures and Measures

All PCNs will identify and describe sedimentation and erosion control structures and measures proposed for placement in waters of the United States. The structures and measures should be depicted on maps, surveys or drawings showing location and impacts to jurisdictional wetlands and streams.

3.10 Restoration of Temporary Impacts to Stream Beds

Upon completion of work that involves temporary stream impacts, streambeds are to be restored to pre-project elevations and widths using natural streambed material such that the impacted stream reach mimics the adjacent upstream and downstream reach. The impacted area shall be backfilled with natural streambed material to a depth of at least 12 inches or to the bottom depth of the impacted area if shallower than 12 inches. An engineered in-stream structure or material can be used to provide protection of a buried structure if it provides benefits to the aquatic environment and can be accomplished by a natural streambed design. A permittee may request a waiver of this condition if it is determined a buried structure needs significant physical protection beyond those provided in this condition. This condition does not apply to NWP 27 – Aquatic Habitat Restoration, Enhancement, and Establishment Activities.

3.11 Restoration of Temporary Impacts to Stream Banks

Upon completion of work involving temporary stream bank impacts, stream banks are to be restored to pre-project grade and contours or beneficial grade and contours if the original bank slope is steep and unstable. Natural durable materials, native seed mixes, and native plants and shrubs are to be utilized in the restoration. Natural designs which use bioengineered and/or geo-engineered methods are to be applied. An engineered structure or material can be used to provide protection of a buried structure if it provides benefits to the stream bank environment, provided it is not in excess of the minimum amount needed for protection and does not exceed an average of one cubic yard per running foot placed along the bank below the plane of the ordinary high water mark. A permittee may request a waiver of this condition if it is determined a buried structure

needs significant physical protection beyond those provided in this condition. This condition does not apply to NWP 27 – Aquatic Habitat Restoration, Enhancement, and Establishment Activities.

3.12 Federal Navigation Channel Setbacks and Corps Easements

3.12.1 Authorized structures and fills located in or adjacent to Federally authorized waterways will be constructed in accordance with the latest setback criteria established by the Wilmington District Engineer. You may review the setback policy at http://www.saw.usace.army.mil/Missions/Navigation/Setbacks.aspx. This general permit does not authorize the construction of hardened or permanently fixed structures within the Federally Authorized Channel Setback, unless the activity is approved by the Corps. The permittee shall submit a PCN (see General Condition 32) to the District Engineer prior to the construction of any structures or fills within the Federally Authorized Channel Setback.

3.12.2 The permittee shall obtain a Consent to Cross Government Easement from the Wilmington District's Land Use Coordinator prior to any crossing of the Corps easement and/or prior to commencing construction of any structures, authorized dredging or other work within the right-of-way of, or in proximity to, a federally designated disposal area. The Land Use Coordinator may be contacted at: CESAW-OP-N, 69 Darlington Avenue, Wilmington, North Carolina 28403-1343, email: SAWWeb-NAV@usace.army.mil

3.13 Northern Long-eared Bat – Endangered Species Act Compliance

The Wilmington District, U.S. Army Corps of Engineers has consulted with the United States Fish and Wildlife Service (USFWS) in regards to the threatened Northern long-eared bat (NLEB) (*Myotis septentrionalis*) and Standard Local Operating Procedures for Endangered Species (SLOPES) have been approved by the Corps and the USFWS. This condition concerns effects to the NLEB only and does not address effects to other federally listed species and/or federally designated critical habitat.

A. Procedures when the Corps is the lead federal* agency for a project:

The permittee must comply with (1) and (2) below when:

- the project is located in the western 41 counties of North Carolina, to include non-federal aid North Carolina Department of Transportation (NCDOT) projects, OR;

- the project is located in the 59 eastern counties of North Carolina, and is a non-NCDOT project.

*Generally, if a project is located on private property or on non-federal land, and the project is not being funded by a federal entity, the Corps will be the lead federal agency due to the requirement to obtain Department of the Army authorization to impact waters of the United States. If the project is located on federal land, contact the Corps to determine the lead federal agency.

(1) A permittee using a NWP must check to see if their project is located in the range of the NLEB by using the following website: http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf. If the project is within the range of the NLEB, or if the project includes percussive activities (e.g., blasting, pile driving, etc.), the permittee is then required to check the appropriate website in the paragraph below to discover if their project:

- is located in a 12-digit Hydrologic Unit Code area ("red HUC" - shown as red areas on the map), AND/OR;

- involves percussive activities within 0.25 mile of a red HUC.

Red HUC maps - for the western 41 counties in NC (covered by the Asheville Ecological Services Field Office), check the project location against the electronic maps found at: http://www.fws.gov/asheville/htmls/project_review/NLEB_in_WNC.html. For the eastern 59 counties in NC (covered by the Raleigh Ecological Services Field Office), check the project location against the electronic maps found at: https://www.fws.gov/raleigh/NLEB_RFO.html.

(2) A permittee must submit a PCN to the District Engineer, and receive written authorization from the District Engineer, prior to commencing the activity, if the activity will involve any of the following:

- tree clearing/removal, construction/installation of wind turbines in a red HUC, AND/OR;

- bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, (applies anywhere in the range of the NLEB), AND/OR:

- percussive activities in a red HUC, or within 0.25 mile of a red HUC.

The permittee may proceed with the activity without submitting a PCN to either the Corps or the USFWS, provided the activity complies with all applicable NWP terms and general and regional conditions, if the permittee's review under A.(1) and A.(2) above shows that the project is:

- located outside of a red HUC (and there are no percussive activities), and the activity will NOT include bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, OR;

- located outside of a red HUC and there are percussive activities, but the percussive activities will not occur within 0.25-mile of a red HUC boundary, and the activity will NOT include bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, OR;

- located in a red HUC, but the activity will NOT include: tree clearing/removal; construction/installation of wind turbines; bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, and/or; any percussive activities.

B. Procedures when the USACE is not the lead federal agency:

For projects where another federal agency is the lead federal agency - if that other federal agency has completed project-specific ESA Section 7(a)(2) consultation for the NLEB, and has (1) determined that the project would not cause prohibited incidental take of the NLEB, and (2) completed coordination/consultation that is required by the USFWS (per the directions on the respective USFWS office's website), that project may proceed without notification to either the USACE or the USFWS, provided all General and Regional Permit Conditions are met.

The NLEB SLOPES can be viewed on the USACE website at the following World Wide Web Page: http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Agency-Coordination/ESA/. Permittees who do not have internet access may contact the USACE at (910) 251- 4633.

3.14 Work on Eastern Band of Cherokee Indians Land

All PCNs submitted for activities in waters of the United States on Eastern Band of Cherokee Indians (EBCI) trust land (i.e., Qualla Boundary and non-contiguous tracts of trust land), must comply with the requirements of the latest MOU between the Wilmington District and the Eastern Band of Cherokee Indians.

4.0 Additional Regional Conditions for Specific Nationwide Permits

4.1 NWP #12 - Utility Line Activities

4.1.1 Pipeline/utility line construction through jurisdictional waters and wetlands will be accomplished utilizing directional drilling/boring methods to the maximum extent practicable.

4.1.2 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. Temporary discharges will be fully contained with appropriate erosion control or containment methods or otherwise such fills will consist of non-erodible materials.

4.1.3 The work area authorized by this permit, including temporary and/or permanent fills, will be minimized to the greatest extent practicable. Justification for work corridors exceeding forty (40) feet in width is required and will be based on pipeline diameter and length, size of equipment required to construct the utility line, and other construction information deemed necessary to support the request. The permittee is required to provide this information to the Corps with the initial notification package.

4.1.4 Excavated materials shall be returned to the excavated areas and any remaining materials shall be disposed of in uplands, unless the Corps authorizes disposal in waters of the United States**.**

4.1.5 In areas where a sub-aqueous utility line is to cross a federally-maintained channel, (i.e., the Atlantic Intracoastal Waterway [AIWW]), the line will be buried at least six (6) feet below the allowable overdepth of the authorized channel, including all side slopes. For areas outside federally-maintained channels, sub-aqueous lines must be installed at a minimum depth of two (2) feet below the substrate when such lines might interfere with navigation.

4.1.6 The minimum clearance*(see NOTE in 4.1.7) for aerial communication lines, or any lines not transmitting electrical power, will be ten (10) feet above the clearance required for nearby stationary bridges as established by the U.S. Coast Guard. In the event the U.S. Coast Guard has not established a bridge clearance, minimum vertical clearances for power and aerial lines will not be less than required by Section 23, Rule 232, of the latest revision of the National Electrical Safety Code (ANSI C2). Clearances will not be less than shown in Table 232-1, Item 7, ANSI C2.

4.1.7 The minimum clearance* for an aerial line, transmitting electrical power, is based on the low point of the line under conditions that produce the greatest sag, taking into consideration temperature, load, wind, length or span and the type of supports. The minimum clearance for an aerial electrical power transmission line crossing navigable waters of the United States, where there is an established bridge clearance established by the U.S. Coast Guard, shall be governed by the system voltage, as indicated below:

Nominal System Voltage, kilovolt	Minimum Clearance Above Bridge Clearance (As Established by the U.S. Coast Guard)
115 and below	20 feet
138	22
161	24
230	26
350	30
500	35
700	42
750 to 765	45

*NOTE: Minimum clearance is the distance measured between the lowest point of a stationary bridge, including ***any*** infrastructure attached to underside of the bridge, and the Mean High Water (MHW) of the navigable waters of the United States beneath the bridge.

4.1.8 On navigable waters of the United States, including all federal navigation projects, where there is no bridge for reference for minimum clearance, the proposed project will need to be reviewed by the Corps in order to determine the minimum clearance between the line and MHW necessary to protect navigational interests.

4.1.9 A plan to restore and re-vegetate wetland areas cleared for construction must be submitted with the required PCN. Cleared wetland areas shall be re-vegetated to the maximum extent practicable with native species of canopy, shrub, and herbaceous species. Fescue grass shall not be used.

4.1.10 Any permanently maintained corridor along the utility right of way within forested wetlands shall be considered a permanent impact. A compensatory mitigation plan will be required for all such impacts associated with the requested activity if the activity requires PCN and the cumulative total of permanent forested wetland impacts exceeds 1/10-acre, unless the District Engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse effects of the proposed activity are minimal.

For permanent forested wetland impacts of 1/10-acre or less, the District Engineer may determine, on a case-by-case basis, that compensatory mitigation is required to ensure that the activity results in minimal adverse effects on the aquatic environment.

4.1.11 Use of rip-rap or any other engineered structures to stabilize a stream bed should be avoided to the maximum extent practicable. If riprap stabilization is needed, it should be placed only on the stream banks, or, if it is necessary to be placed in the stream bed, the finished top elevation of the riprap should not exceed that of the original stream bed.

4.1.12 When directional boring or horizontal directional drilling (HDD) under waters of the United States, including wetlands, permittees shall closely monitor the project for hydraulic fracturing or "fracking." Any discharge from hydraulic fracturing or "fracking" into waters of the United States, including wetlands, shall be reported to the appropriate Corps Regulatory Field Office within 48 hours. Restoration and/or compensatory mitigation may be required as a result of any unintended discharges.

4.1.13 For purposes of this NWP, the term utility line does not include pipes or culverts associated with driveways, roadways, lots, etc.

4.1.14 The permittee shall submit a PCN to the District Engineer prior to commencing the activity if the activity will involve the discharge of dredged or fill material into more than 1/10-acre of wetlands or 150 linear feet of stream channel for the construction of temporary access fills and/or temporary road crossings. The PCN must include a restoration plan that thoroughly describes how all temporary fills will be removed, describes how pre-project conditions will be restored, and includes a timetable for all restoration activities.