FAYETTEVILLE PUBLIC WORKS COMMISSION
FAYETTEVILLE, NORTH CAROLINA

GRADING TECHNICAL SPECIFICATIONS
FOR THE
POINT OF DELIVERY 5

ISSUED FOR BIDS

04/10/2026

Revision 1

Booth & Associates, LLC
Consulting Engineers
2300 Rexwoods Drive, Suite 300
Raleigh, NC 27607
Firm License No.: F-0221

FAYETTEVILLE PUBLIC WORKS COMMISSION
FAYETTEVILLE, NORTH CAROLINA

GRADING TECHNICAL SPECIFICATIONS FOR THE POINT OF DELIVERY 5

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1.0 SCOPE OF WORK

1.1 **The work consists of furnishing all labor, equipment, materials, and supplies necessary for grading and installing the access drives and substation pad; installing the all-weather access road and switch pads for Duke Energy structures; installing, maintaining, remediating, and later decommissioning proposed erosion control devices; maintaining, remediating, and later decommissioning existing erosion control devices; installing sidewalks, permanent asphalt driveway aprons, privacy fence, and property perimeter chain link fence and associated gates and stoppers; installing streetscape and landscaping and maintaining the aforementioned under warranty for one year; and ensuring a minimum seventy percent (70%) permanent vegetative coverage of the site and maintaining the aforementioned for one year**; in strict accordance with the Specifications and Drawings and subject to the terms and conditions of the Contract. Omission of particular reference to any such item necessary for complete installation and proper operation thereof shall not relieve the Contractor of responsibility of furnishing same. **Please note the site will be cleared and certain temporary erosion control measures installed by the Owner before work for this Contract begins. If any existing erosion control measures require remediation or if seventy percent (70%) temporary site stabilization is not attained, associated remediation and stabilization efforts are included in this Contract.**

1.2 The attached Drawings indicate the grading requirements for the Point of Delivery 5. These Drawings are to be considered an integral part of the Technical Specifications as if bound herein.

Drawing	Description
CG001-CG604	POINT OF DELIVERY 5 (POD 5) CIVIL/GRADING BID DRAWINGS

The major items of work to be included in this Proposal are as follows:

a. Furnish all labor and materials required to grub, cut, fill, grade, compact, and re-seed or mulch areas disturbed.

b. Provide labor and materials to maintain silt fence and all other pre-installed erosion control measures and devices as indicated on the Drawings and to ensure seventy percent (70%) temporary vegetative coverage/site stabilization.

c. Provide all compaction testing services, as per Specifications. **Contractor is responsible for hiring a reputable North Carolina-licensed Geotechnical Engineer that is approved by the Owner to perform testing.** Provide reports to Owner and Engineer.

d. Roughen steep slopes and vegetate as required.

e. Grub the areas where the road and pad are to be installed. Roughen main access road corridors prior to onset of remaining land disturbing activities.

f. Due to the presence of very loose/soft surface soils, it is anticipated that subgrade undercut/repair depths will be on the order of **twelve to twenty-four inches (12”-24”)** for the access road and substation pad. **Please follow the recommendations of the Geotechnical Engineering report in Appendix 1, particularly Sections 5.6, 6.1, 6.2, and 6.5.**

g. Contractor is responsible for streetscape and landscaping installations. **A one-year warranty shall be provided on all streetscape and landscape plantings. This shall include coverage for one continuous growing season; dead or unhealthy plants are to be replaced. It is required that the plantings be maintained for 12 months after Date of Substantial Completion.**

h. Contractor is responsible for any traffic control that may be required by the North Carolina Department of Transportation (in the case of work in close proximity to McArthur Road) or by the City of Fayetteville (in the case of work in close proximity to Southland Drive).

i. The proposed perimeter chain link fence is to generally be installed along the property perimeter as shown in the Drawings. The perimeter chain link fence is to transition to a PVC privacy fence for two sections as delineated on Sheet CG201 of the Drawings. The Contractor is responsible for both fences, these transitions, and all associated gates and stoppers.

j. Sidewalk is to be installed along McArthur Road and along Southland Drive as detailed in the Drawings and Specifications.

k. This Contract includes tree clearing which will be required in the vicinity of the existing pond near McArthur Road for the perimeter chain link fence and sidewalk installations. See Drawing Sheet CG200.

l. All stone shown in the Drawings to be part of the Contract is to be installed during contract time period. Erosion and sediment control devices to be removed and permanent seeding to be installed at a later time after the rest of construction activities have occurred in coordination with Owner and Engineer.

m. All contours represent Finished Grade. The only instance in which contractually obligated elevations differ from Finished Grade elevations is the instance of the substation pad. **In this case, the Contractor is only responsible for bringing the substation pad to Design Grade, which is six inches (6") below Finished Grade.** The top of compacted earth for the substation pad is to be stabilized with two inches (2") of crusher run, which is included in this Contract. The top of these two inches (2") of crusher run represent the Substation Pad Design Grade. The remaining proposed 6" of No. 57 stone is to be installed by Others and is not included in this Contract. See Sheets CG401, CG402, and CG604 of the Drawing set for more information.

n. Furnish all labor and materials required to obtain seventy percent (70%) permanent vegetative coverage for the site as agreed upon by the Owner, the Engineer, and the Department of Environmental Quality (NCDEQ). This may require multiple rounds of seeding. **Contract includes maintenance of seeding for a period of one year dating from final inspection.**

o. All work is to be carried out in accordance with the Drawings and Specifications included herein. If there is a discrepancy between the Drawings and Specifications, contact the Engineer, Laura Harris, P.E., for clarity, via email at Laura.Harris@booth-assoc.com or via phone at (919) 851-8770. However, any questions prior to Contract award must instead be directed to Fayetteville Public Works Commission.

Major items of note:

p. Reference is made in the Drawings to the tree clearing and erosion control installation portions of this work. This work will be completed by the Owner before work on this Contract starts.

q. All proposed substation steel, electrical equipment, utility lines, poles, and the like, are included in the Drawings for reference but are to be installed by Others. The substation chain link fence is also incorporated in the Drawings for reference but is also to be installed by Others.

r. There is to be no disturbance in the thirty foot (30') drainage easement as shown in the Drawings.

s. Proposed contours in the Drawings represent finished elevations.

t. Relevant excerpts of the *City of Fayetteville Technical Specifications* dated September 2024 are incorporated herein for reference. They can be found in full at the following link:
https://www.fayettevillenc.gov/files/sharedassets/main/v/1/public-services/documents/city-technical-specifications_revisedsept2024.pdf

u. Relevant excerpts of the *North Carolina Erosion and Sediment Control Planning and Design Manual* are incorporated herein for reference. They can be found in full at the following link:

https://www.deq.nc.gov/energy-mineral-and-land-resources/land-quality/erosion-and-sediment-control-planning-and-design-manual/erosion-design-manual-rev-may-2013-compressed/download

2.0 GENERAL

2.1 **Contractor to obtain all applicable permits prior to construction (building permits, electrical permits, etc.).**

2.2 The following permits are to be obtained by Owner or their Engineer. All other applicable permits are the responsibility of the Contractor.

a. North Carolina Department of Environmental Quality (NCDEQ) Erosion Control Plan Approval;

b. NCDEQ NCG01 Permit Certificate of Coverage;

c. North Carolina Department of Transportation (NCDOT) Driveway Permit;

d. Cumberland County Site Plan Approval;

e. Cumberland County Watershed Permit; and

f. City of Fayetteville Driveway Street and Commercial Driveway Access Permit.

2.3 **Contact the NCDEQ Fayetteville Regional Office at 910-433-3300, NCDOT Highway Division 6 District 2 office at 910-364-0601, Cumberland County Planning & Inspections at 910-678-7600, the City of Fayetteville Permitting & Inspections at 910-433-1707, and any other relevant authorities to schedule a Pre-Construction Meeting at least 72 hours prior to project activation.**

2.4 The following must be kept on site until the permits have been closed out with all relevant authorities:

a. Rain gauge,
b. 30 Days of self-inspection records (Owner to keep up to one year of records in office),
c. Copies of all approved permits,
d. Construction drawings.

These items should be located near the main construction entrance. Failure to maintain these items on site violates the permits.

2.5 All stockpiles shall be surrounded by silt fence on all sides except for the ingress/egress (3 sides). All stockpiles must have a minimum 5’ separation from stockpile toe to silt fence and other erosion control measures.

2.6 Contractor shall ensure that there is proper cover and protection over the culverts per detail sheet in the Drawings.

2.7 **Contractor is responsible for reviewing the Geotechnical Report for pertinent site soils information.** The Geotechnical Report is entitled “Report of Subsurface Exploration and Geotechnical Engineering Evaluation” prepared by Froehling & Robertson, Inc. and certified by Brian W. McCarthy, P.E. (License No. 047377) on October 25, 2024, and is incorporated for reference herein.

2.8 Additional pertinent erosion control measures detailed in the Drawings.

2.9 All subgrade, fill, and stone shall be compacted as specified herein.

2.10 **Follow the steps from “Construction – Phase 1” and “Construction – Phase 2” of the Construction Sequence on Sheet CG002 of the Drawings for general process and project phasing.**

2.11 Proposed Area of Disturbance = 31.48 acres

2.12 Proposed contours in the Drawings represent finished elevations.

2.13 All proposed cut/fill side slopes are 3H:1V unless otherwise specified. Dry, well-compacted unreinforced fill slopes built at 3H:1V or flatter are generally stable provided compaction is carried to the face of the slope. Any steeper fill slopes must be properly designed with geosynthetic reinforcement installed. Any water encountered on the face of slopes should be brought to the attention of a Geotechnical Engineer so that necessary provisions can be made.

2.14 Contractor should minimize subgrade disturbance by using light tracked equipment.

2.15 **Site to be graded and stabilized within sixty (60) calendar days.**

2.16 Temporary ground stabilization will be provided for all disturbed areas within 14 calendar days after construction activity is complete, unless construction activity is going to resume within 21 calendar days. Slopes 3H:1V or steeper, perimeter dikes, swales, ditches, and perimeter slopes are to be stabilized within 7 calendar days.

2.17 After the permanent cessation of construction activities, any areas with temporary ground stabilization shall be converted to permanent ground stabilization as soon as practicable but in no case longer than 90 calendar days after the last land disturbing activity. Temporary ground stabilization shall be maintained in a manner to render the surface stable against accelerated erosion until permanent ground stabilization is achieved.

2.18 Clarifications can be addressed by contacting Laura Harris, P.E. Email: Laura.Harris@booth-assoc.com, Phone: (919) 851-8770.

3.0 GRADING

3.1 Booth & Associates, LLC has set two control points. The first is a nail in the curb of Southland Drive and the second is located northeast of the existing pond near McArthur Road. Please note the second control point may have been disturbed by on-going land-disturbing activity and as such should not be relied upon for accuracy. **The Contractor will be responsible for staking/flagging/performing work based on Control Point 1.** The Contractor will be responsible for maintaining these flags and stakes.

a. Control Point 1 (located in curb of Southland Drive)

i. Northing: 501884.5970’

ii. Easting: 2034933.7220’

iii. Elevation: 241.676’

b. Control Point 2 (located northeast of pond near McArthur Road – do not use as this may have been disturbed by previous land-disturbing activities)

i. Northing: 501097.4348’

ii. Easting: 2033383.0930’

iii. Elevation: 206.147’

3.2 Construction of erosion and sediment control devices is to be carried out and their location is to be as described in the plan. Certain devices are to be constructed before grading operations begin. All devices are to be maintained during construction and temporary ones removed afterward.

3.3 If possible, the site should be graded during a period of warm and dry weather when unstable soils can be repaired by discing, drying, and recompacting. During an average year, the time period from April through October provides an opportunity for drying, with the period from May through September being most ideal. The most effective means for drying include the use of a large tractor and farm disc capable of turning soils to a depth of twelve (12) inches. If the site is graded during an unfavorable drying period and/or if the Contractor does not provide correct equipment, undercut quantities may increase.

3.4 Grading should begin with the stripping of all surface topsoil and organic soils, should any still remain after current ongoing site disturbance. All vegetation and debris should be removed from the site. All subgrade soils shall be free of organic material from grading activity, be compacted, and inspected by an **NC licensed Geotechnical Engineer (hired by the Contractor at their expense and approved by the Owner)** prior to the placement of fill material. Any material to be stockpiled on site shall be stockpiled within the construction limits and in designated areas.

3.5 Any off-site borrow and waste required for this project must come from a site with an approved erosion control plan, a site regulated under the Mining Act of 1971, or a landfill regulated by the Division of Waste Management. Trash/debris and other spoils from demolition activities must be disposed of at a facility regulated by the Division of Waste Management. [15A NCAC 4B.0110]

3.6 All grading inside the proposed fenced area shall be carried to a firm subgrade. The subgrade shall not be frozen, saturated, soft, or unstable.

3.7 Exposed subgrade shall be compacted to at least ninety five percent (95%) of the maximum dry density within ±2 from the optimum moisture content as determined by ASTM D698.

3.8 **Compacted subgrade shall be examined by an approved Geotechnical Engineer or certified testing firm, hired by the Contractor at their expense.** Field compaction tests should be conducted every two thousand square feet (2,000 ft^2). Virgin subgrade soils can be proof rolled to detect zones of soft or loose soils. Any reports by Geotechnical Engineer to be forwarded to the Owner and their Engineer.

3.9 **Proof-rolling should be done in the presence of an approved Geotechnical Engineer, hired by the Contractor at their expense.** Proof-rolling may be accomplished with a lightly to moderately loaded dump truck or similar construction equipment. Any soils which continue to rut or deflect excessively under the rolling operations should be undercut to suitable soils and replaced with compacted fill material as recommended by the Geotechnical Engineer. All Geotechnical Engineering reports to be shared with the Owner and their Engineer.

4.0 BACKFILLING

4.1 **Samples of the proposed backfill material should be taken by the approved Geotechnical Engineer (hired by the Contractor at their expense)** before filling operations begin. Any reports by Geotechnical Engineer to be forwarded to the Owner and their Engineer.

4.2 Material for backfill shall be composed of earth free of wood, grass, roots, broken concrete, large stones, trash, or debris of any kind. No rock material larger than six inches (6") in maximum dimension shall be in the top twenty-four inches (24") of fill.

4.3 A Standard Proctor Compaction Test shall be performed on the proposed backfill material samples. The samples should be tested to determine the maximum dry density, optimum moisture content, and natural moisture content. These test results are to be used to ensure proper compaction during backfilling procedures.

4.4 All fill material shall be placed in lifts not to exceed eight inches (8") in un-compacted thickness and be free of all organic material.

a. Fill shall not be placed in heavy rain.

b. Fill shall not be placed on frozen ground and frozen material shall not be used as fill.

4.5 **Field compaction tests shall be taken by the approved Geotechnical Engineer (hired by the Contractor at their expense) from each fill volume measuring 2,000 ft^2 maximum by twelve inches (12") deep.**

4.6 If testing results indicate that compaction does not meet specified requirements, fill materials shall be removed, replaced as required, and compacted and retested until acceptable.

4.7 All fill areas shall be mechanically compacted to at least ninety-five percent (95%) of the maximum dry density within ±2 percent from the optimum moisture content as determined by ASTM D698, except in the final foot which shall be increased to ninety-eight percent (98%).

5.0 BACKFILL MATERIAL

5.1 Material for backfill shall be composed of earth that is free of wood, grass, roots, broken concrete, large stones, trash, or debris of any kind and compacted prior to placement.

5.2 **The Grading Contractor shall be responsible for hiring a reputable Geotechnical Engineering firm, approved by the Owner or Engineer, to perform laboratory and field testing of backfill material at the Contractor's expense.**

5.3 Backfill shall be placed in lifts not to exceed 8" in un-compacted thickness and mechanically compacted to at least 95% of the maximum density at ±2% optimum moisture content according to ASTM D698. Density testing shall be completed and filed for evaluation.

5.4 All fill material used at the site shall utilize a low plasticity soil (liquid limit less than 50, plasticity index less than 25).

5.5 **A Standard Proctor Compaction Test shall be performed by the approved Geotechnical Engineering firm on the material to be used as backfill.**

6.0 DRIVEWAY

6.1 The driveway shall be installed as shown in the Drawings and as described in the attached Specifications. The drives shall be surfaced per the details in the Drawings and in the attached Specifications.

6.2 The subgrade, directly below access drive and two (2) feet outside of the access drive, shall be mechanically compacted in the top 12" to at least ninety-five percent (95%) of the maximum dry density at optimum moisture content as determined by ASTM D698.

6.3 Minimum construction entrance thickness shall be six inches (6").

6.4 Compaction testing should be performed once per one-hundred lineal feet (100') minimum.

6.5 Access drive as shown on the drawings shall have aggregate base course (ABC) placed in two six-inch (6") layers and compacted to ninety-eight percent (98%) of the maximum dry density at optimum moisture content as determined by ASTM D1557.

6.6 Minimum gravel driveway thickness shall be twelve inches (12"). Aggregate shall be placed in two (2) compacted layers with a minimum lift of six inches (6"), with a tolerance of plus or minus half inch (± 0.5").

6.7 Coordinate paving of asphalt aprons with NCDOT for McArthur Road entrance and with the City of Fayetteville for the Southland Drive entrance.

7.0 EROSION AND SEDIMENT CONTROL NOTES

7.1 Construction of erosion and sediment control devices is to be carried out as described in the Construction Sequence and their location is to be as shown on the Drawings. Certain devices are to be constructed by the Owner before grading operations begin. All devices are to be maintained by Contractor during construction and temporary ones removed afterward.

7.2 Inspect silt fence outlets weekly after each significant rainfall event of one inch (1") or greater within twenty-four (24) hours. Clear mesh wire of debris or other objects to provide adequate flow for subsequent rains. Take care not to damage or undercut the wire mesh during sediment removal. Replace stone as needed.

7.3 Add additional silt fence sections and silt fence outlets as needed in order to ensure adequate erosion protection and silt fence integrity.

7.4 Add seed and mulch to any disturbed slopes as needed. All seeded areas will be checked regularly to see that a good stand is maintained. Areas will be fertilized and reseeded as needed.

7.5 Add coir wattles throughout site as needed as slope breaks and where excessive storm water velocities and scouring are observed.

7.6 Channels and diversions will be checked regularly to see that structural integrity is maintained and runoff is adequately being directed into the temporary sediment basins.

7.7 The temporary sediment basins will be checked regularly to ensure that the sediment has not accumulated to one-half (1/2) the design depth. If so, the basin will be restored to its original dimensions.

7.8 Culvert inlets will be checked to ensure that sediment and debris have not accumulated. If so, remove the sediment and debris and stabilize the vicinity immediately.

7.9 Skimmer devices will be inspected to verify condition, orientation, and proper operation. Remove any debris or clogs from skimmer arm or barrel pipe.

7.10 Add riprap check dams in site where excessive storm water velocities and scouring are observed.

7.11 All bare soils are to be stabilized under conditions outlined in the current NCDEQ NCG01 Permit, or, if in a critical area, by the end of the day.

7.12 Temporary ground stabilization will be provided for all disturbed areas within 14 calendar days after construction activity is complete, unless construction activity is going to resume within 21 calendar days. Slopes 3H:1V or steeper, perimeter dikes, swales, ditches, and perimeter slopes are to be stabilized within 7 calendar days.

7.13 After the permanent cessation of construction activities, any areas with temporary ground stabilization shall be converted to permanent ground stabilization as soon as practicable but in no case longer than 90 calendar days after the last land disturbing activity. Temporary ground stabilization shall be maintained in a manner to render the surface stable against accelerated erosion until permanent ground stabilization is achieved.

7.14 Perimeter sediment containment devices are to remain in operating condition until permanent vegetation is established and approved by an NCDEQ inspector.

7.15 The contract person responsible for Erosion Control Maintenance for Fayetteville Public Works Commission is David Deschamps. Email: David.Deschamps@faypwc.com, Phone: (910) 263-1453.

8.0 SITE STABILIZATION

8.1 Temporary and Permanent Seeding: Follow the directions as shown within the Drawings and attached Specifications.

8.2 Permanent Seeding Maintenance:

a. Inspect seeded areas for failure and make necessary repairs and reseed immediately.
b. If vegetative cover is inadequate to prevent rill erosion, overseed and fertilize in accordance with soil test results.
c. If a stand of permanent vegetation has less than 40 percent cover, reevaluate choice of plant materials and quantities of lime and fertilizer.
d. Re-establish the stand following seed bed preparation and seeding recommendations omitting lime and fertilizer in the absence of soil test results.
e. If the season prevents re-sowing, mulch is an effective temporary cover.
f. Final stabilization of the site requires a 70% overall coverage rate. This does not mean that 30% of the site can remain bare. The coverage is defined as looking at a square yard of coverage in which 70% of that square yard is covered with vegetation.

9.0 MAINTENANCE PLAN

9.1 All erosion and sediment control measures will be checked for stability and operation following every runoff-producing rainfall, but in no case less than once every week. Any needed repairs will be made immediately to maintain all devices as designed. The Contractor will be responsible for all repairs (labor and materials) for all devices on site while they are mobilized during Construction Phases 1 and 2. **At any time when the responsibility for erosion control inspections and repairs is to be handed off to another entity, the Contractor shall set up a meeting for an official hand-off. Further information is provided in the Construction Sequence in the Drawings on Sheet CG002.**

9.2 All public rights-of-way will be maintained and free of construction debris and sediment.

9.3 All disturbed areas will be limed, fertilized, and reseeded as necessary according to specifications in the vegetative plan to maintain a vigorous, dense vegetative cover.

APPENDIX 1

REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION

FROEHLING & ROBERTSON, INC.

Report of Subsurface Exploration and Geotechnical Engineering Evaluation

Fayetteville Public Works Commission – POD 5 Substation
Fayetteville, North Carolina
F&R Project No. 66C-0109

Prepared For:
McKim & Creed, Inc.
4300 Edwards Mill Road, Suite 200
Raleigh, North Carolina 27612

Prepared By:
Froehling & Robertson, Inc.
310 Hubert Street
Raleigh, North Carolina 27603

October 25, 2024

FROEHLING & ROBERTSON

Engineering Stability Since 1881

October 25, 2024

Mr. Robin Lee
Director of Surveying
McKim & Creed Inc.
4300 Edwards Mill Road, Suite 200
Raleigh, North Carolina C 27612

Subject: Report of Subsurface Exploration & Geotechnical Engineering Evaluation
Fayetteville Public Works Commission – POD 5 Substation
Fayetteville, North Carolina
F&R Project No. 66C-0109

Dear Mr. Lee:

Froehling & Robertson, Inc. (F&R) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the proposed Fayetteville Public Works Commission (FPWC) – POD 5 Substation located in Fayetteville, North Carolina. Our services were performed in general accordance with F&R's Proposal No. 2466-00122 dated July 16, 2024. The attached report presents our understanding of the project, reviews our exploration procedures, describes existing site and general subsurface conditions, and presents geotechnical engineering design and construction recommendations.

We have enjoyed working with you on this project, and 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.

Brian W. McCarthy, P.E.
Staff Geotechnical Engineer

NORTH CAROLINA PROFESSIONAL SEAL 047377 ENGINEER Brian William McCarthy

Michael S. Sabodish Jr., Ph.D., P.E.
Geotechnical Dept. Manager

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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 development 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 nine (9) soil test borings (SB-1 through SB-5, and TB-6 through TB-9) to a depth of 30 feet below the existing ground surface;
- Preparation of typed Boring Logs and development of a Subsurface Profile;
- Performance of geotechnical laboratory testing on representative soil samples;
- Performing a geotechnical engineering evaluation of the subsurface conditions with regard to their suitability for the proposed construction;
- Preparation of this geotechnical report by professional engineers.

2.0 PROJECT INFORMATION

2.1 SITE LOCATION AND DESCRIPTION

The project site consists of two (2) parcels of land with a total plan area of approximately 32 acres in Fayetteville, North Carolina. The parcels are identified with Parcel Identification Number (PINs) 0530-31-2280 and 0530-41-4252 based on information obtained from the Cumberland County online GIS database. The project site is located approximately 400 feet west of the intersection of Arbor Road and Southland Road and currently consists of moderate to heavy wooded land and dense brush. An existing pond is located at the southeast corner of Parcel 0530-31-2280. In addition, and existing overhead power line is present at the southwest corner of the same parcel. Based on the ground surface elevations obtained from Cumberland County topographic data, the project site is relatively flat in the area of the proposed sub-station footprint, with ground surface elevations in this area ranging from EL 236 to EL 240. The land around the sub-station footprint generally slopes to the west, with elevations ranging from EL 202 to EL 236. The site has approximately 38 feet of topographic relief.

2.2 PROPOSED CONSTRUCTION

Based on the provided "Fayetteville Public Works Commission – Specifications for Soil Borings for POD 5 Substation" that was prepared by Booth and Associates, LLC, the site is being explored for possible development of an electric substation. The proposed POD 5 Substation will generally consist of the installation of foundations for the following structures:

- H-Frame Line Terminating Structures: approximately 50 feet tall supported on 4-foot diameter piers (borings SB-1 and SB-2);
- Switch Stand: approximately 20 feet tall supported on 3-foot diameter piers (SB-2);
- Bus Support Stands: approximately 20 feet tall supported on 3-foot diameter piers (SB-2 and SB-3);
- Ten-Bay Distribution Structures: approximately 30 feet tall supported on 3.5-foot diameter piers (SB-4 and SB-5);
- Transmission Poles: approximately 2 to 3 foot in diameter, either directly embedded or on approximately 3.5 to 4.5 foot diameter piers (TB-6 through TB-9);
- Transformer: weighing approximately 175,000 pounds supported on a 20'x16' pad with associated oil containment dimensioned at 32'x24' (SB-3 and SB-5);
- Breakers: each weighing approximately 3,500 pounds and supported by pads with approximate dimensions of 5'x5' (SB-3 through SB-5); and,
- Control House: weighing approximately 80,000 pounds supported on a monolithic pad and footings with dimensions of 12'x22 (SB-5).

3.0 EXPLORATION AND LABORATORY TESTING PROCEDURES

3.1 SUBSURFACE EXPLORATION

F&R advanced a total of nine (9) soil test borings (SB-1 to SB-5, and TB-6 to TB-9) as part of this exploration at the approximate locations requested by Booth & Associates and as shown on the Boring Location Plan presented as Figure No. 2 in Appendix I.

The test boring locations were established in the field by F&R using a hand-held GPS unit. Ground surface elevations at the boring locations were interpolated from Cumberland County GIS topographic information. Given these methods of determination, the boring locations and ground surface elevations should only be considered approximate.

The test borings were advanced with 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-value representing the penetration resistance of the soil. Five (5) Standard Penetration Tests were collected within the top 10 feet and then at a nominal interval of approximately 5 feet thereafter.

A representative portion of the soil was obtained from each SPT sample, sealed in an eight-ounce glass jar, labeled, and transported to our laboratory for final classification and analysis by a geotechnical engineer. The soil samples were classified in general accordance with the Unified Soil Classification System (USCS), using visual-manual identification procedures (ASTM D2488). A Boring Log for each test boring is presented in Appendix II.

Groundwater level measurements were attempted at the termination of drilling and after a stabilization period of approximately 24-hours following the completion of drilling in all of the borings. Temporary piezometers were installed in borings SB-1, SB-2, and TB-6 through TB-9 to facilitate the measurement of stabilized groundwater levels. The temporary piezometers consisted of 1-inch diameter, hand-slotted PVC pipe installed into the completed borings. Following the collection of the stabilized groundwater readings, the temporary piezometers were removed from the borings and all of the boreholes were backfilled with soil cuttings.

3.2 LABORATORY TESTING

F&R selected five (5) representative soil samples and subjected them to routine geotechnical index testing consisting of Natural Moisture Content, Sieve 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 and are presented in Appendix III 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 an ocean receded from this area to its present location along the Atlantic coast. It is noted that 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 and an Intrusion from the Cape Fear Formation. The Middendorf Formation is described as sandy deposits that vary in color from gray to orange gray with discontinuous bedding and cross bedding common. The Cape Fear Formation is described as sandstone and sandy mudstone, yellowish gray to bluish gray, mottled red to yellowish orange, indurated, graded and laterally continuous bedding, blocky clay, with faint cross-bedding, feldspar and mica. Both the Middendorf Formation and the Cape Fear Formation contain Coastal Plain soils which are defined as marine sediment from ancient oceans and water bodies in the greater region surrounding the proposed project location that were deposited during the Qaurternary period and Pleistocene epoch.

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. A subsurface profile has been prepared from the boring data to graphically illustrate the subsurface conditions encountered at the site. The subsurface profile is presented as Figure No. 3 in Appendix I. Strata breaks designated on the boring logs and subsurface profile represent approximate boundaries between soil types. The transition from one soil type to another may be gradual or occur between soil samples. 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 of the borings and extended to a depth of 0.2 feet below the existing ground surface. 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.

4.2.3 Coastal Plain Soils

Coastal Plain soils were encountered in all of the borings below the surficial organic soils. The Coastal Plain soils typically consisted of very soft to very stiff, low to high plastic sandy and silty clays (USCS – CL and CH) with SPT N-values ranging from 2 to 16 blows-per-foot (bpf), and very loose to very dense silty and clayey sands (USCS – SM and SC) with SPT N-values ranging from 2 to 67 bpf.

Very soft and soft clay soil layers were encountered in borings SB-2 and SB-4 just below the surficial organic soils and extended to depths of 2 and 3.5 feet below the existing ground surface,

respectively. A deeper layer of very soft to soft clay soils were encountered in boring TB-9 at a depth of 18.5 feet and extended to a depth of 28.5 feet below the existing ground surface.

Very loose sand layers were encountered in six (6) borings (SB-1, SB-3, SB-5, TB-6, TB-7, and TB-9) just below the surficial organic soils and extended to depths ranging from 2 to 6.5 feet below the existing ground surface. A deeper layer of very loose sand was encountered in boring TB-9 at a depth of 6.5 feet and extended to a depth of 8.5 feet in the soil profile.

A deep layer of highly plastic Coastal Plain clays was encountered in borings TB-9 at a depth of 18.5 feet below the ground surface and extended to a depth of 28.5 feet.

4.3 Soil Moisture and Groundwater Conditions

A majority of the recovered soil samples were typically described as being moist (*i.e.*, within 3 percentage points of the estimated optimum moisture content). Shallow wet soil conditions (greater than 3 percentage points over the estimated optimum moisture content) were encountered in the upper 2 feet of the soil profile in boring SB-1. Deeper layers of wet and/or saturated soils were encountered in boring TB-9 at a depth of 8.5 feet and extended to the boring termination depth of 30.0 feet.

Groundwater level measurements were attempted at the termination of drilling in all borings. Immediately after drilling groundwater was encountered in boring TB-9 at a depth of 7.2 feet below the existing ground surface. Additionally, after a stabilization period of approximately 24-hours following completion of drilling, groundwater levels were measured again in all borings. Stabilized groundwater was encountered in boring TB-9 at a depth of 9.0 feet below the existing ground surface. Subsurface water was not encountered in the remaining borings immediately after drilling or after the 24-hour stabilization period.

It should be noted that the 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. F&R notes that due to the presence of relatively impervious silty and clayey soils, trapped or perched water conditions may be encountered during periods of inclement weather and during seasonally wet periods.

5.0 PRELIMINARY GEOTECHNICAL DESIGN RECOMMENDATIONS

5.1 GENERAL

The geotechnical engineering recommendations contained in this section of the report are based upon the results of the nine soil test borings, the information provided regarding the proposed construction, and our familiarity with geotechnical engineering practices in this area. It is our opinion that the subsurface conditions encountered at the project site are suitable for the proposed construction from a geotechnical engineering perspective provided the recommendations presented in this report are followed throughout the design and construction phases of this project. F&R requests an opportunity to review project structural plans and specifications to confirm that the recommendations presented in this report have been properly interpreted and implemented, and to determine if additional geotechnical recommendations are warranted. Please contact F&R at your earliest convenience if you feel additional recommendations are warranted or if the recommendations in this report need additional clarification.

5.2 Shallow Foundations

The proposed control house, transformers, and breakers can be supported on shallow foundations (i.e., spread footings or mats) bearing on approved subgrades consisting of native soils of at least stiff/medium dense consistency or properly-placed and compacted structural fill (see Section 6.2, Structural Fill Placement and Compaction).

Based on anticipated light structural loads provided in the scope of work, and the subsurface conditions encountered in our test borings, we recommend that the shallow foundations be designed for a net allowable bearing pressure of 2,000 pounds per square foot (psf) for footings bearing on approved subgrades consisting of native soils of at least stiff/medium dense consistency (9 to 15 bpf or higher) or newly placed well compacted structural fill. To reduce the possibility of localized shear failures, spread and strip footings should be a minimum of 3.0 feet and 1.5 feet wide, respectively. We recommend that exterior footing bearing grades be constructed at least 2 feet below adjacent grades in order to bear below normal frost depth.

We envision that an intermittent transient load factor may be helpful during development of the mat foundation design for structures subjected to overturning forces. Intermittent transient loads are loads that are envisioned to be of short duration such that they would not induce additional foundation settlement. We consider wind and seismic loads to fall into this category, but not snow or ice loads, as it is possible that a frozen precipitation load could be in place for an extended period of time during a given winter event. If needed, an intermittent transient load factor of 1.25 can be used for foundation design.

The following friction and passive earth pressure coefficients are provided for use in evaluating the foundation member's resistance to sliding. Based on our experience with similar subsurface conditions, we recommend an allowable coefficient of friction value of 0.3 between the foundation concrete and soil subgrade. For soils similar to well compacted structural fill recommended in this report (see Section 6.2), we recommend a passive earth pressure coefficient of $K_p = 3.0$. Please note that significant movement is required to develop the full passive pressure; therefore, the total calculated passive pressure should be reduced by one-half to two-thirds for design purposes. In addition, the passive pressure should be ignored in the upper 2 feet due to the potential for frost penetration and surface disturbance. A moist unit weight of 120 pounds per cubic feet (pcf) should be used for design purposes. The provided passive pressure requires that backfill against the footing edge is compacted and placed in accordance with the structural fill requirements provided in this report, or that the foundations be neat-line poured against near-vertical excavation walls.

It is recommended that during construction of the proposed structures, an experienced geotechnical engineer or their representative should be on site to confirm that the in-situ bearing conditions at the bottom of each footing excavation is adequate for the design bearing pressure recommended in this report.

5.3 Settlement for Shallow Foundations

Based on the existing site grades, F&R anticipates that approximately 3 to 5 feet of cut and/or fill will be required to establish proposed finished grades within the footprint of station. We estimate that foundation settlements for the structures will be less than one inch with differential settlement

of up to one-half the estimated total settlement. The magnitude of differential settlements will be influenced by the variation in excavation requirements across the structures' footprints, the distribution of loads, and the variability of underlying soils. Actual settlements experienced by the structure and the time required for these soils to settle will be influenced by undetected variations in subsurface conditions, final grading plans, and the quality of fill placement and foundation construction.

5.4 Drilled Shaft Foundations

We understand the H-Frame Line Terminating, Switch Stand, Bus Support Stands, and Distribution Structures as well as the Transmission Poles will utilize deep foundation (i.e. drilled shafts, driven piles etc.) to support these structures. In addition to these structures other lightly loaded structures can also be supported on deep foundations. As such, F&R has provided design parameters for drilled shaft support as discussed below. The tables shown in Appendix IV provide an idealized subsurface profile for drilled shaft soil parameters including Ultimate End Bearing Pressure and Ultimate Skin Friction, and LPILE design parameters for each boring.

The lateral earth pressure coefficient (k_0) values provided in this report are based on empirical correlations and assumed soil properties. No specialized field testing (i.e. Cone Penetration Test (CPT), Dilatometer Test (DMT) etc.) or lab testing (i.e. Triaxial testing) were performed to verify these values, and as such, we recommend the foundation design engineer exercise care and conservatism during deep foundation capacity analysis using these values.

Drilled shafts should initially be drilled to the design elevation or penetration requirements. A minimum spacing of 3 shaft diameters should be used for Drilled Shafts constructed on the same day, i.e. concrete should be allowed to cure for at least 24 hours before drilling at an adjacent (closer than of 3 shaft diameters) drilled shaft location. Casing of each shaft, under full time inspection during installation of the drilled shafts, should be conducted. We recommend the center of the drilled shaft be maintained within a 3-inch radius of its predetermined center. The drilled shaft should be installed straight, and should not be out-of-plumb by more than two percent of the shaft

length. Eccentricities associated with misalignments should be given consideration in the structural design of the drilled shaft.

Please note the tabulated values in Appendix IV are for the given layered models with the understanding the transitions between different soil strata are usually less distinct than those tabulated. Appropriate factors of safety must be applied by the foundation designer. In addition, the foundation designer should consider the potential for layer variations and, *especially with respect to the end-bearing values*, the soil conditions below the planned foundation bottom. The allowable soil bearing pressure may need to be reduced when a weaker layer lies within twice the diameter of a shaft below its planned tip depth.

The actual shaft diameter and depth should be determined by the structural engineer based on axial capacity as well as lateral and torsional load analyses using the actual design loads and/or factored design loads. In addition, we note that different amounts of shaft movement are required to fully mobilize the skin friction and end-bearing values provided in the table in Appendix IV. Therefore, the design should not utilize the full value of both skin friction and end-bearing simultaneously. Construction of the drilled shaft should be performed in accordance with the American Concrete Institute (ACI) Standard Specification for the Construction of Drilled Piers (ACI 336.1).

A structural engineer should establish the required diameter of the drilled pier, the embedment depth, the reinforcing steel, and the concrete strength. The drilled shaft should be field inspected at the time of construction by a geotechnical engineer or a geologist.

5.5 Slab on Grade

If required for the control house, transformers, and/or breakers, floor slabs may be designed as a slab-on-grade supported by newly placed structural fill. Any loose/soft or otherwise unsuitable materials should be remediated as judged necessary by the Geotechnical Engineer. We recommend that a modulus of subgrade reaction (k) of 125 pounds per cubic inch (pci) be used for slab design. The subgrade soils for support of floor slabs should be prepared as outlined in subsequent sections of this report. The floor slab should be supported on at least 4 inches of

NCDOT #57 clean washed stone to provide a uniformly well-compacted material immediately beneath the slab. The floor slab should be underlain by a vapor retarder to reduce the potential for floor slab dampness. Vapor retarder construction should be performed in accordance with applicable ACI guidelines.

Floor slab design and construction should incorporate isolation joints around columns, utility penetrations, and along bearing walls to allow for differential movement to occur without damage to the floor. Final slab design should be determined by the project structural engineer based on actual design loads, building code requirements and other structural considerations.

5.6 Access Road Design Considerations

Due to the presence of some very loose/soft and soft surface soils, unstable subgrade conditions could develop along the access roadway alignment beneath equipment during removal of surficial organic soils. In order to help prevent unstable conditions from occurring, it is recommended that the surficial soils be stabilized prior to roadway grading by undercutting and replacing the very loose soils. F&R anticipates that the subgrade undercut/repair depths will be on the order of 12 to 24 inches. Additional repairs may be recommended at the time of construction. These repairs will be based upon actual field conditions observed by the geotechnical engineer and should be determined based upon proofrolling and/or other subgrade evaluations. If these evaluations reveal unstable conditions, the method of repair should be as directed by the project geotechnical engineer. Methods of repair may include, but are not necessarily limited to: drying and re-compaction; additional undercutting; application of lime; use of geotextiles; or other methods deemed appropriate by the project geotechnical engineer. Any necessary repairs should be made based upon actual field conditions observed by the geotechnical engineer at the time of construction, and should be determined based upon proofrolling and other subgrade evaluations.

We have been informed the entrance driveways will consist of asphalt pavement, with the remaining length of access roads being unpaved. The pavement structure should comply with the minimum standards for roadways as required by the City of Fayetteville. Proofrolling of the

pavement subgrades, placement of ABC base course and asphalt surface courses, should be observed, tested and approved by the project geotechnical engineer. Upon request, F&R would be pleased to provide a site specific pavement design in accordance with the City of Fayetteville requirements based on the actual soil subgrade strength testing (CBR tests) and estimated traffic volumes. However, at this time we believe a preliminary asphalt section consisting of 3 inches of 9.5B asphalt and 8 inches of compacted NCDOT ABC stone would likely be sufficient for the project.

We understand the access roads to the substation will likely consist of compacted gravel. The gravel roadway design should consist of a 12 inch thick well-graded crushed limestone with particle size ranging from ½ inch to ¾ inch over well-compacted subgrade consisting of native soils or approved structural fill. A woven geo-textile (equivalent to Mirafi 500X) should be placed over the subgrade prior to placement of the gravel surface. The subgrade should be confirmed to be stable prior to placement of the geo-textile. However, we emphasize that good drainage is essential for successful performance of the road. The access road should be maintained in a drained condition at all times. Water build-up in the gravel surface could saturate the underlying highly plastic soils and result in softening of the subgrade and premature failures. Proper drainage may be aided by: grading the site such that surface water is directed away from the road, and construction of swales adjacent to the road. The access road should be graded such that surface water is directed towards the outer limits of the road.

6.0 GEOTECHNICAL CONSTRUCTION RECOMMENDATIONS

6.1 SITE PREPARATION

Initial site development should include stripping all surficial organic soils, roots, vegetation and any other deleterious materials from load bearing areas. The stripping should extend a distance of at least 5 feet beyond the structure/foundation perimeters. Following the stripping operations, the exposed subgrade soils at the finished subgrade level and in fill sections should be proofrolled with a loaded tandem axle dump truck, scraper, or other similar type of construction equipment at the option of the geotechnical engineer to confirm the stability of the subgrade soils. The

proofroll operations should be observed by a geotechnical engineer or their representative. If proofrolling reveals unstable conditions, the method of repair should be as directed by the project geotechnical engineer. Methods of repair may include, but are not necessarily limited to drying and re-compaction; undercutting and replacement with suitable structural fill; use of geo-textiles and/or geo-grids with select fill; use of lime stabilization; or other methods deemed appropriate by the project geotechnical engineer. Very loose/soft soils were encountered within 6.5 feet of the ground surface in eight borings and as such, F&R anticipates that subgrade repairs may be required to establish stable subgrades across a majority of the site.

As reported earlier in this report, a layer of highly plastic clay was encountered in one boring. In general, these soils can undergo volume changes (shrink/swell) with changes in moisture content and are generally considered to be poor subgrade and bearing grade materials. Due to the shrink/swell potential of these soils and poor subgrade/bearing grade characteristics, F&R recommends that a minimum of 2.0 feet of separation be maintained between stable highly plastic soils and proposed subgrades for the drive areas and a minimum of 3.0 feet of separation be maintained between stable highly plastic soils and footings for the structures.

6.2 Structural Fill Placement and Compaction

If on-site soils are to be used for structural fill, the low plasticity soils (USCS –CL, SC, and SM) are generally considered fair to good materials for use as structural earth fill. As previously indicated, some of the excavated soils may be wet and moisture conditioning may be required (i.e., drying of wet soils) prior to being used as structural fill. As such, it is recommended that earthwork be performed during the summer months when weather conditions are more conducive to moisture conditioning of fill materials.

Higher plasticity soils (USCS – CH and MH) are generally considered poor material for use as structural fill and are considered poor material for direct support of the building foundations, slabs and roadways. As such, if highly plastic soils are encountered in cut areas, it is generally recommended that they be used in non-load bearing areas or in the lower portion of deeper fills provided they can be properly placed and compacted.

If soils are required to be imported to the site to achieve finished grades, F&R recommends that a qualified geotechnical engineer or engineering technician working under the direction of the geotechnical engineer approve the suitability of the imported soils prior to their delivery to the site. Imported structural fill should consist of low plasticity soil (LL<35, PI<20), have a maximum dry density of at least 100 pcf, and be free of organic and other deleterious materials.

All structural earth fill should be compacted at a moisture content within ±3 percentage points of the optimum moisture content. All structural earth fill (*i.e.,* fill placed in load bearing areas or slopes) should be placed in loose lifts not exceeding 8 inches and be compacted to at least 95 percent of the Standard Proctor maximum dry density as determined by ASTM D-698. All areas requiring grade increases that are steeper than a slope of 4H:1V should be plowed, stepped, and leveled to assure that fill is placed on near-level surfaces. All structural fill material should be placed and compacted under the full-time control and supervision of a qualified geotechnical engineer or engineering technician working under the direction of the geotechnical engineer. The placement and compaction of all fill material should be tested at frequent intervals in order to confirm that the recommended degree of compaction is achieved.

As previously stated, the on-site soils have sufficient fines 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 3 percentage points above the optimum moisture content are generally considered to have excessive moisture, and soil with a moisture content more than 3 percentage points below the optimum moisture content are generally considered to be excessively dry. During earthwork and construction activities, surface-water runoff must be drained away from the construction areas to prevent water from ponding on or saturating the soils within excavations or on subgrades. Due to the moisture sensitivity of the on-site soils and potential for wet conditions, it is typically recommended that earthwork operations be performed during the seasonally-drier months (typically May to October) when weather conditions are more-conducive to moisture conditioning of earth fill (*e.g.,* drying) and achieving proper compaction of structural fill. If earthwork is performed during the seasonally-wet months, additional subgrade undercutting and repair will likely be required and it may be difficult

to properly compact structural fill. All structural fill placement and compaction activities should be monitored on a full-time basis by a geotechnical engineer or qualified engineering technician working under the supervision of the geotechnical engineer.

6.3 Shallow Foundation Construction Considerations

All foundation subgrades should be observed, evaluated, and verified for the design bearing pressure by a qualified geotechnical engineer or their representative after excavation and prior to reinforcement steel placement. The purpose of the engineering observation would be to determine that the foundations bear in suitable soils at the proper embedment depths, and that unsuitable soft or loose materials are undercut and backfilled with approved, structural fill material. Hand auguring and Dynamic Cone Penetrometer (DCP) testing should be performed to test the consistency of the bearing soils and underlying supporting soils. If low consistency soils are encountered during foundation construction, they should be undercut and replaced with approved structural fill as directed by the on-site geotechnical engineer or their representative.

Excavations for foundations should be made in such a way as to provide bearing surfaces that are firm and free of loose, soft, wet, or otherwise disturbed soils. Foundation concrete should not be placed on frozen or saturated subgrades. If such materials are allowed to remain below foundations, settlements will increase. Foundation excavations should be concreted as soon as practicable after they are excavated. If an excavation is left open for an extended period, or may be exposed to inclement weather, a 3 to 4 inch thick mat of lean concrete (minimum 28 day compressive strength of 2,000 psi) should be placed over the exposed soils, but beneath the design footing bottom, to minimize damage to the bearing surface from weather or construction activities. Water should not be allowed to pond in any excavation.

The foundation bearing area should be free of any very loose or soft material, standing water, and debris at the time of concrete placement. Concrete should not be placed on soils that have been softened by precipitation or freezing. Exposure of the subgrade materials to the environment may weaken the soils at the foundation bearing level. If the foundation excavations

remain open for long periods of time, or during inclement weather, re-evaluation of the subgrade materials by F&R should be performed prior to steel, concrete, or stone placement.

6.4 Drilled Shaft Foundation Construction

The drilled shaft contractor should be qualified, experienced and properly equipped to drill shafts of the specified diameters into the soil encountered in the borings and referenced in this report. Drilled shafts should be installed in accordance with the American Concrete Institute (ACI) Standard Specification of the Construction of Drilled Piers (ACI 336.1-01).

If non-slurry drilling or "dry" drilling methods are utilized, temporary steel casing should be installed in the drill hole of each caisson to keep the hole from collapsing, and also to allow workers to safely excavate, clean and inspect the drilled shaft, prior to placement of concrete. Care should be taken to clean out any soft or loose soil at the bottom of the drilled shaft prior to placement of reinforcing steel and concrete.

The steel casing should not be pulled until there is sufficient head of concrete at the bottom of the casing to prevent slurry, water, or loose material from entering the excavation and creating a zone of weakness in the shaft. Typically, this means the casing is extracted as the concrete is placed up to the ground surface. At a minimum, five feet of head should be maintained at all times when pulling the casing. The contractor should prevent concrete from "hanging up" inside the steel casing which can cause a soil intrusion below the steel shell. However, the steel casing should not be moved until the concrete is above the groundwater level.

If drilling fluid is utilized for installation of the drilled shafts, down hole inspection cannot be conducted. We recommend that installation records including drilling effort and drilling times associated with the final 3 feet of installation be recorded.

If slurry is utilized, there should be a minimum delay between drilling and concrete placement. Concrete should be placed with a tremie as soon as possible after drilling (e.g. no more than a few hours) and certainly within the same day as drilling. The concrete should exhibit good flow characteristics. The concrete placement technique should result in complete filling of the

excavation without segregation. We recommend that the concrete placed into the drilled hole be directed through a center chute at the surface to prevent contact with the sides of the hole and any reinforcing steel. This procedure should reduce side flow and segregation of the concrete.

Generally concrete slumps ranging from six to nine inches are recommended for drilled shaft construction. We refer the drilled shaft designer to ACI 336.1-01, for further discussion on concrete slumps. Concrete slumps in this range should usually fill irregularities along the sides and bottom of the hole and displace any water in the borehole. The structural engineer should specify the concrete strength needed, but a minimum strength of 3,000 psi should be used.

Drilled shaft construction should be conducted under full time supervision of the geotechnical engineer or their qualified inspector. The geotechnical engineer and/or inspector should document the shaft diameter, depth, plumbness, and type of bearing material encountered. Significant deviations from the specified or anticipated conditions should be reported immediately to the geotechnical design engineer and structural engineer. Detailed installation records should be maintained for each shaft location.

6.5 Surface/Subsurface Water Control

Subsurface water, for the purposes of this report, is defined as water encountered below the existing ground surface. Based on the measurements listed above in Section 4.3, subsurface water is not likely to be encountered across the site during general site preparation. Stabilized groundwater was only encountered in one boring at a depth of 9.0 feet below the existing ground surface.

We understand that the method of surface water and groundwater control should be determined and designed by the contractor. Temporary and/or permanent open ditches, dewatering and interceptor drains will likely be required to improve site and soil profile drainage, improve soil moisture conditions and aid in draining subsurface water that could be encountered during construction.

It should be noted that if groundwater levels are not effectively maintained during construction, unstable excavations and loosened bearing grade or subgrade conditions could develop. 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.

An important aspect to consider during development of this site is surface water control. During the construction, we recommend that steps be taken to enhance surface flow away from areas of construction and any excavations, and promote rapid clearing of rainfall and runoff water following rain events. It should be incumbent on the contractor to maintain favorable site drainage during construction to reduce deterioration of otherwise stable subgrades.

6.6 Temporary Excavation Recommendations

Mass excavations and other excavations required for construction of this project must 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 the excavation 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".

7.0 CONTINUATION OF SERVICES

As previously discussed, a geotechnical engineer should be retained to monitor and test earthwork activities, and observe subgrade preparations for foundations and pavements. It should be noted that the actual soil conditions at the various subgrade levels and footing bearing grades will vary across this site and thus the presence of the geotechnical engineer and/or their representative during construction will serve to validate the subsurface conditions and recommendations presented in this report.

A geotechnical engineer should be employed to monitor the earthwork, foundation construction, and pile testing performed by others and to report that the recommendations contained in this report are completed in a satisfactory manner. The continued geotechnical engineering 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 placing structural fill including proofroll observations;
- Observe the placement and compaction of any structural fill and backfill, and perform laboratory and field compaction testing of the fill;
- Observe the installation and testing of drilled shafts for the deep foundation systems; and,
- Observe all foundation excavations and footing bearing grades for compliance with the recommended design soil bearing capacity. We also stress the importance of conducting hand auger and DCP testing at and extending several feet below the footing bearing grade in order to give an indication of the anticipated subsurface conditions and define footings that should be undercut and repaired as outlined in this report.

8.0 LIMITATIONS

This report has been prepared for the exclusive use of McKim & Creed 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 previously-described, subsurface exploration program, and generally-accepted geotechnical engineering practice. 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.

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 V. 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, pavement, and foundation construction to verify 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 design or location of the proposed structures, 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

0 375 750 1,500 2,250 3,000 Feet

FROEHLING & ROBERTSON
Engineering Stability Since 1881
310 Hubert Street
Raleigh, North Carolina 27603
T 919.828.3441

Client:	McKim & Creed
Project:	FPWC POD 5 Site
Location	Fayetteville, Cumberland County, NC
Project Number:	66C-0109
Data:	Open Street
Date:	October 2024
Scale:	1 inch = 1,500 feet

FIGURE No.: 1

Boring Location Plan

0 75 150 300 450 600 Feet

N

FROEHLING & ROBERTSON
Engineering Stability Since 1881

310 Hubert Street
Raleigh, North Carolina 27603
T 919.828.3441

Client:	McKim & Creed	
Project:	FPWC POD 5 Site	
Location	Fayetteville, Cumberland County, NC	
Project Number:	66C-0109	FIGURE No.: 2
Data:	NCOne Map Aerial 2021/ Parcel 2024	
Date:	October 2024	Scale: 1 inch = 300 feet

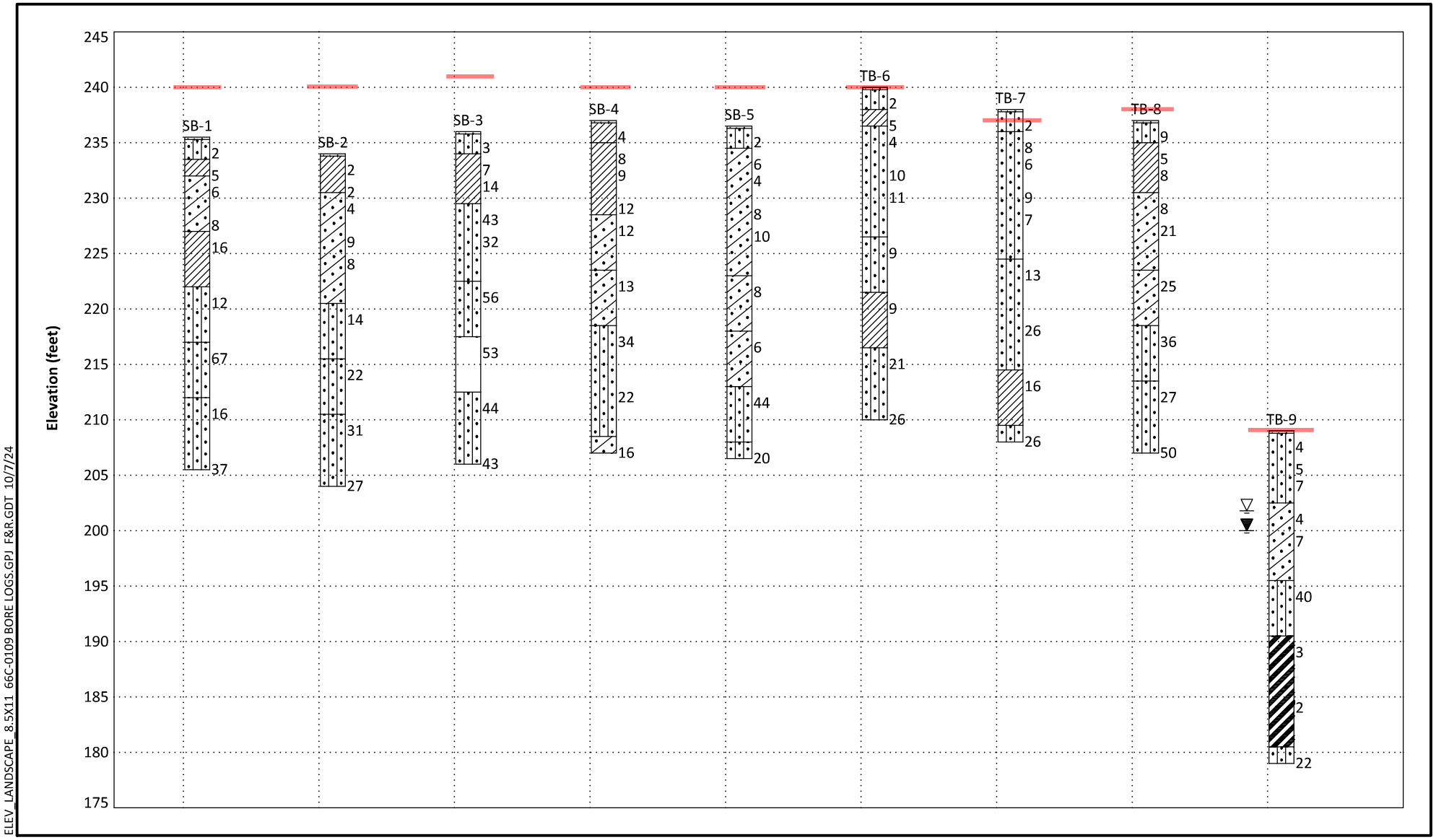
FROEHLING & ROBERTSON
Engineering Stability Since 1881

SUBSURFACE PROFILE

Plot Based on Elevation
Profile Name: Figure No. 3

Project No: 66C-0109
Client: McKim & Creed
Project: FPWC POD 5 Site
City/State: Fayetteville, NC

= Proposed Site Grades



ELEV_LANDSCAPE_8.5X11_66C-0109 BORE LOGS.GPJ F&R.GDT 10/7/24

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

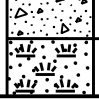
Ground Water

▽ Water Level in Bore Hole Immediately after Drilling

▼ Static Water Level after 24 Hours

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

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BORING LOG

Boring: SB-1 (1 of 1)

Project No: 66C-0109
Client: McKim & Creed
Project: FPWC POD 5 Site
City/State: Fayetteville, NC

Elevation: 235.5 ±
Total Depth: 30.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/5/24
Driller: A. Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
235.3	0.2	SURFICIAL ORGANIC SOILS	1-1-1	0.0		GROUNDWATER DATA:
		COASTAL PLAIN: Very Loose, Brown, Wet, Silty Fine to Medium SAND (SM) with Trace Roots		1.5	2	0 Hr: Dry inside PVC
233.5	2.0	Firm, Brown and Orange, Wet, Fine Sandy CLAY (CL)	2-2-3	2.0		24 Hrs: Dry inside PVC
232.0	3.5	Loose, Brown and Orange, Moist, Clayey Fine SAND (SC)	3-3-3	3.5	5	
				5.0	6	
			2-4-4	6.5		
				8.0	8	
227.0	8.5	Very Stiff, Red-Brown, Brown, and Yellow, Moist, Fine Sandy CLAY (CL)	6-8-8	8.5		
				10.0	16	
222.0	13.5	Medium Dense, Mottled Gray and Tan, Moist, Silty Fine SAND (SM)	5-5-7	13.5		
				15.0	12	
217.0	18.5	Very Dense, White-Gray, Moist, Silty Fine SAND (SM)	15-29-38	18.5		
				20.0	67	
212.0	23.5	Medium Dense to Dense, Mottled Gray, Yellow and Pink, Moist, Silty Fine to Medium SAND (SM)	8-8-8	23.5		
				25.0	16	
			13-17-20	28.5		
205.5	30.0	Boring Terminated at 30.0 feet.		30.0	37	

BORING_LOG 66C-0109 BORE LOGS.GPJ F&R.GDT 10/21/24

*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.

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BORING LOG

Boring: SB-2 (1 of 1)

Project No: 66C-0109
Client: McKim & Creed
Project: FPWC POD 5 Site
City/State: Fayetteville, NC

Elevation: 234 ±
Total Depth: 30.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/4/24
Driller: A. Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
233.8	0.2	SURFICIAL ORGANIC SOILS	2-1-1	0.0		GROUNDWATER DATA:
		COASTAL PLAIN: Very Soft, Orange-Brown and Gray, Moist, Fine Sandy CLAY (CL)		1.5	2	0 Hr: Dry inside PVC
			1-1-1	2.0		24 Hrs: Dry inside PVC
230.5	3.5	Very Loose to Loose, Orange-Brown, Moist, Clayey Fine SAND (SC)	2-2-2	3.5	2	
				5.0	4	
			2-3-6	6.5		
				8.0	9	
			2-3-5	8.5		
				10.0	8	
220.5	13.5	Medium Dense, Red-Brown, Gray, and Orange, Moist, Silty Fine SAND (SM)	4-6-8	13.5		
				15.0	14	
215.5	18.5	Medium Dense, Mottled Gray and Red-Brown, Moist, Silty Fine SAND (SM)	9-11-11	18.5		
				20.0	22	
210.5	23.5	Medium Dense to Dense, Gray and Tan, Moist, Silty Fine to Medium SAND (SM)	10-14-17	23.5		
				25.0	31	
			11-13-14	28.5		
204.0	30.0	Boring Terminated at 30.0 feet.		30.0	27	

*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.

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BORING LOG

Boring: SB-3 (1 of 1)

Project No: 66C-0109
Client: McKim & Creed
Project: FPWC POD 5 Site
City/State: Fayetteville, NC

Elevation: 236 ±
Total Depth: 30.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/4/24
Driller: A. Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
235.8	0.2	SURFICIAL ORGANIC SOILS	1-1-2	0.0		GROUNDWATER DATA:
		COASTAL PLAIN: Very Loose, Brown, Moist, Silty Fine to Medium SAND (SM)		1.5	3	0 Hr: Dry, Caved at 25.3'
234.0	2.0	Firm to Stiff, Orange-Brown, Moist, Fine Sandy CLAY (CL)	2-3-4	2.0		24 Hrs: Dry, Caved at 25.2'
				3.5	7	
			4-6-8			
				5.0	14	
229.5	6.5	Dense, Orange-Brown, Moist, Silty Fine to Coarse SAND (SM)	12-19-24	6.5		
				8.0	43	
			16-16-16	8.5		
				10.0	32	
222.5	13.5	Very Dense, Orange-Brown, Brown, and Yellow, Moist, Silty Fine SAND (SM)	13-32-24	13.5		
				15.0	56	
217.5	18.5	No Sample Recovered	27-19-34	18.5		
				20.0	53	
212.5	23.5	Dense, Mottled Gray and Tan, Silty Fine SAND (SM)	16-20-24	23.5		
				25.0	44	
			12-19-24	28.5		
206.0	30.0	Boring Terminated at 30.0 feet.		30.0	43	

*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.

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BORING LOG

Boring: SB-4 (1 of 1)

Project No: 66C-0109
Client: McKim & Creed
Project: FPWC POD 5 Site
City/State: Fayetteville, NC

Elevation: 237 ±
Total Depth: 30.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/3/24
Driller: A. Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
236.8	0.2	SURFICIAL ORGANIC SOILS	1-2-2	0.0	4	GROUNDWATER DATA:
		COASTAL PLAIN: Soft, Orange-Brown and Gray, Moist, Fine Sandy CLAY (CL)		1.5		0 Hr: Dry, Caved at 25.6'
235.0	2.0	Firm to Stiff, Orange-Brown, Moist, Fine Sandy CLAY (CL)	2-4-4	2.0	8	24 Hrs: Dry, Caved at 25.5'
			3-4-5	3.5	9	
				5.0		
			4-5-7	6.5	12	
				8.0		
228.5	8.5	Medium Dense, Orange-Brown, Moist, Clayey Fine SAND (SC)	4-6-6	8.5	12	
				10.0		
223.5	13.5	Medium Dense, Mottled Gray and Yellow-Brown, Moist, Clayey Fine SAND (SC)	4-5-8	13.5	13	
				15.0		
218.5	18.5	Medium Dense to Dense, Gray and Orange-Brown, Moist, Silty Fine to Coarse SAND (SM)	12-17-17	18.5	34	
				20.0		
			9-10-12	23.5	22	
				25.0		
208.5	28.5	Medium Dense, Purple, Moist, Clayey Fine SAND (SC)	4-5-11	28.5	16	
207.0	30.0	Boring Terminated at 30.0 feet.		30.0		

*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.

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BORING LOG

Boring: SB-5 (1 of 1)

Project No: 66C-0109
Client: McKim & Creed
Project: FPWC POD 5 Site
City/State: Fayetteville, NC

Elevation: 236.5 ±
Total Depth: 30.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/4/24
Driller: A. Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
236.3	0.2	SURFICIAL ORGANIC SOILS	1-1-1	0.0		GROUNDWATER DATA:
		COASTAL PLAIN: Very Loose, Brown, Moist, Silty Fine to Medium SAND (SM)		1.5	2	0 Hr: Dry, Caved at 25.1'
234.5	2.0	Very Loose to Loose, Orange-Brown, Moist, Clayey Fine SAND (SC)	2-3-3	2.0		24 Hrs: Dry, Caved at 25.1'
				3.5	6	
			2-2-2		4	
				5.0		
				6.5		
			2-3-5		8	
				8.0		
			3-5-5	8.5		
				10.0	10	
223.0	13.5	Loose, Tan and Orange, Moist, Clayey Fine SAND (SC)	3-4-4	13.5		
				15.0	8	
218.0	18.5	Loose, Orange, Purple, and Gray, Moist, Clayey Fine SAND (SC)	3-3-3	18.5		
				20.0	6	
213.0	23.5	Dense, Tan-Gray, Moist, Silty Fine to Medium SAND (SM)	5-20-24	23.5		
				25.0	44	
208.0	28.5	Medium Dense, Purple and Gray, Moist, Silty Fine SAND (SM) with Trace Clay	9-9-11	28.5		
206.5	30.0	Boring Terminated at 30.0 feet.		30.0	20	

*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.

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BORING LOG

Boring: TB-6 (1 of 1)

Project No: 66C-0109
Client: McKim & Creed
Project: FPWC POD 5 Site
City/State: Fayetteville, NC

Elevation: 240 ±
Total Depth: 30.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/3/24
Driller: A. Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
239.8	0.2	SURFICIAL ORGANIC SOILS	WOH-1-1	0.0		GROUNDWATER DATA:
		COASTAL PLAIN: Very Loose, Brown, Moist, Silty Fine to Medium SAND (SM)		1.5	2	0 Hr: Dry inside PVC
238.0	2.0	Firm, Orange-Brown, Moist, Fine Sandy CLAY (CL)	2-2-3	2.0		24 Hrs: Dry inside PVC
236.5	3.5	Very Loose to Medium Dense, Red-Brown, Moist, Silty Fine SAND (SM)	2-2-2	3.5	5	
				5.0	4	
			2-4-6	6.5		
				8.0	10	
			4-4-7	8.5		
				10.0	11	
226.5	13.5	Loose, Red-Brown, Gray, and Orange, Moist, Silty Fine SAND (SM)	6-4-5	13.5		
				15.0	9	
221.5	18.5	Stiff, Mottled Gray and Yellow-Brown, Moist, Fine Sandy CLAY (CL)	4-3-6	18.5		
				20.0	9	
216.5	23.5	Medium Dense, Gray and Tan, Moist, Silty Fine to Coarse SAND (SM)	4-10-11	23.5		
				25.0	21	
			7-11-15	28.5		
210.0	30.0	Boring Terminated at 30.0 feet.		30.0	26	

*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.

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BORING LOG

Boring: TB-7 (1 of 1)

Project No: 66C-0109
Client: McKim & Creed
Project: FPWC POD 5 Site
City/State: Fayetteville, NC

Elevation: 238 ±
Total Depth: 30.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/5/24
Driller: A. Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
237.8	0.2	SURFICIAL ORGANIC SOILS	1-1-1	0.0		GROUNDWATER DATA:
		COASTAL PLAIN: Very Loose, Brown, Moist, Silty Fine to Medium SAND (SM) with Trace Roots		1.5	2	0 Hr: Dry inside PVC
236.0	2.0	Loose, Orange and Red-Brown, Moist, Silty Fine SAND (SM)	2-4-4	2.0		24 Hrs: Dry inside PVC
				3.5	8	
			3-3-3	5.0	6	
			3-4-5	6.5	9	
				8.0		
			3-3-4	8.5	7	
				10.0		
224.5	13.5	Medium Dense, Gray and Pink, Moist, Silty Fine to Medium SAND (SM)	5-5-8	13.5	13	
				15.0		
			8-10-16	18.5	26	
				20.0		
214.5	23.5	Very Stiff, Dark Gray, Purple and Gray, Moist, Fine Sandy CLAY (CL) with Trace Roots	9-8-8	23.5	16	
				25.0		
209.5	28.5	Medium Dense, Gray and Pink, Moist, Silty Fine SAND (SM)	10-10-16	28.5	26	
208.0	30.0	Boring Terminated at 30.0 feet.		30.0		

*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.

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BORING LOG

Boring: TB-8 (1 of 1)

Project No: 66C-0109
Client: McKim & Creed
Project: FPWC POD 5 Site
City/State: Fayetteville, NC

Elevation: 237 ±
Total Depth: 30.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/4/24
Driller: A. Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
236.8	0.2	SURFICIAL ORGANIC SOILS	4-6-3	0.0	9	GROUNDWATER DATA:
		COASTAL PLAIN: Loose, Brown, Moist, Silty Fine SAND (SM)		1.5		0 Hr: Dry inside PVC
235.0	2.0	Firm, Orange-Brown, Moist, Fine Sandy CLAY (CL) with Trace Roots	2-2-3	2.0	5	24 Hrs: Dry inside PVC
			3-4-4	3.5	8	
				5.0		
230.5	6.5	Loose to Medium Dense, Orange-Brown, Moist, Clayey Fine SAND (SC)	4-4-4	6.5	8	
				8.0		
			6-9-12	8.5	21	
				10.0		
223.5	13.5	Medium Dense, Mottled Gray and Red-Brown, Moist, Clayey Fine SAND (SC)	13-10-15	13.5	25	
				15.0		
218.5	18.5	Dense, Yellow and Gray, Moist, Silty Fine SAND (SM)	14-16-20	18.5	36	
				20.0		
213.5	23.5	Medium Dense to Dense, Purple and Gray, Moist, Silty Fine to Medium SAND (SM)	8-12-15	23.5	27	
				25.0		
			16-24-26	28.5	50	
207.0	30.0	Boring Terminated at 30.0 feet.		30.0		

*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.

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Engineering Stability Since 1881

BORING LOG

Boring: TB-9 (1 of 1)

Project No: 66C-0109
Client: McKim & Creed
Project: FPWC POD 5 Site
City/State: Fayetteville, NC

Elevation: 209 ±
Total Depth: 30.0'
Boring Location: See Boring Location Plan

Drilling Method: 2.25" ID HSA
Hammer Type: Automatic
Date Drilled: 9/5/24
Driller: A. Sturchio

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
208.8	0.2	SURFICIAL ORGANIC SOILS	1-2-2	0.0		GROUNDWATER DATA:
		COASTAL PLAIN: Very Loose to Loose, Brown and Gray, Moist, Silty Fine to Medium SAND (SM)		1.5	4	0 Hr: 7.2' inside PVC
			2-2-3	2.0		24 Hrs: 9.0' inside PVC
				3.5	5	
			2-3-4		7	
				5.0		
202.5	6.5	Very Loose to Loose, Orange-Brown and Gray, Moist to Wet, Clayey Fine SAND (SC)	2-2-2	6.5	4	
				8.0		
		Wet 8.5'-13.5'	4-3-4	8.5	7	
				10.0		
195.5	13.5	Dense, Orange and Gray, Saturated, Silty Fine to Coarse SAND (SM)	10-19-21	13.5	40	
				15.0		
190.5	18.5	Very Soft to Soft, Gray, Wet, Fine Sandy CLAY (CH)	2-2-1	18.5	3	
				20.0		
			1-1-1	23.5	2	
				25.0		
180.5	28.5	Medium Dense, Orange-Brown and Gray, Wet, Silty Fine to Medium SAND (SM)	9-10-12	28.5	22	
179.0	30.0	Boring Terminated at 30.0 feet.		30.0		

*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 TESTING REULTS

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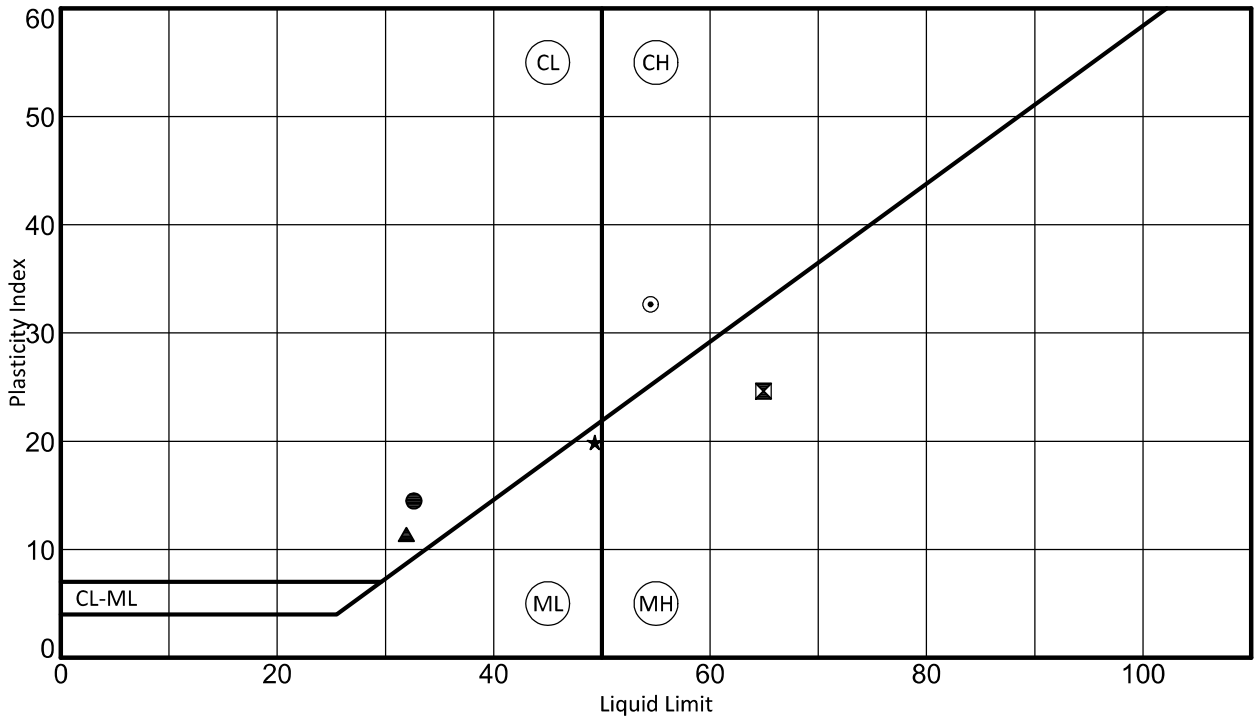
ATTERBERG LIMITS

Sheet: 1 of 1

Project No: 66C-0109
Client: McKim & Creed
Project: FPWC POD 5 Site
City/State: Fayetteville, NC



Boring No.	Depth	LL	PL	PI	% PASSING #200	Classification	% Natural Water Content
● SB-1	3.5' - 5.0'	33	18	15	42.0	CLAYEY SAND (SC)	14.6
⊠ SB-3	6.5' - 8.0'	65	40	25	29.7	SILTY SAND (SM)	13.7
▲ SB-5	13.5' - 15.0'	32	21	11	39.8	CLAYEY SAND (SC)	14.0
★ TB-7	6.5' - 8.0'	49	29	20	43.6	SILTY SAND (SM)	17.5
⊙ TB-9	18.5' - 20.0'	54	22	32	61.0	SANDY FAT CLAY (CH)	37.8

APPENDIX IV

DEEP FOUNDATION SOIL PARAMETERS

L-PILE PARAMETERS

Deep Foundation Soil Parameters

TABLE 2: Idealized Subsurface Profile

Depth (feet)		Soil Type	SPT N-Values	Field Corrected SPT Blow Count (N_{60})	Effective Unit Weight (pcf)	Cohesive Strength (psf)	L-Pile 5.0 Design Parameters		Friction Angle (degrees)	Ultimate End Bearing Pressure (psf)	Ultimate Skin Friction (psf)	USCS
Top	Bottom						Strain ε_{50}	Static Soil Modulus, K (pci)				
0	3.5	Sandy Clay	2	3	105	200	0.02	30	--	1,250	--	CL
3.5	6.5	Clayey Sand	4	5	115	--	--	25	29	3,650	--	SC
6.5	13.5	Clayey Sand	9	12	115	--	--	25	29	8,300	700	SC
13.5	18.5	Silty Sand	13	17	120	--	--	90	31	12,000	1,700	SM
18.5	23.5	Silty Sand	24	32	120	--	--	90	34	22,100	2,100	SM
23.5	33.5	Silty Sand	27	36	125	--	--	90	35	24,900	2,600	SM
33.5	40	Sandy Clay	2	3	43	200	0.02	30	--	1,500	100	CH

Assumed ground water table at EL 200 feet.

TABLE 3: L Pile Parameters – SB-1

Depth (feet)		Soil Type	Total Unit Weight (pcf)	Cohesive Strength (psf)	L-Pile 5.0 Design Parameters		Friction Angle (degrees)	USCS
Top	Bottom				Strain ε_{50}	Static Soil Modulus, K (pci)		
0	3.5	Silty Sand/Sandy Clay	110	100	0.02	25	27	SM/CL
3.5	8.5	Clayey Sand	115	-	-	25	29	SC
8.5	13.5	Sandy Clay	120	800	0.005	500	29	CL
13.5	18.5	Silty Sand	120	-	-	90	30	SM
18.5	23.5	Silty Sand	125	-	-	225	41	SM
23.5	30	Silty Sand	120	-	-	90	34	SM

Notes:
1. All depths are from existing grade and should be adjusted based on the top of foundation elevation.
2. The soil parameters in the above tables are based on correlations with the SPT values.

TABLE 4: L Pile Parameters – SB-2

Depth (feet)		Soil Type	Total Unit Weight (pcf)	Cohesive Strength (psf)	L-Pile 5.0 Design Parameters		Friction Angle (degrees)	USCS
Top	Bottom				Strain ε_{50}	Static Soil Modulus, K (pci)		
0	6.5	Sandy Clay/Clayey Sand	110	100	0.02	30	25	CL/SC
6.5	13.5	Clayey Sand	115	-	-	25	29	SC
13.5	18.5	Silty Sand	120	-	-	90	31	SM
18.5	23.5	Silty Sand	120	-	-	90	32	SM
23.5	30	Silty Sand	125	-	-	90	35	SM

Notes:
1. All depths are from existing grade and should be adjusted based on the top of foundation elevation.
2. The soil parameters in the above tables are based on correlations with the SPT values.

TABLE 5: L Pile Parameters – SB-3

Depth (feet)		Soil Type	Total Unit Weight (pcf)	Cohesive Strength (psf)	L-Pile 5.0 Design Parameters		Friction Angle (degrees)	USCS
Top	Bottom				Strain ε_{50}	Static Soil Modulus, K (pci)		
0	2.0	Silty Sand	110	-	-	25	28	SM
2.0	6.5	Sandy Clay	120	500	0.007	500	26	CL
6.5	13.5	Silty Sand	125	-	-	225	38	SM
13.5	23.5	Silty Sand	125	-	-	225	40	SM
23.5	30	Silty Sand	125	-	-	225	39	SM

Notes:
1. All depths are from existing grade and should be adjusted based on the top of foundation elevation.
2. The soil parameters in the above tables are based on correlations with the SPT values.

TABLE 6: L Pile Parameters – SB-4

Depth (feet)		Soil Type	Total Unit Weight (pcf)	Cohesive Strength (psf)	L-Pile 5.0 Design Parameters		Friction Angle (degrees)	USCS
Top	Bottom				Strain ε_{50}	Static Soil Modulus, K (pci)		
0	2.0	Sandy Clay	115	200	0.01	100	25	CL
2.0	8.5	Sandy Clay	115	450	0.01	100	26	CL
8.5	18.5	Clayey Sand	120	-	-	90	31	SC
18.5	23.5	Silty Sand	125	-	-	225	37	SM
23.5	30	Silty Sand/Clayey Sand	120	-	-	90	33	SM/SC

Notes:
1. All depths are from existing grade and should be adjusted based on the top of foundation elevation.
2. The soil parameters in the above tables are based on correlations with the SPT values.

TABLE 7: L Pile Parameters – SB-5

Depth (feet)		Soil Type	Total Unit Weight (pcf)	Cohesive Strength (psf)	L-Pile 5.0 Design Parameters		Friction Angle (degrees)	USCS
Top	Bottom				Strain ε_{50}	Static Soil Modulus, K (pci)		
0	6.5	Silty Sand/Clayey Sand	115	-	-	25	28	SM/SC
6.5	23.5	Clayey Sand	115	-	-	25	29	SC
23.5	28.5	Silty Sand	125	-	-	225	38	SM
28.5	30	Silty Sand	120	-	-	90	32	SM

Notes:
1. All depths are from existing grade and should be adjusted based on the top of foundation elevation.
2. The soil parameters in the above tables are based on correlations with the SPT values.

TABLE 8: L Pile Parameters – TB-6

Depth (feet)		Soil Type	Total Unit Weight (pcf)	Cohesive Strength (psf)	L-Pile 5.0 Design Parameters		Friction Angle (degrees)	USCS
Top	Bottom				Strain ε_{50}	Static Soil Modulus, K (pci)		
0	2.0	Silty Sand	105	-	-	25	26	SM
2.0	6.5	Sandy Clay/Silty Sand	115	100	0.02	25	27	CL/SM
6.5	18.5	Silty Sand	120	-	-	90	29	SM
18.5	23.5	Sandy Clay	115	450	0.01	100	26	CL
23.5	30	Silty Sand	120	-	-	90	33	SM

Notes:
1. All depths are from existing grade and should be adjusted based on the top of foundation elevation.
2. The soil parameters in the above tables are based on correlations with the SPT values.

TABLE 9: L Pile Parameters – TB-7

Depth (feet)		Soil Type	Total Unit Weight (pcf)	Cohesive Strength (psf)	L-Pile 5.0 Design Parameters		Friction Angle (degrees)	USCS
Top	Bottom				Strain ε_{50}	Static Soil Modulus, K (pci)		
0	2.0	Silty Sand	105	-	-	25	27	SM
2.0	13.5	Silty Sand	115	-	-	25	29	SM
13.5	23.5	Silty Sand	120	-	-	90	31	SM
23.5	28.5	Sandy Clay	120	800	0.007	500	28	CL
28.5	30	Silty Sand	125	-	-	90	34	SM

Notes:
1. All depths are from existing grade and should be adjusted based on the top of foundation elevation.
2. The soil parameters in the above tables are based on correlations with the SPT values.

TABLE 10: L Pile Parameters – TB-8

Depth (feet)		Soil Type	Total Unit Weight (pcf)	Cohesive Strength (psf)	L-Pile 5.0 Design Parameters		Friction Angle (degrees)	USCS
Top	Bottom				Strain ε_{50}	Static Soil Modulus, K (pci)		
0	2.0	Silty Sand	115	-	-	25	29	SM
2.0	8.5	Sandy Clay/Clayey Sand	115	300	0.01	25	26	CL
8.5	18.5	Clayey Sand	120	-	-	90	33	SC
18.5	28.5	Silty Sand	125	-	-	90	36	SM
28.5	30	Silty Sand	125	-	-	225	40	SM

Notes:
1. All depths are from existing grade and should be adjusted based on the top of foundation elevation.
2. The soil parameters in the above tables are based on correlations with the SPT values.

TABLE 11: L Pile Parameters – TB-9

Depth (feet)		Soil Type	Total Unit Weight (pcf)	Cohesive Strength (psf)	L-Pile 5.0 Design Parameters		Friction Angle (degrees)	USCS
Top	Bottom				Strain ε_{50}	Static Soil Modulus, K (pci)		
0	6.5	Silty Sand	115	-	-	25	29	SM
6.5	13.5	Clayey Sand	115	-	-	25	29	SC
13.5	18.5	Silty Sand	125	-	-	125	38	SM
18.5	28.5	Sandy Clay	105	200	0.02	30	-	CH
28.5	30	Silty Sand	120	-	-	60	32	SM

Notes:
1. All depths are from existing grade and should be adjusted based on the top of foundation elevation.
2. The soil parameters in the above tables are based on correlations with the SPT values.

APPENDIX V

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.***

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APPENDIX 2

EXCERPTS FROM *CITY OF FAYETTEVILLE TECHNICAL SPECIFICATIONS*

(Note: Items concerning payment have been redacted.)

SECTION 00401

EROSION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work consists of providing all labor, material, equipment, and services required to conduct erosion control as described herein and indicated on drawings in accordance with the requirements of the North Carolina Sedimentation Pollution Control Act of 1973 and the rules and regulations promulgated pursuant to the provisions of said act. Erosion control devices shall be selected based on field conditions.

PART 2 PRODUCTS

A. Products specified are for establishing the type, design and quality required. Products of equal type, design and quality produced by other manufacturers will be considered.

B. Filter Cloth (Silt Fence, including High Hazard) shall be a synthetic, permeable barrier sheet that is resistant to soil chemicals and mildew, stable under freeze-thaw cycles, will not shrink or expand under wet conditions, and will not unravel or become clogged during use. The filter cloth shall have a minimum tensile strength of 120 pounds. Allowable open area shall not exceed 36 percent and shall not be less than 4 percent. Percent open area is defined as the summation of the open areas divided by the total area of the filter cloth. Equivalent opening size (EOS) shall not be finer than the U.S. Standard Sieve No. 70. EOS is defined as the number of the U.S. Standard sieve having openings closest in size to the filter cloth openings.

C. Erosion Control Stone

1. Use field stone or rough unhewn quarry stone for plain rip rap. Use stone that is sound, tough, dense, resistant to the action of air and water and suitable in all other respects for the purpose intended. Where broken concrete from demolished structures or pavement is available, it may be used in place of stone provided that such use meets with the approval of the Engineer. However, the use of broken concrete that contains reinforcing steel will not be permitted.

2. All stone shall meet the approval of the Engineer. While no specific gradation is required, there shall be equal distribution of the various sizes of the stone within the required size range. The size of an individual stone particle will be determined by measuring its long dimension.

3. Stone or broken concrete for rip rap shall meet the following for the class and size distribution.

ACCEPTANCE CRITERIA FOR RIP RAP AND STONE FOR EROSION CONTROL

	Required Stone Sizes, Inches		
Class	**Minimum**	**Midrange**	**Maximum**
A	2	4	6
B	5	8	12
1	5	10	17
2	9	14	23

No more than 5.0% of the material furnished can be less than the minimum size specified nor no more than 10.0% of the material can exceed the maximum size specified.

D. Erosion Control Matting:

Matting for erosion control shall be excelsior matting or straw matting. Furnish a material certification certifying that the matting meets this article. Other acceptable material manufactured especially for erosion control may be used when approved by the Engineer in writing before being used. Matting for erosion control shall not be dyed, bleached or otherwise treated in a manner that will result in toxicity to vegetation.

1. Excelsior Matting

   Excelsior matting shall consist of a machine produced mat of curled wood excelsior at least 47" in width and weigh 0.975 lb/sy with a tolerance of ± 10%. At least 80% of the individual excelsior fibers shall be 6" or more in length. Evenly distribute the excelsior fibers over the entire area of the blanket. Cover one side of the excelsior matting with an extruded plastic mesh. The mesh size for the plastic mesh shall be no more than 1" x 1".

2. Straw Matting

   Straw matting shall consist of a machine produced mat of 100% grain straw. The straw matting shall have a width of at least 48" and no more than 90" and weighing at least 0.50 lb/sy and no more than 0.75 lb/sy. Evenly distribute the straw over the entire area of the blanket. Cover one side of the blanket with photodegradable netting with a maximum mesh (netting) size of 0.75" x 0.75" sewn together with a degradable thread. The grain straw shall contain no weed seeds. Package each roll separately.

3. Wire Staples

   Staples shall be machine made of No. 11 gauge new steel wire formed into a U-shape. The size when formed shall be not less than 6" in length with a throat of not less than 1" in width.

PART 3 EXECUTION

A. Work: Shall include labor, equipment, tools, saw cutting, legal disposal, and all other incidentals necessary to complete the work.

B. Install Erosion Control Devices:
   1. Install erosion control devices, which shall be in place and operational prior to other land disturbing activity.
   2. After installing erosion control devices as indicated on the Drawings, verify that reasonable measures have been taken to prevent the sedimentation of nearby watercourses, existing and new facilities, and adjacent property.
   3. Should Contractor believe that additional measures are necessary to adequately prevent erosion, immediately notify Engineer. If rain is predicted before the Engineer can be notified, take measures as necessary to prevent siltation of nearby water courses.
   4. After installing erosion control devices, request an inspection by the local agency having jurisdiction and the Engineer.
   5. Incorporate permanent erosion control work into the project at the earliest practicable time. Coordinate temporary erosion control measures with permanent erosion control measures and other work on the project to assure effective and continuous erosion control throughout the construction and post construction period.
   6. Maintain erosion control devices during construction until the disturbed areas are stabilized and the agency having jurisdiction, and the Engineer have approved the removal of the erosion control devices.

C. Borrow and Disposal Areas:
   1. Obtain and pay for erosion control permit for borrow and disposal areas as required by Engineer and the local agency having jurisdiction. (NC Department Environmental Quality)
   2. Install and maintain erosion control devices in accordance with Contractor's approved plan.

D. Silt Fences: Provide posts and metal fence fabric as detailed on the drawings and cover with filter cloth as indicated to furnish an effective filtering medium to separate soil sediment from the storm water runoff. The filter cloth shall be permanently attached to the fence to prevent displacement, and the bottom of the filter cloth shall be buried to prevent under-washing in heavy rainstorms.

E. Filters: Gravel filters as detailed on the drawings, consisting of piles of #57 stone shall be placed around permanent and temporary drainage structures to allow storm water to flow into natural drainage channels while separating soil sediment from the storm water runoff.

F. Rock Inlet Sediment Traps: Provide posts, staples, hardware cloth and stone of type and class as detailed on the drawings. Structural stone, per class specified, shall be placed around the outside perimeter of the inlet structure with approximately 2:1 side slope and plate the upstream side with #57 stone.

G. Rock Pipe Inlet Sediment Traps: Provide stone of type and class detailed on the drawings. Surround structure with a sediment storage area built to 3600 cubic feet per disturbed acre. Dam must be a minimum of 18 inches high.

H. Temporary Swales and Ditches: Temporary swales and ditches shall be graded to the profiles and sections indicated and, in the locations, directed. Slope all swales and ditches to drain to the basins and/or filters as indicated.

I. Erosion Control Matting:

Matting for erosion control shall be excelsior matting or straw matting. Furnish a material certification certifying that the matting meets this article. Other acceptable material manufactured especially for erosion control may be used when approved by the Engineer in writing before being used. Matting for erosion control shall not be dyed, bleached or otherwise treated in a manner that will result in toxicity to vegetation.

1. Excelsior Matting

Excelsior matting shall consist of a machine produced mat of curled wood excelsior at least 47" in width and weigh 0.975 lb/sy with a tolerance of ± 10%. At least 80% of the individual excelsior fibers shall be 6" or more in length. Evenly distribute the excelsior fibers over the entire area of the blanket. Cover one side of the excelsior matting with an extruded plastic mesh. The mesh size for the plastic mesh shall be no more than 1" x 1".

2. Straw Matting

Straw matting shall consist of a machine produced mat of 100% grain straw. The straw matting shall have a width of at least 48" and no more than 90" and weighing at least 0.50 lb/sy and no more than 0.75 lb/sy. Evenly distribute the straw over the entire area of the blanket. Cover one side of the blanket with photodegradable netting with a maximum mesh (netting) size of 0.75" x 0.75" sewn together with a degradable thread. The grain straw shall contain no weed seeds. Package each roll separately.

3. Wire Staples

Staples shall be machine made of No. 11 gauge new steel wire formed into a U-shape. The size when formed shall be not less than 6" in length with a throat of not less than 1" in width.

J. Seeding: Refer to Section 00480.

K. Maintenance

1. The Contractor shall be responsible for periodic reviews of the conditions of the erosion control measures and shall remove all soil sediment and debris as it accumulates in and around the sediment collection structures.
2. The Contractor shall make all necessary repairs to the erosion control measures to insure their proper operation and function throughout the duration of the project.

L. Self-Inspection and Monitoring:

1. Provide self-inspection and reporting as required by the Sedimentation Pollution Control Act for the duration of the project. These inspections will be performed to ensure that the approved sedimentation and erosion control measures on the Drawings are installed, maintained, and working adequately.
    1. The inspections need to be conducted after each phase of the project and continue until permanent ground cover is established.
    2. The self-inspection forms and information regarding this program are provided at the following website:
    http://www.dlr.enr.state.nc.us/pages/sedimentation new.html.
    3. Documentation of inspections shall be recorded on a single copy of the approved erosion and sedimentation control drawings. These Drawings and inspection reports shall be made available at the project site.

2. Provide weekly self-monitoring in accordance with the NPDES Stormwater permit for all construction activities

M. Removal of Temporary Erosion Control Measures: Remove erosion control devices upon the approval of the permanent stabilization of the site by the agency having jurisdiction of the area (NCDEQ) and the Engineer. Dress sediment deposits remaining in place after the erosion control devices are removed to conform to the existing grade, prepared and seeded. Include cost of removal and cleanup in the cost of the installation of the device. All grassed areas disturbed as a result of this removal shall be re-grassed as called for in Section 00480.

[redacted]

END OF SECTION 00401

SECTION 00402

FILTER FABRIC

REFERENCE – North Carolina Department of Transportation (Raleigh, N.C.) – Standard Specifications for Roads and Structures, current edition, and any revisions.

PART 1 GENERAL

1.01 The fabric shall consist of strong rot-proof synthetic fibers formed into a woven fabric or a nonwoven needle punched fabric meeting all applicable requirements of this section.

1.02 The fabric shall be free from any treatment or coating which might significantly alter in physical properties before or after installation. The fabric fibers shall contain stabilizers and/or inhibitors to make the filaments resistant to deterioration resulting from ultraviolet or heat exposures. The fabric shall be a pervious sheet of synthetic fibers oriented into a stable network so that the fibers retain their relative position with respect to each other. The edge of the fabric shall be finished to prevent the outer fibers from pulling away from the fabric. The fabric shall be free of defects or flaws which significantly affect its physical and/or filtering properties. Sheets of fabric may be sewn or bonded together with a fungus resistant material. No deviation from any physical requirements will be permitted due to the presence of the seam.

1.03 During all periods of shipment and storage, the fabric shall be wrapped in a heavy-duty protective covering to protect the fabric from direct sunlight, mud, dust, dirt, and debris. The fabric shall not be exposed to temperatures greater than 140°.

1.04 When anchor pins are required, they shall be fabricated of steel and installed per manufacturer's recommendation unless otherwise specified by the Engineer.

PART 2 INSTALLATION

2.01 This item shall include all labor, equipment, and materials necessary for the placement of filter fabric under Rip Rap and Reno Mattress as required by the plans. Filter fabric shall be placed as shown on the plans and in strict accordance with manufacturer's written instructions. To be acceptable for use, all filter fabric must be certified by the manufacturer to meet the specified requirements (minimum roll average) and shall be packaged and labeled according to ASTM procedures. Filter fabric for this job shall meet the following specifications:

PROPERTY	TEST PROCEDURE	VALUE
Grab Tensile	ASTM D-4632	300 lbs.
Grab Elongation	ASTM D-4632	15%
Mullen Burst	ASTM 3786	600 lbs.
Puncture	ASTM D-4633	120 lbs.
Trapezoidal Tear	ASTM D-4633	120 lbs.
AOS	ASTM D-4751	30/70 US Sieve

PART 3 ACCEPTANCE

3.01 The Contractor shall furnish a Type I Certified Mill Test Report, Type 2 Typical Certified Mill Test Report, or Type 4 Certified Test Report for the fabric in accordance with Article 106-3 of the NCDOT Standard Specifications for Roads and Structures, current edition, and any revisions.

Additionally, the material shall be subject to inspection, test, or rejection by the Engineer at any time.

3.02 Fabric will be rejected if more than 72 hours has elapsed between the time the protective wrapping has been removed and the fabric is covered up during installation except where the fabric is used for temporary silt fence.

[redacted]

END OF SECTION 00402

SECTION 00405

CLEARING, GRUBBING, AND SELECTED TREE REMOVAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This item should consist of the furnishing of all labor, equipment, and materials in performing all operations in connection with clearing and grubbing and selected tree removal, in accordance with this section of the specifications and the applicable drawings or as designated by the Engineer, and subject to the terms and conditions of the contract.

PART 2 PRODUCTS

2.01 MATERIALS

A. For cut or scarred surfaces, damaged area should be trimmed with a sharp blade to remove shredded or loose outer layer(s) and left to heal on its own. No paint or dressing is required.

PART 3 EXECUTION

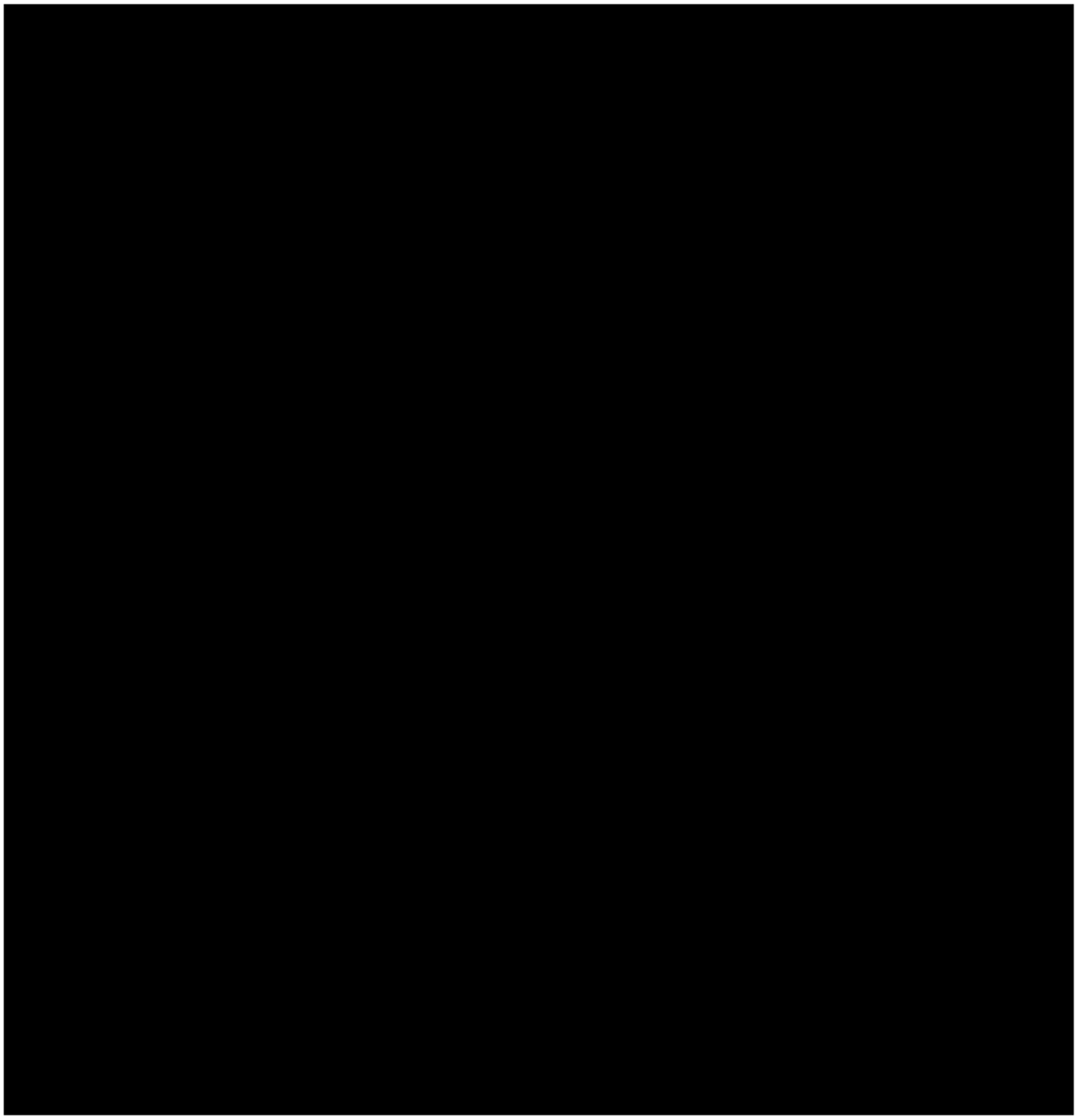
3.01 INSTALLATION

A. Protection: Locate and protect property corners and survey control stakes prior to start of clearing operations. Contractor shall protect underground utilities in the area.

B. Clearing: Clearing shall consist of the felling and cutting up of trees, the trimming of trees, and the satisfactory disposal of trees and other vegetation together with down timber, snags, brush, and rubbish occurring within the areas to be cleared. Trees and other vegetation, except such individual trees, groups of trees, and vegetation as may be indicated on the drawings or designated by the Engineer to be left standing, and all stumps, roots, and brush in areas to be cleared shall be cut off flush with or slightly below the original ground surface. Trees and stumps that are to be grubbed under the same contract may be cut to any height up to three feet (3'). When it is necessary to remove limbs and branches from trees which are to be left standing, the cut shall be neatly made close to the bole of the tree or to main branches. Individual trees, groups of trees, and other vegetation to be left standing shall be thoroughly protected from damage incident to construction operations by the erection of barriers or by other approved means. Clearing operations shall be conducted to prevent damage by falling trees to trees to be left standing, existing structures and installations, and to those under construction, and to provide safety of employees and others.

C. No trees, brush, stumps, or other refuse from clearing shall be thrown upon adjacent property, but trees unavoidably falling outside the specified limits shall be removed to within the clearing and disposed of there.

D. Grubbing: Grubbing shall consist of the removal and disposal of all stumps, roots larger than three inches in diameter and matted roots from the areas designated to be grubbed. All stumps, roots, logs, or other timber more than three inches in diameter, matted roots, and other suitable debris shall be excavated and removed to a depth not less than three feet below any subgrade, shoulder, or slope. All depressions excavated for or by the removal of stumps and roots, shall be refilled with suitable material thoroughly compacted.



G. Disposal of Cleared and Grubbed Material and Trees: All timber, logs, stumps, roots, brush, rotten wood, and other debris from the clearing and grubbing operations shall be disposed of legally by the Contractor.

H. Erosion Control: Clear areas required to install erosion control devices, which shall be in place and operational prior to other land disturbing activity. Install erosion control devices in accordance with Project Manual and Drawings and Erosion Control Permit.

I. Access Roads: Clear for access roads. Limit clearing and grubbing for access roads to maximum width necessary or as shown on plans.

END OF SECTION 00405

SECTION 00410

PROOFROLLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This item shall consist of furnishing and operating, at the direction of the Engineer, heavy pneumatic tired compaction equipment or fully loaded tandem dump truck for compacting the roadbed and testing the roadbed for stability and uniformity of compaction.

[redacted]

C. The requirement for proofrolling may not be eliminated or modified without the approval of the Engineer.

PART 2 PRODUCT

2.01 EQUIPMENT

A. The Engineer shall check to see that the equipment conforms to the requirements of this article. A tandem dump truck legally fully loaded (not less than 28 tons) with soil or stone may be used to proofroll.

B. If requested weight tickets signed by a licensed public weighmaster may be used to determine the weight of the dump truck and the weight of load to be used.

C. Requests by the Contractor to substitute other types of equipment shall be forwarded to the Engineer for approval or disapproval.

D. The Contractor shall not be permitted to drive the loaded dump truck over existing structures or curbing. The Contractor shall use rubber tired or other types of tractive equipment for operation on the roadbed. The Contractor shall protect all structural facilities within the project area, such as, but not limited to, bridges, box culverts, pipe culverts and utilities. Damage resulting from proofrolling equipment shall be repaired by contractor at no cost to the City. The entire assembly, including motivating equipment, shall be capable of executing a 180° turn.

PART 3 EXECUTION

3.01 INSTALLATION

A. Proofrolling is to be done when the roadbed is within plus or minus 0.5 feet of finished grade and the roadbed shall be rolled for a width located between points 2 feet outside the proposed edges of pavement including shoulder pavement.

B. A coverage is considered to be at that stage in the rolling procedure when the entire area to be proofrolled has been in contact with the pneumatic tires of the roller or loaded dump truck. One complete coverage shall be made with additional coverage as required when failure is suspected. Areas which have failed and been repaired shall be given a complete coverage after repair has been completed.

C. Equipment shall be operated at a speed between 225 ft/min and 300 ft/min.

D. The Engineer shall follow (walking is preferable) a short distance behind the proofroller observing the action of the roadbed produced immediately behind the tires of the roller.

When the roadbed material compresses and remains compressed, the roadbed is satisfactory. When the roadbed material compresses and then rebounds to any appreciable extent, further testing and investigation shall be made. Horizontal slippage or crust breakage is not considered as failure. Any slippage or breakage shall be repaired.

E. The Engineer shall take immediate steps to determine the cause of any failure observed. Failures are usually due to the necessity for underdrains, unsuitable materials, or excessively wet materials. These conditions may be found to be as much as 6 feet below the roadbed surface. Assistance in determining corrective action required when needed, may be obtained from the Engineer.

F. Should it be determined that the failure is due to negligence or weather, the City Engineer shall so inform the Contractor, verbally and in writing and shall document all work (including equipment, personnel, and time) necessary for correction of the area.

END OF SECTION 00410

SECTION 00412

INCIDENTAL STONE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. DESCRIPTION

1. Perform the work covered by this section including but not limited to, furnishing, hauling, placing and shaping a graded stone material for use in driveways, temporary maintenance of traffic, adjacent to mailboxes, beneath traffic island, median covers and at any other locations, other than use as a part of any base course on which pavement is to be placed; shaping; tamping when required; maintaining the base; and disposing of any surplus stockpiled material.

2. This section specifically does not include bedding stone for pipes and other structures.

PART 2 PRODUCTS

2.02 MATERIALS

1. Use stone gravel or recycled concrete for the graded stone material which is well graded from the 1-1/2 inches through the No. 200 sieve. The liquid limit of the recycled concrete is raised 5 points to no more than 35.

PART 3 EXECUTION

3.01 INSTALLATION

A. WORK

1. Work: Labor, tools, materials, equipment, furnishing, placing, supplementing stone required for maintenance, grading/leveling stone, hauling, wetting, blading, compacting, removing and disposal of incidental stone immediately prior to asphalt pavement patch.

B. GRADATION SAMPLING, TESTING AND ACCEPTANCE

1. Acceptance of the graded stone material will be made by visual inspection and approval by the Engineer as being satisfactory for the purpose intended before it use. No sampling for testing of the graded stone material will be performed.

C. PLACING AND SHAPING STONE

1. Spread the stone material uniformly over the area required and then shape and dress to the satisfaction of the Engineer.

2. Uniformly spread, grade to the required depth and firmly tamp the stone material beneath traffic island and median covers. If the Contractor desires, the surface of the stone material me be covered with a sufficient amount of fine material to facilitate grading and shaping.

D. MAINTENANCE

1. Maintain the stone material until final acceptance of the project by reshaping and by the addition of incidental stone base material when directed by the Engineer.

[redacted]

END OF SECTION 00412

SECTION 00420

AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work consists of providing all labor, material, equipment, and services required for all work as described herein and indicated on drawings.

[redacted]

D. Work: The work consists of providing all labor, material, equipment, and services required for all work as described herein and indicated on drawings.

1.02 REFERENCES

A. Standard Specifications for Roads and Structures: Section 520, most recent edition by the North Carolina Department of Transportation will govern the work under these specifications except as they are modified hereinafter.

1.03 SCHEDULING

A. No aggregate base course will be laid until the sub-grade is approved for grade and density by the Engineer.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL AND TESTS

A. Gradation testing may be required by Engineer if visible segregation in material is noted.

B. Sand cone test shall be utilized for density testing. Density testing shall be performed at a minimum of one test per road or every 1,000 feet for roads less than 27 feet in width and every 500 feet for roads greater than 27 feet in width.

C. Proofrolling is required for roadway subbase and base courses.

PART 3 EXECUTION

NOT USED

[redacted]

END OF SECTION 00420

SECTION 00425

EXCAVATION/BACKFILLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roadway: This item shall consist of the removal and satisfactory disposal of all materials excavated within the area of the street to be paved, the removal and replacement of unsuitable sub-grade material with satisfactory material, the formation, compacting, and shaping of all embankments to the lines and grades established by the Engineer, excavation from borrow areas of suitable materials to be hauled in and used as fill or back-fill, when sufficient quantities of suitable material are not available from the roadway, all in accordance with this section of the specification, and subject to the terms and conditions of the contract. The classification of all material excavated shall be either "Unclassified Excavation" or "Undercut Excavation."

B. Storm Sewer: The Contractor shall provide labor, equipment, and material to perform required excavating, backfilling, and compacting for storm sewer utilities and related structures to the depths shown on the plans or as directed by the Engineer. The width of the trench shall not exceed the width required to properly tamp backfill material around pipe or to adequately shore trench but shall be limited to pipe diameter plus two feet or pipe diameter plus ½ pipe diameter, whichever is greater.

C. All pipes shall be laid true to lines and grades shown on the plans or as designated by the Engineer. Recesses shall be excavated to receive the bells of the pipe.

D. When the foundation materials are of poor supporting value, the pipe foundation shall be reinforced by one of the following methods:
   1. By replacing the unsuitable material in a minimum depth of six inches, or as directed by the Engineer with sand, sand-clay, gravel, or crushed stone and thoroughly tamped.
   2. By constructing supporting cradles of concrete under each joint.

E. Excavation below grade shall be backfilled at the Contractor's expense, as directed by the Engineer, and thoroughly tamped. When select borrow material is required by the Engineer, it shall be paid for as Select Borrow.

F. The ground adjacent to all excavation shall be graded to prevent surface water running in. The Contractor shall, at his expense, remove by pumping or other means approved by the Engineer any water accumulated in the trench.

G. All banks or trenches shall conform to City and OSHA safety standards (whichever more stringent). The Contractor shall, at his expense, do all bracing, sheeting, and shoring necessary to perform and protect all excavations, as required for safety, and as directed by the Engineer or when the Contractor deems it necessary.

H. The excavation for manholes and catch basins shall be of sufficient width and depth to permit ready construction.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 INSTALLATION

A. Work: Complete removal and disposal of unstable soil including, but not limited to, excavating, loading, hauling, properly disposing of excavated material, and providing select granular material for backfill. Providing select granular material for backfilling shall include, but not be limited to, material, loading, hauling, placing and compacting.

B. Construction Methods: The Contractor shall proceed with excavation and disposal of material at such locations and in such sequence as the Engineer may approve.

1. All excess excavated material from a project shall be disposed of by the Contractor at his expense unless ordered to another project by the Engineer. The Contractor's obligation to remove and dispose of excess materials shall in no manner convey to him any right of property in any material taken from any excavation.

C. Sub-Grade: The sub-grade shall be graded and regulated either by hand labor, the use of one-man motor graders or other approved methods. The sub-grade of the area to be paved shall be in a true plane parallel with and to the grade line established by the Engineer. Should soft or yielding places develop in the sub-grade, the unsuitable material shall be removed and replaced with suitable material and thoroughly compacted. Care shall be taken to ensure that all utility excavations have been thoroughly backfilled and compacted. Any settlement evident after base has been placed shall be corrected at the Contractor's expense. No soil, sand-clay or other base material shall be placed on the sub-grade until the sub-grade has been checked and approved by the Engineer. A variation of more that one-half inch (½") shall be cause for rejection of the sub-grade. Compaction testing for subgrade and for base is 100% compaction.

D. Unclassified Excavation: All excavation of every description and of whatever substance including rock and rock-like material encountered shall be to the lines and grades indicated or otherwise as specified. The classification of all material excavated shall be "Unclassified Excavation." The work shall consist of the excavation, placement, compaction or satisfactory disposal of all materials encountered within the limits of the work, necessary for the construction of the roads, parking lots, building pads, and utilities. Suitable material excavated shall be transported to and placed in fill areas within the work limits. Excavation and filling shall be performed in a manner and sequence that will provide drainage at all

times. All excess unsuitable excavated material from the project shall be legally disposed of by the Contractor at his expense.

E. Undercut Excavation: All undercut excavation consists of the excavation, placement, and compaction and/or satisfactory disposal of materials removed from a location below finished grade roadway cross section.

F. Drainage Ditches: Drainage ditches shall be excavated in accordance with the plans, sections, and grades, and at the time directed by the Engineer. No deviation from alignment, grade, or section will be allowed except by the Engineer.
   1. The Contractor shall, in general, be required to excavate all drainage ditches in proper sequence or at the time directed by the Engineer. All roots, stumps, and objectionable matter in the sides and bottom of the ditch shall be cut to conform to the slope, grade, and shape of the section. The Contractor shall dispose of the excavated material as directed by the Engineer and no excavated material or spill from a drainage ditch shall be deposited or left within three feet of the edge of the ditch, but shall be scattered back and not left piled up in a ridge along the ditch, unless otherwise shown on the plans or directed by the Engineer in writing.

G. Removal of Old Pipe, Walls, Steps, Curb, Gutter, Sidewalk and Pavement: All old pipe, walls, steps, curb, gutter, sidewalks, and pavement shall be removed (including saw cutting) as directed by the Engineer, and legally disposed of by the Contractor. None of the above pay items shall be removed until measured in place by the Engineer.

H. Private Driveways: The Contractor shall keep private driveways open and unobstructed as far as practicable and shall regrade same from curb to property line when directed by the Engineer.

[redacted]

END OF SECTION 00425

SECTION 00426

SOIL MATERIALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Subsoil materials.

B. Topsoil materials.

1.02 REFERENCES

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12-inch (304.8 mm) Drop.

C. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

D. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18-inch (457 mm) Drop.

E. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

F. ASTM D2487 - Classification of Soils for Engineering Purposes.

G. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.03 SUBMITTALS FOR INFORMATION

A. Materials Source: Submit name of imported materials source.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with State of North Carolina standards. Maintain one copy on site.

PART 2 PRODUCTS

2.01 SUBSOIL MATERIALS

A. Subsoil Type S1: Conforming to State of North Carolina standard.

B. Subsoil Type S2:
   1. Excavated and re-used material.
   2. Graded.
   3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

2.02 TOPSOIL MATERIALS

A. Topsoil Type S3: Conforming to State of North Carolina standard.

B. Topsoil Type S4:
   1. Excavated and reused material.

2. Graded.
3. Free of roots, rocks larger than ½ inch, subsoil, debris, large weeds, and foreign matter.

C. Topsoil Type S5:
1. Imported borrow.
2. Friable loam.
3. Free of roots, rocks larger than ½ inch, subsoil, debris, large weeds, and foreign matter.
4. Acidity range pH of 5.5 to 7.5.
5. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.

PART 3 EXECUTION

3.01 SOIL REMOVAL

A. Excavate subsoil and topsoil from areas designated.

B. Remove lumped soil, boulders, and rock.

C. Stockpile excavated material on approved site and remove excess material, not being used, from site.

D. Remove excavated material from site. When no onsite, stockpile area is approved.

3.02 STOCKPILING

A. Stockpile materials on approved site.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Prevent intermixing of soil types or contamination.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.03 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition, with permanent ground cover. Grade site surface to prevent free standing surface water.

B. If a borrow area is indicated, leave area in a clean and neat condition, with permanent ground cover. Grade site surface to prevent free standing surface water.

[redacted]

END OF SECTION 00426

SECTION 00450

PLANT MIX BITUMINOUS CONCRETE SURFACE COURSE
AND
BITUMINOUS CONCRETE BASE COURSE
(TYPE B 25.0 C; TYPE I 19.0 C; TYPE S 9.5 B; TYPE S 9.5 C)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work covered by this section consists of the production, delivery, placement and compaction of all types of bituminous plant mixed bases and surface courses.

[redacted]

1.02 REFERENCES

A. The "Standard Specification for Roads and Structures" current edition and any revisions by the North Carolina Department of Transportation (NCDOT) will govern in its entirety the work under these specifications except as they are modified hereinafter.

B. Bituminous Plants Production: All bituminous plants shall meet specification 610 of the Standard Specifications of Roads and Structures current edition and any revisions by the NCDOT. All bituminous plants that produce bituminous mixes that are to be used within the rights-of-way of the City of Fayetteville, or on any new street that is to be accepted by the City of Fayetteville, shall have a current and up to date certification of the asphalt plant on file with the City of Fayetteville.
   1. Any bituminous mix that is produced by a plant that does not have NCDOT certification is unacceptable for use within the City of Fayetteville.

C. Quality Management System for Asphalt Pavements: The Contractor shall produce and construct asphalt mixtures and pavements in accordance with a quality management system as described in Section 609 of the NCDOT Standard Specifications. The Contractor shall submit only NCDOT approved mix design and must be approved by the Engineer prior to delivery. Apply these specifications to all materials and work performed in accordance with Division 6 of the NCDOT Standard Specifications. Perform all quality control activities in accordance with NCDOT “Hot Mix Asphalt Quality Management System (HMA/QMS)” Manual.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Weather and Temperature Limitations: This section addresses air temperature, road surface temperatures, seasonal limitations, weather requirements, the layer thickness that apply when producing and/or placing the various mixture types. Bituminous mixtures shall not be produced or placed during rainy weather, when the sub-grade or base course is frozen, nor when the moisture on the surface to be paved would prevent proper bond. Bituminous material shall not be placed when the air temperature, measured in the shade away from artificial heat at the location of the paving operations, is less than the following temperatures:

	TEMPATURE OF LAYER BEING PLACED	
Material Type	Minimum Air Temperature	Minimum Road Surface Temperature
ACBC, Types B 25.0C, B 37.5 C, PADC	35 degree F (2 degree C)	35 degree F (2 degree C)
ACIC, Types I 19.0C	35 degree F (2 degree C)	35 degree F (2 degree C)
ACSC, Types S 4.75A, SF 9.5B	40 degree F (5 degree C)	40 degree F (5 degree C)
ACSC, Types S 9.5C	40 degree F (5 degree C)	40 degree F (5 degree C)

* For final layer of surface mixes containing recycled asphalt shingles (RAS) the minimum surface and air temperature shall be 50°F.

1. In addition, surface course material, which is to be the final layer of pavement, shall not be placed between December 15 and March 16, except that open-graded asphalt friction courses (OGAFC) will not be placed between October 31 and April 1 of the next year, unless otherwise approved by the Engineer.
2. As an exception to the above, when in any day's operations the placement of a layer of bituminous base course material or binder material 2" or greater in thickness has started, it may continue until the temperature drops to 32 degrees Fahrenheit (F).

PART 2 PRODUCTS

2.01 MATERIALS

A. Composition of Mixtures (Job Mix Formula): All bituminous plant mixes that shall be used within the rights-of-way of the City of Fayetteville shall be produced in a NCDOT certified bituminous plant.

B. All bituminous base courses and surface course mixes that are to be use within the rights-of-way of the City of Fayetteville shall be NCDOT approved and have all job mix formulas on file with the City of Fayetteville. No other bituminous mixes will be acceptable. Must submit mix design for the project.

C. All binder shall meet the appropriate requirements of Section 610 of the NCDOT Standard Specifications.

PART 3 EXECUTION

3.01 INSTALLATION

A. Work: Production, delivery, placement, and compaction to successfully install bituminous pavement.

B. Construction Requirement: The production, spreading, finishing, weather limitation, joints, compaction, density and surface requirements shall be in accordance with the Standard Specifications for Roads and Structures current edition and any revisions by the NCDOT.

C. Transportation of Bituminous Mixture: The mixture shall be transported from the mixing plant to the point of use in vehicles which have tight, clean, smooth metal beds that have been sprayed with a lime solution, a soap and oil solution, or other approved material, to prevent the mixture from adhering to the beds. Fuel oil is not permitted for this purpose. Truck beds shall be drained prior to loading. Each load of mixture shall be fully covered with a canvas or other suitable material. All covers shall be so constructed and secured as to prevent the entrance of moisture and the rapid loss of temperature. A 3/8-inch diameter hole shall be provided on each side of the vehicle body near the center of the body and 6 inches above the bed of the vehicle for the purpose of inserting a thermometer.

D. The temperature of the mixture immediately prior to discharge from the hauling vehicle shall be within a tolerance of plus 15 degrees F to minus 25 degrees F of the specified job mix temperature.

TABLE 610-1 MIXING TEMPERATURE AT THE ASPHALT PLANT	
Binder Grade	JMF Temperature
PG 64-22	300°F
PG 70-22	315°F

PG 76-22	335°F

E. The contractor is required to have a certified Roadway Technician with each paving operation at all times. This person is responsible for monitoring all roadway paving operations and directly supervising all quality control processes and activities. Provide a certified nuclear gauge operator when nuclear density control is being used. Provide the City of Fayetteville with an organizational chart, including names, telephone numbers, and current certification numbers of all personnel responsible for the quality control program while asphalt paving work is in progress.

F. Utilize the 30-foot minimum length mobile grade system to control longitudinal profile when placing the initial lanes and all adjacent lanes of all courses, including resurfacing, leveling courses, and asphalt in-lays, unless otherwise approved by the Engineer. Where public traffic is being maintained, apply only as much tack coat as can be covered during the same day's operation. In addition, the Engineer may limit the application of tack coat in advance of the paving operation depending on traffic conditions, project location, proximity to business or residential areas, or other reasons. In the event that tack coat material is not covered in the same day's operation; the Engineer may require the application of suitable granular material or other means to provide a safe traffic condition at no additional cost to the City of Fayetteville. The contractor will be responsible for any clean-up of the materials that was placed at no cost to the City of Fayetteville.

G. Contractor will furnish with each load of asphalt a scale ticket by a certified weigh master showing the amount of asphalt on the truck. Contractor will be paid on a unit price per ton of asphalt that is actually placed and rolled to a finish asphalt surface or base course.

H. The Engineer may prohibit or restrict the use of vibratory rollers where damage to the pavement being placed, the underlying pavement structure, drainage structures, utilities, or other facilities is likely to occur or is evident.

I. The final surface course material shall be compacted using two steel-wheel rollers and a pneumatic tired roller. For any paving operations, two rollers required on site.
   1. Initial rolling shall be achieved using an 8-to-10-ton steel wheel roller.
   2. Intermediate rolling shall be achieved using a pneumatic tired roller.
   3. Final rolling shall be achieved using an additional steel wheel roller.

J. Surface Smoothness:
   1. Base Course – 1/4" in 10 feet.
   2. Surface Course – 1/8" between any two contact points, 10-foot straight edge.

3.02 SPECIAL CONSIDERATION

A. Traffic Loops: When paving intersections requiring loop installations, the Owner shall be given ten (10) calendar days between completion of the first course and beginning of the second course in which to execute said loop installation. Contractor shall install loops before final layer, no later than five (5) days from when milled or as approved by the Engineer.

[redacted]

END OF SECTION 00450

SECTION 00455

CONCRETE (CURB AND GUTTER, SIDEWALK, DRIVEWAY)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This work shall consist of Portland cement concrete combination curb and gutter, sidewalk and driveway constructed on a prepared sub-grade, in one course, in conformity with the lines, grade and typical cross section shown on the plans and in accordance with these specifications.

1.06 DESIGN REQUIREMENTS

A. Proportioning of Concrete: The concrete shall be mixed in proportions approved by the Engineer. The concrete shall develop at 28 days a minimum compressive strength of 2,500 pounds per square inch (Class B). The consistency range in slump of the concrete shall be two to four inches.

B. Air Entrainment of Concrete: All exposed concrete shall have 6 percent (+ or - 1.5 percent) entrained air as discussed in ASTM C 494-80. Measurement shall be with a roll-meter in accordance with ASTM C173-81 or a pressure meter in accordance with ASTM C281-81. Use of other testing procedures will be considered if requested in writing.
   a) The concrete from a central plant shall be delivered by a mobile agitator type mixer and deposited at the consistency specified without segregation. The time lapsing from mixing to placing the concrete shall be in accordance with NCDOT requirements.
   b) Concrete shall be mixed only in such quantities as are required for immediate use and all such material shall be used while fresh and before initial set has taken place. Any concrete in which set has begun shall not be used in the work. Re-tempering of concrete will not be allowed.

C. Finished grade of the sidewalk shall be based on the top of curb elevation.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather and Night Concreting: Concreting shall be done when weather conditions are favorable unless otherwise directed by the Engineer. Concrete operations shall be discontinued when the temperature of 40° 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 and plastic or other thermal insulation satisfactory to the Engineer. The Contractor shall be responsible for the quality and strength of the concrete laid during cold weather and any concrete damaged by frost action or freezing shall be removed and replaced as directed by the Engineer at the Contractor's expense.

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

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement: The cement used in this item shall be a standard brand of Portland cement or high-early-strength Portland cement conforming to the requirements of AASHTO Specifications. Different brands of cement, or the same brand from different mills, shall not be mixed nor shall they be used alternately in any one continuous pouring between transverse joints.

B. Concrete Joint Sealer –

2.02 SOURCE QUALITY CONTROL

A. Testing: The Engineer shall engage and pay an approved independent testing agency to conduct the routine testing of material for compliance in accordance with ACI 301-72, Chapter 16.

B. Test reports shall be furnished to the Engineer in quadruplicate at the earliest possible date following the testing.

C. If cylinder test results indicate that the concrete has not or will not reach the required 28-day compressive strength, the Engineer shall have the right to require any additional testing as necessary to determine the actual in-place strength of the concrete. Such additional testing will be at the Contractor's expense.

D. The Engineer shall have the right to require the removal and subsequent replacement of any concrete not meeting the minimum 28-day compressive strength. Such removal and replacement shall be at the Contractor's expense.

2.03 CONCRETE

A. The concrete shall be an approved NCDOT certified mix.

PART 3 EXECUTION

3.01 WORK

A. Furnishing, hauling, and placing all materials, fine grading of sub-grade, installation and removal of forms, compacting subgrade, truncated dome, soil amendments, backfilling behind curb with topsoil, all equipment, tools, curing and labor and incidentals necessary to complete the work.

3.02 PREPARATION

A. Cleaning Site: Prior to the acceptance of the work, unsightly objects such as stones, stumps, limbs, roots, concrete, etc., shall be removed from the site and disposed of to the satisfaction of the Engineer. Work shall not be considered complete until all cleaning up has been done and the site is of a neat appearance.

3.03 INSTALLATION

A. Sub-grade: The sub-grade shall be excavated to the required depth below the finished surface in accordance with the plans and lines and grades established by the Engineer. All soft and yielding material or other unsuitable material shall be removed and replaced with approved material and compacted thoroughly at the expense of the Contractor. If the sub-grade is in a filled section, the entire area shall be compacted to an unyielding surface.

B. Forms: Forms shall be set true to the lines and grades established by the Engineer. Sections less than 5 feet will not be accepted. Forms shall be held rigidly in position and shall be of sufficient strength to resist springing out of line when the concrete is placed. Forms shall be metal of the necessary dimensions to construct the combined curb and gutter, sidewalk or driveway shown on the drawings or specified. Wood forms may be used only where conditions make the use of metal forms impractical, and then only when approved by the Engineer. Forms for straight curb and gutter or radius curb and gutter having a radius of 350 feet or over shall be of steel of an approved type. Bent steel forms or steel forms with top or bottom flanges out of square sides or forms without pin lugs shall not be used and shall be removed from the construction site. Flexible steel forms shall be used on all radius curb having less than a 350-foot radius.

C. Placing of Concrete (Curb and Gutter): The curb and gutter shall be constructed in place in uniform sections 10 feet in length. The joints between sections shall be formed by steel templates 3/16 inches in thickness. Templates shall conform strictly to the curb and gutter section. All joints shall be at right angles to straight curb and in radius line in radius curb. Any broken edges or joints may be cause for rejection. Templates must be pulled halfway out before concrete is set in order that concrete may run under the template. After concrete is set and while the forms are still in place, the templates are to be completely removed. When a curbing machine is used, the Contractor should use all precautions to prevent curb from settling when first starting, especially when grade is critical (below 1 percent). Contractor shall check grade on new poured curb before concrete has set so that correction can be made to the flow line of the curb.

a) Expansion joints of approved material for curb and gutter shall be provided every 90 feet or as directed by the Engineer. Joint material shall be not less than ½ inch in thickness, cut true to section, and shall be placed against the steel template forming the joint. Care shall be taken not to disturb the position of the expansion joint filler material during the removal of the templates.

b) Prior to placing of concrete, the sub-grade shall be moistened, and the contact side of the forms shall be coated with a heavy oil. After the placing of the concrete within the forms, the sides of the forms shall be spaded with a flat spade of approved type. All voids that may appear after forms have been removed, shall be wetted thoroughly and plastered. An excess of voids will be cause for rejection. A slip form concrete machine may be used only on a trial basis and must meet the approval of the Engineer.

D. Placing of Concrete (Driveways and Sidewalks): Thickness shall be minimum of 4" for residential driveway aprons and 6" for commercial driveway aprons. Expansion joints of approved material shall be provided every 50 feet and contraction joints every 5 feet or as directed by the Engineer. Joint material shall be not less than ½ inch in thickness, cut true to section, and shall be placed against the template forming the joint. Care shall be taken not to disturb the position of the expansion joint filler materials during the removal of the

templates. Seal expansion joints where sidewalk and curb ramps are placed adjacent to concrete curb and/or gutter. Seal all joints to include expansion and contraction joints.

a) Prior to placing of concrete, the sub-grade shall be moistened, and the contact side of the forms shall be coated with heavy oil. After the placing of the concrete within the forms, the sides of the forms shall be spaded with a flat spade of approved type. All voids that may appear, after forms have been removed, shall be wetted thoroughly and plastered. An excess of voids will be cause for rejection. A Slip Form Concrete Machine may be used only on a trial basis and must meet the approval of the Engineer.

E. Finishing: 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 broom finished with a dampened broom. Broom finished in direction of flow, all joints and all exposed edges shall be rounded off with approved jointing and edging tools.

F. Curing: Immediately after finishing operations have been completed, the entire surface of the concrete shall be sprayed with white curing compound (type 11 white pigment). The use of liquid retarding agents shall conform to standards specified by current AASHTO or ASTM specifications.

G. Removal of Forms: Forms shall not be removed from freshly placed concrete until it has set for at least 24 hours. They shall be carefully removed and in such a manner as to prevent damage to the edges of the concrete. Honeycombed areas shall be promptly filled with mortar composed of one part cement and two parts sand.

3.04 FIELD QUALITY CONTROL

A. The Engineer shall have the authority to require the Contractor to remove and replace any curb and gutter, sidewalk, or driveway which has been placed at grade elevations other than those shown on the plans and/or cut sheet. The finished grade of sidewalk is based on the top of curb. Such curbing, sidewalk, or driveway shall be removed and replaced at the Contractor's expense.

B. Curbing, sidewalk, or driveway found to be holding "ponding" water will be removed and replaced at the Contractor's expense.

3.05 PROTECTION OF FINISHED WORK

A. Protection of Concrete: After 72 hours the forms may be removed. Immediately after the forms have been removed and all honeycombed areas repaired, the back of the curb shall be backfilled to prevent under-wash. Traffic shall be excluded from crossing the concrete for a period of approximately 7 days by erection and maintenance of suitable barricades. Contractor shall be responsible for any damage resulting from traffic within the 7-day period and he shall remove and replace any concrete damaged as directed by the Engineer.

END OF SECTION 00455

SECTION 00491

TRAFFIC CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work covered by this section consists of furnishing, erecting, maintaining, relocating and removing traffic control devices for maintenance of traffic during construction operations.

1.02 REFERENCES

A. All work performed is to be in accordance with:
   1. The North Carolina Department of Transportation Standards and Specifications for Road and Structures, current edition and any revisions.
   2. The North Carolina Department of Transportation Highway Design Branch Roadway Standard Drawings, January 2018 edition and revisions or current edition and any revisions.
   3. The Manual on Uniform Traffic Control Devices (MUTCD).
   4. The North Carolina Supplement to the MUTCD.
   5. Any project plans or sketches.
   6. Any project special provisions.

1.03 SUBMITTAL

A. If the traffic control plan is not included as a part of the project plans, the individual project traffic control plan must be submitted to the City Traffic Engineer within two weeks of being declared the lowest responsible bidder. The City Traffic Engineer will approve or revise and approve the traffic control plan within 5 working days of submittal.

PART 2 PRODUCTS

2.01 MATERIALS

A. The Contractor shall use interim pavement marking paint as described in the most recent edition of The North Carolina Department of Transportation Standard Specifications for Roads and Structures.

B. Traffic cones may be used when approved by the City Traffic Engineer. When cones are used, they shall be either double stacked or have special heavy bottoms such that they will not be blown over by traffic.

C. All traffic control devices furnished by the Contractor shall remain the property of the Contractor, unless otherwise required by the Special Provisions.

PART 3 EXECUTION

3.01 PREPARATION

A. Street Closure
   1. Intended street closures must be requested, in writing to the City of Fayetteville Traffic Engineer, a minimum of five (5) working days prior to the desired closure date. The request shall state the street name, the from and to locations, and the length of closure time of the individual street to be closed.
   2. The request must also be accompanied by a traffic control plan, showing the detour information of through traffic. This plan must be in accordance with the current edition of the MUTCD.
   3. After approval, in writing, the Contractor bears full responsibility for the closure to include installation, maintenance and removal of all traffic control devices, as well as all implied liability.

B. No work shall start until all the traffic control devices required for the particular work activity have been installed, inspected, and approved by the Traffic Engineer or his representative.

3.02 TEMPORARY ROAD CLOSURE

A. Conditions represented are for work that requires closings during daytime hours only.

B. This application is intended for a planned temporary closing not to exceed 15-20 minutes.

C. The flaggers shall stop the first vehicle from the position shown, then move to the centerline to stop approaching traffic.

D. A portable message sign may be used in addition to the initial warning sign.

E. NOTE: The spacing between signs has a recommended standard of 200' but can be modified by the City Inspector according to the location of the workspace.

3.03 LANE CLOSURE ON MINOR STREET

A. The traffic control procedure shown is appropriate only for low volume, low speed facilities, such as local residential streets.

B. Traffic can regulate itself when volumes are low and the length of the workspace is short, thus enabling drivers to readily see the roadway beyond.

C. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.

D. NOTE: The spacing between signs has a recommended standard of 200' but can be modified by the City Inspector according to the location of the workspace.

3.04 SIDEWALK CLOSURES

A. Additional advance warning may be necessary.

B. Only the traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets. Use lane closure signing as required.

3.05 INSTALLATION

A. The furnishing, erecting, maintaining, relocating and removing of traffic control devices will be in accordance with the current edition of *The Manual on Uniform Traffic Control Devices* for streets and highways.

B. All traffic control devices must be in place before beginning work each day, removed during intervals when work is not ongoing and removed at the end of the workday.

C. The Contractor shall not obstruct or impede any of the traffic on adjacent streets while installing traffic control or doing construction work.

D. The Contractor shall not close a lane to through traffic at night and during periods of construction inactivity, unless otherwise approved by the Engineer.

E. The Engineer may restrict the Contractor from placing lane closures during certain hours, holidays, or special events because traffic may be unusually heavy. All lane closure types, hours of installation and lengths, will be controlled by and required to be approved by the Engineer.

F. When working within the travelway, the Contractor shall use a standard lane closure or a moving operation caravan utilizing a shadow vehicle and truck mounted impact attenuator, as approved by the City Traffic Engineer. A moving operation caravan shall only be used if the marker operation maintains a minimum speed of 3 MPH at all times with no stops that would narrow or close a lane of travel.

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

H. Time limitation for placement and replacement on pavement markings and markers completed by contractors on newly resurfaced areas:
   1. Marking By Contractor
      a. Divided and Multi-Lane Facilities
         1) For all Interstate highways and access ramps, place all markings including symbols and legends, by the end of each workday's operation.
         2) For all divided and multi-lane facilities, place all center line and lane line markings and railroad and school symbols and stop bars by the end of each workday's operation. Place all edge lines, gore lines, and other symbols within 3 calendar days after they have been obliterated by the resurfacing operation.
         3) A multi-lane facility is defined as any roadway having more than two lanes to include a two-lane, two-way with two-way center left turn lane.
      b. Two-Lane, Two-Way Facilities
         1) For all two-lane, two-way facilities, place all centerline markings, railroad and school symbols within 5 calendar days after they have been obliterated by the resurfacing operation. Place all edge lines and other symbols within 15 calendar days after they have been obliterated by resurfacing operations.
      c. All Facilities
         1) Place two applications of paint on newly resurfaced asphalt which will remain in place over three (3) months. Place the second application of paint upon ample drying time of the first, as determined by the Engineer.
         2) Install permanent markers within sixty (60) calendar days after completing the resurfacing on each map.

[redacted]

END OF SECTION 00491

SECTION 02831

FENCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide chain link fencing where indicated on the Drawings and specified herein.

B. Work shall include, but not be limited to, the following major items and necessary accessories for a complete and operational system:
   1. Clearing as necessary for installation of fence.
   2. Fence post, frame, and concrete foundation.
   3. Chain link fabric and barbed wire.
   4. Gates.

[redacted]

1.02 SYSTEM DESCRIPTION

A. Fencing Location
   1. Fence Height: As shown on drawings
   2. Provide posts, bottom intermediate and top rails as indicated. Provide corner and brace assemblies.
   3. Provide fabric gauges as indicated and install fabric on outside of fence and anchor to framework such that fabric remains in tension after pulling force is released.

1.03 SUBMITTALS

A. Submit the following in accordance with Section, Submittal Procedures:
   1. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following. Equipment to be furnished for the Project shall be clearly indicated including all options to be provided.
      a. Individual components of the fencing system.
   2. Shop Drawings: Submit Project specific shop drawings for the following:
      a. Layout drawing showing spacing of posts and location of gate, corner, end, and pull posts.
   3. Manufacturer's Installation Procedures.

PART 2 PRODUCTS

2.01 FABRIC

A. Selvage: Fabric shall be twisted and barbed at both selvages. Both selvages of meshes less than 2 inches shall be knuckled. Bottom tension wire shall be 7 gauge and shall terminate at posts.

B. Galvanized Steel Chain-Link Fence Fabric: Fabricated in one-piece widths for fencing 12 feet and less in height to comply with Chain Link Fence Manufactures Institute (CLFMI) “Product Manual” and with requirements indicated below:
   1. Mesh and Wire Size: 2-inch mesh, 0.148-inch diameter (9 gage).

2. Coating: ASTM A 392-74, Class 2, galvanized.

2.02 FRAMING

A. Round member sizes are given in actual outside diameter (OD) to the nearest thousandth of inches. Round fence posts are often referred to in ASTM standard specifications by Nominal pipe sizes (NPS) or the equivalent trade sized inches. The following indicates these equivalents all measured in inches:

Actual OD Size (in)	NPS Size	Trade
1.660	1 1/4	1 5/8
1.900	1 1/2	2
2.375	2	2 1/2
2.875	2 1/2	3
4.000	3 1/2	4

B. Type I Round Posts: Standard weight (schedule 40) galvanized-steel pipe conforming to ASTM F 1083, according to heavy industrial requirements of ASTM F 669. Group IA, with minimum yield strength of 25,000 psi, not less than 1.8 oz. of zinc per square foot. Type coating inside and outside according to ASTM F 1234, as determined by ASTM A 90, and weights per foot as follows:

Actual OD Size (in)	Weight (lb/ft)	NPS Size
1.660	2.27	1-1/4
1.900	2.72	1-1/2
2.375	3.65	2
2.875	5.79	2 1/2
4.000	9.11	3 1/2

C. Top Rail: Manufacturer's longest lengths (21 feet) with expansion-type coupling, approximately 6 inches long for joining. Provide rail ends of other means for attaching top rail securely to each gate, corner, pull, and end post.
1. Round Steel: 1.660-inch OD Type.

D. Steel posts for all fabric heights:
1. Round Line or Intermediate Posts: 2.375-inch OD Type I steel pipe.
2. Round End, Corner, and Pull Posts: 2.875-inch OD Type I steel pipe.

E. Swing Gate Posts: Furnish post to support single gate leaf, or one leaf of a double-gate installation, according to ASTM F 900, sized as follows.
1. Steel posts for fabric height of 8 feet or less and gate leaf width:
a. Up to and including 4 feet: 2.875-inch OD pipe weighing at least 5.79 lb per foot.
b. Over 4 to 10 feet: 4.000-inch OD pipe weighing at least 9.11 lb per ft.

2.03 FITTINGS AND ACCESSORIES

A. Material: Comply with ASTM F 626. Galvanized iron or steel to suit manufacturer's standards.
1. Steel and Iron: Unless specified otherwise, hot-dip galvanize steel or cast-iron fence fittings and accessories with at least 1.2 oz. Zinc per sq. ft. as determined by ASTM A 90.

B. Post and Line Caps: Provide weather-tight closure cap for each post. Provide line post caps with loop to receive top rail.

C. Post Brace Assembly: Manufacturer's standard adjustable brace. Use material specified below for brace, and truss to line posts with 3/8-inch-diameter rod and adjustable tightener. Provide manufacturer's standard galvanized-steel, cast iron or cast-aluminum cap for each end.
   1. Round Steel: 1.6600-inch OD Type I steel pipe.

D. Bottom and Center Rail: (Where indicated on drawings). Same material as top rail unless indicated otherwise. Provide manufacturer's standard galvanized-steel, cast-iron or cast-aluminum cap for each end.

E. Tension or Stretcher Bars: Hot-dip galvanized steel with a minimum length 2 inches less than the full height of fabric, a minimum cross section of 3/16 inch by 3/4, and a minimum of 1.2 oz of zinc coating per sq. ft. Provide one bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into the post.

F. Tension and Brace Bands: 3/4 –inch-wide minimum hot-dip galvanized steel with a minimum of 1.2 oz. of Zinc coating per sq. ft.
   1. Tension Bands: 0.074-inch thick (14 gauge) minimum.
   2. Brace Bands: 0.105-inch thick (12 gauge) minimum

G. Tension Wire: 0.177-inch-diameter metallic-coated steel marcelled tension wire conforming to ASTM A 824 with finish to match fabric.
   1. Coating Type II zinc in the following class as determined by ASTM A 90.
      a. Class 2, with a minimum coating weight of 1.20 oz. per sq. ft. of uncoated wire surface.

H. Tie Wire: (9-gauge) aluminum wire alloy 1350-H19 or equal.

2.04 BARBED WIRE

A. Provide three lines of 4-point pattern barbed wire. Barbed wire shall be double strand 12-1/2 gauge twisted wire with 14-gauge, 4 point round aluminum barbs spaced on approximately 5 inch centers conforming to the requirements of ASTM A121. Extension arms to accommodate barbed wire shall withstand a 250-pound pulldown load from end of arm and have a 3-inch apron around post. The topmost barbed wire shall be approximately 18 inches above the fabric and approximately 18 inches out from fence line. Barbed wire shall be securely fastened in slots by heavy wire pins. Arms having projections to bend down over barbed wire will not be acceptable.

2.05 CONCRETE

A. Concrete: Provide concrete consisting of Portland cement per ASTM C150, aggregates per ASTM C 33, and potable water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 3000 psi. Use at least four sacks of cement per cu. yd., 1-inch maximum size aggregate, 3-inch maximum slump.

B. Package Concrete Mix: Mix dry-packaged normal-weight concrete conforming to ASTM C 387 with clean water to obtain a 2-inch to 3-inch slump.

2.06 GATES

A. General: Fabricate perimeter frames of gates from same material and finish as fence framework. Assemble gate frames by welding. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame members a maximum of 8 feet apart unless otherwise indicated.

1. Fabric: Same as for fence unless otherwise indicated. Secure fabric at vertical edges with tension bars and bands and to top and bottom of frame with tie wires.
2. Bracing: Install an adjustable truss rod diagonally on gates six foot wide and greater to prevent sagging.

B. Swing Gates: Comply with ASTM F 900.
1. Framework: Fabricate using 1.660-inch minimum OD Type I steel pipe or 1-inch-square galvanized steel tubing weighing 1.84 lb per sq. ft.
2. Gate Hardware: Provide galvanized hardware and accessories for each gate according to the following:
   a. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180-degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 6-foot nominal height.
   b. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as an integral part of latch.
   c. Keeper: Provide a keeper for vehicle gates that automatically engages gate leaf and holds it in the open position until manually released.
   d. Gate stops: Provide gate stops for double gates consisting of mushroom-type flush plate with anchors, set in concrete, and designed to engage a center drop rod or plunger bar. Include a locking device and padlock eyes as an integral part of the latch, permitting both gate leaves to be locked with a single padlock.

PART 3 EXECUTION

3.01 INSTALLATION

A. Work: Shall include labor, material, equipment, grading and any other incidentals required for installation. Fence to match existing fence material or as specified by the Engineer.

B. General: Install fence to comply with ASTM F 567. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

C. Excavation: Drill or hand-excavate (using post-hole digger) holes for posts to diameter and spacings indicated, in firm, undisturbed or compacted soil.
1. If not indicated on Drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than four times the largest cross section of post.
2. Unless otherwise indicated, excavate hole depths approximately 3 inches lower than post bottom, with bottom of posts set not less than 36 inches below finish grade surface.

D. Setting Posts: Center and align posts in holes 3 inches above bottom of excavation. Space a maximum of 10 feet o.c., unless otherwise indicated.
1. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and hold in position during placement and finishing operations.
   a. Pour concrete footings to a level 2" below finished grade and cover with fresh earth from excavation.

E. Top Rails: Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

F. Center Rails: Install center rails in one piece between posts and flush with post on fabric side, using rail ends and special offset fittings where indicated.

G. Brace Assemblies: Install braces at end and gateposts and at both sides of corner and pull posts. Locate horizontal braces at midheight of fabric. Install so posts are plumb when diagonal rod is under proper tension.

H. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric before stretching fabric and tie to each post with not less than same gage and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter (11-gage) hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c.

I. Fabric: Pull fabric taut and tie to post, rails, and tension wires.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and Gateposts with tension bands spaced not over 15 inches o.c.

K. Tie Wires: Use wire of proper length to secure fabric firmly to posts and rails. Bend ends of wire to minimize hazard to persons or clothing.
   1. Maximum Spacing: Tie fabric to line posts 12 inches o.c. and to rails and braces 24 inches o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

M. Netting Ties: Fasten safety netting to tension cable and fence top rail with cable ties at 12" o.c.

N. Barbed Wire: Install three parallel wires on each extension arm on security side of fence, unless otherwise indicated. Pull wires taut.

O. Gates: Install gates plumb, level and secure for full opening without interference. Install ground set items in concrete for anchorage as recommended by the manufacturer.

[redacted]

END OF SECTION 02831

SECTION 02950

TREES, PLANTS, AND GROUND COVER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of soil.

B. Topsoil bedding.

C. Relocation of trees, plants and ground cover.

D. Mulch and fertilizer.

E. Maintenance.

F. Tree Pruning.

[redacted]

1.02 REFERENCES

A. ANSI Z60.1 - Nursery Stock.

B. NAA (National Arborist Association) - Pruning Standards for Shade Trees.

1.03 DEFINITIONS

A. Weeds: Any plant life not specified or scheduled.

B. Plants: Living trees, plants, and ground cover specified in this Section [, and described in ANSI Z60.1].

1.04 SUBMITTALS - PROJECT CLOSEOUT

A. Maintenance Data: Include cutting and trimming method; types, application frequency, and recommended coverage of fertilizer.

B. Submit list of plant life sources.

1.05 QUALITY ASSURANCE

A. Nursery Qualifications: Company specializing in growing and cultivating the plants with three years' experience.

B. Installer Qualifications: Company registered and specializing in installing and planting the plants with 3 years' experience.

C. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.

D. Tree Pruning: NAA - Pruning Standards for Shade Trees.

E. Maintenance Services: Performed by installer.

1.06 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Plant Materials: Certified by state department of agriculture. Described by ANSI Z60.1, free of disease or hazardous insects.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

B. Protect and maintain plant life until planted.

C. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.08 COORDINATION

A. Install plant life after and coordinate with installation of underground irrigation system piping and watering heads specified in Section 02810.

1.09 WARRANTY

A. Provide one year warranty.

B. Warranty: Includes coverage for one continuous growing season; replace dead or unhealthy plants.

C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

1.10 MAINTENANCE SERVICE

A. Maintain plant life for 12 months after Date of Substantial Completion.

B. Maintain plant life immediately after placement until plants are well established and exhibit a vigorous growing condition. Continue maintenance until termination of warranty period.

C. Maintenance to include:
1. Cultivation and weeding plant beds and tree pits.
2. Applying herbicides for weed control in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.
3. Remedy damage from use of insecticides.
4. Irrigating sufficient to saturate root system.
5. Pruning, including removal of dead or broken branches, and treatment of pruned areas or other wounds.
6. Disease control.
7. Maintaining wrapping, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.
8. Replacement of mulch.

PART 2 PRODUCTS

2.01 TREES, PLANTS, AND GROUND COVER

A. Trees, plants and ground cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.02 SOIL MATERIALS

A. Topsoil: Fertile, agricultural soil, capable of sustaining vigorous plant growth; free of subsoil, clay or impurities, plants, weeds and roots

2.03 SOIL AMENDMENT MATERIALS

A. Fertilizer: Nitrogen 5 percent, phosphoric acid 10 percent, soluble potash 5 percent.

B. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

C. Water: Clean, fresh, and free of substances or matter which could inhibit vigorous growth of plants.

2.04 MULCH MATERIALS

A. Mulching Material: Hardwood mulch.

2.05 ACCESSORIES

A. Wrapping Materials: Burlap.

B. Stakes: Softwood lumber w/ pointed end. Mild steel angle, galvanized, pointed end.

C. Cable, Wire, Eye Bolts [and Turnbuckles]: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.

D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

PART 3 EXECUTION

3.01 WORK

A. Preparation of subgrade and topsoil, placing soils, planting, watering and maintenance.

3.02 EXAMINATION

A. Verify that prepared subsoil is ready to receive work

B. Saturate soil with water to test drainage.

C. Verify that required underground utilities are available, in proper location, and ready for use.

3.03 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.

C. Scarify subsoil to a depth of 3 inches where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

D. Dig pits and beds 6 inches larger than plant root system.

3.04 PLACING TOPSOIL

A. Spread topsoil to a minimum depth of 4 inches over area to be planted. Rake smooth.

B. Place topsoil during dry weather and on dry unfrozen sub-grade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

E. Install topsoil into pits and beds intended for plant root balls, to a minimum thickness of 6 inches.

3.05 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after initial raking of topsoil.

C. Mix thoroughly into upper 2 inches of topsoil.

D. Lightly water to aid the dissipation of fertilizer.

3.06 PLANTING

A. Place plants for best appearance for review and final orientation by Architect/Engineer.

B. Set plants vertical.

C. Remove non-biodegradable root containers.

D. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth as indicated on drawings under each plant. Loosen burlap, ropes, and wires, from the root ball.

E. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in 6-inch lifts. Maintain plant life in vertical position.

F. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.07 PLANT RELOCATION AND RE-PLANTING

A. Relocate plants as directed by Engineer.

B. Re-plant plants in pits or beds, partly filled with prepared topsoil mixture, at a minimum depth as indicated on drawings under each plant. Loosen burlap, ropes, and wires, from the root ball.

C. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in 6-inch layers. Maintain plant materials in vertical position.

D. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.08 FIELD QUALITY CONTROL

A. Field inspection and testing.

B. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.09 MAINTENANCE

A. Neatly trim plants where necessary.

B. Immediately remove clippings after trimming.

C. Water to prevent soil from drying out.

D. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.

E. Apply pesticides in accordance with manufacturer’s instructions.

[redacted]

END OF SECTION 02950

SECTION 02951

SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work consists of providing all labor, material, equipment, and services required for all work as described herein and indicated on drawings.
   1. Work specified in this section:
      a. Preparation and placement of topsoil. Seeding required within 24 hours after preparation.
      b. Initial maintenance of all planting.

[redacted]

1.02 SUBMITTALS

A. Construction sequence and time schedule.

B. Soil additives and mulch materials.

C. Fertilizers, sterilants, herbicides.

D. Monthly maintenance record: List all herbicides, insecticides, and disease control chemicals used; list a corrective action or replacement of work performed.

E. Suggested maintenance plan for maintenance by City to include chemical recommendations, amount of watering and all other proper care necessary to assure quality plant growth.

F. All other materials: Manufacturer and the product designation.

1.03 MAINTENANCE

A. The Maintenance Period shall extend for a period of one (1) year dating from final inspection.

B. Maintenance requirements:
   1. Maintenance shall include mowing, watering, weeding, leaf raking, fertilizing, and all other care dictated by the standard of the best horticultural practices. (In the event the irrigation system is inoperable or in the absence of such system, it shall be the responsibility of the landscape Contractor to supply sufficient watering from the beginning of planting through the one (1) year warranty period at no additional cost to the City).
   2. Maintain all seeded areas from the time of installation until final acceptance of the entire work.
   3. Keep all seeded areas clean and free of weeds, rubbish, and debris at all times.
   4. Seeded areas shall be protected at all times against trespassing and damage of all kinds for the duration of the maintenance period. If any areas become damaged or injured, they shall be treated or replaced as directed by the City at no additional cost to the City.

C. Final inspection and acceptance:
   1. Prior to request for final inspection, Contractor shall again thoroughly clean all seeded areas.
   2. Final inspection will be made upon request and upon notification that Maintenance Period has ended.

3. Acceptance will be given upon satisfactory findings in the final inspection or upon satisfactory correction of any deficiencies disclosed by the final inspection.

1.04 REGULATORY REQUIREMENTS

A. City Contract Policies

1.05 COORDINATION

A. Coordinate with installation of irrigation system.

B. Coordinate with all earth work and site work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Substitutions for any materials will not be permitted unless authorized in writing by the City.

B. Topsoil:
1. Topsoil shall be fertile, friable, natural topsoil typical of topsoil of the locality. The topsoil shall be stripped so that there is no admixture of subsoil and shall be free from clay clumps, stones, roots, or similar substances two inches or more in diameter, debris, or other objects which might be a hindrance to planting operations. The City reserves the right to reject topsoil in which more than 60 percent of the materials passing V.S.S. #100 sieve consist of clay as determined by the Bonyoucous Hydrometer by the dried weights of the materials.

C. Soil Additives:
1. Manure: Well-rotted, unleached, sterilized stable manure which is free of wood shavings, sawdust, or other undesirable litter and contains no chemical or other ingredients harmful to plants and shall not be less than 9 months old and not more than 2 years.
2. Peat: Domestic product consisting of partially decomposed vegetable matter of natural occurrence. It shall be brown, clean, and low in content of mineral and wood material, mildly acid, and granulated or shredded.
3. Lime: Shall be ground limestone (Dolomite) containing not less than 85 percent of total carbonates and shall be ground to such a fineness that 50 percent will pass through a 100-mesh sieve and 90 percent will pass through a 20-mesh sieve. Coarser material will be acceptable, provided the specified rates or application are increased proportionately on the basis of quantities passing through the 100-mesh sieve.
4. Fertilizer:
   a. Turf Areas, Ground Covers, and Flowers shall be a controlled release formula and shall conform to the applicable State Board of Agriculture fertilizer laws. It shall be uniform in composition, dry and free-flowing, and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which has become caked or otherwise damaged making it unsuitable for use will not be acceptable.
   b. All fertilizer and soil conditioners shall be first quality, standard brand agricultural products.

D. Mulch: Use grain straw as mulch at any time of the year. If permission to use material other than grain straw is requested and the use of such material is approved by the Engineer, the season limitations, the methods and rates of application, the type of binding material or other conditions governing the use of such material will be established by the Engineer at the time of approval. Apply mulch within 24 hours of seeding unless otherwise permitted. Spread mulch uniformly by hand or by approved mechanical spreader or blower.

E. Plant Materials: Certificates of inspection shall accompany the invoice for each shipment of seeds as may be required by laws for transportation. File certificates with the City prior to acceptance of the material.

2.02 SOURCE QUALITY CONTROL AND TESTS

A. Testing and Inspection: Within ten days following acceptance of the bid, the City shall be notified of the sources of the materials required, desired to be inspected or tested.

B. Testing:
1. Topsoil: All new loam or stripped topsoil used in the work of this section of the specifications shall be tested and approved for use by the Engineer prior to being spread. Stripped material may be used if approved and shall be stockpiled so as not to interfere with the other work or with other subgrade of fill materials.
2. Testing other than soil testing shall be paid for by the City if the City deems the testing necessary.

C. Inspections:
1. All areas to be planted shall be inspected by the Planting Contractor before starting work. Any defects, such as incorrect grading, etc., shall be reported to the City prior to beginning this work. The commencement of work by the Contractor shall indicate his acceptance of the areas to be planted, and he shall assume full responsibility for the work of this Section.
2. During construction and installation, onsite inspections by the City will be made periodically to ensure proper implementation of design. The City retains the right to accept or reject any material or other incidentals needed to complete the project in whole or part and also may stop all work until all discrepancies are resolved.
3. Any work scheduled beyond normal working hours or on weekends, shall be brought to the attention of the City Inspector for approval. Any work accomplished during these hours and in question will be subject to being done over at the request of the City, at no additional cost to the City.
4. The City will inspect topsoil to be used to determine whether or not it meets the requirements specified.
5. City representative shall be present during the application of post emergent sterilization.
6. After completion of project, Contractor will provide a one (1) year warranty letter.

PART 3 EXECUTION

3.01 INSTALLATION

A. Work: Shall include the full width of the disturbed area for the cleanup and seeding. Work shall include, but not be limited to, the following:
1. Removal and proper disposal of debris and excess material.
2. Grade disturbed areas to original or proposed surface profile.
3. Cleaning of paved surfaces.
4. Proper seeding, fertilizing, mulching and other incidentals necessary to properly seed project area.

B. Soil Preparation:
1. Add any amendments necessary to bring topsoil up to City Standards.
2. All topsoil must be approved by Engineer.
3. Coordinate with irrigation work, if any, to assure all lines have been installed prior to placement of topsoil or any other preparation for planting areas.
4. Rough grades for planting areas have been left 8-12 inches below adjacent paving and/or curbing under work of General Contractor. (Landscape Contractor should plan to provide soil and labor to backfill curbing and sidewalk and should coordinate the

work with the general Contractor as his work progresses. It shall be the responsibility of the Landscape Contractor to provide the specified grade for planting areas -- City will not be responsible for any excavation needed to acquire desired depth.)

5. Debris removal: In all seeding areas, remove and dispose of all wire, rubbish, debris, concrete waste, base rock, or other plant materials which might hinder soil preparation, grading, seeding, or subsequent maintenance. Rake to smooth soil.
6. Scarify existing earthwork: Soil in all on-grade paling areas shall be ripped or cultivated to depth of 10 inches. Water shall be added and ripping or cultivating shall be continued until the entire specified depth is loose and friable. All debris, pavement, concrete, and rocks over 2 inches in diameter shall be removed to the specified depth and shall be removed from the site.
7. Place approved topsoil at grade in seeding areas.
8. Rake soil smooth to finished grade, pitched evenly for drainage. Round all changes in gradient and eliminate all depressions where water will pool.
9. Water areas to settle soil. After drying, correct low spots, irregularities, and reestablish finished grade.

C. Finished Grading: When weeding, soil preparation, and soil conditioning have been completed and soil has been thoroughly water settled, all planting areas shall be smooth graded, ready for placement of plant materials and for seeding and/or sodding.

D. Seeded Lawn Areas:
   1. General:
      a. Once site is prepped with lime and fertilizer, it shall be seeded within a 24 hour period.
      b. Seed all lawn areas not covered by sod or other planting areas within scope of construction.
      c. After the areas have been loosened, conditioned, and finish graded as previously specified, they shall be hand raked to remove all clods, weeds, roots, debris and rocks 1 inch in diameter and larger.
      d. Final grades shall be approved by the City prior to seeding.
      e. After final grading has been accepted, no heavy equipment (except lawn rollers) will be allowed onto planting surfaces. Any damaged areas will be prepared using previous method.
      f. De-thatching shall be done in areas not requiring topsoil and grading work and in areas where existing lawn will be top seeded. Use a motor driven de-thatcher to remove all thatch buildup and loosen all areas to be seeded. Area should be hand raked and all debris promptly removed. All seeding shall take place within 24 hours following dethatching. City shall approve all areas for seeding prior to doing so.
   2. Seed Selection:
      a. Seed quantities and mixtures as specified on drawings.
      b. Provide seed complying with the official seed analysis of North America with respect to purity and germination percentages.
      c. Seed should be newly packaged seed (not greater than one year) and should arrive at the job site in the original container. City retains the right to inspect seed specification tag remaining intact on container.
      d. Do not use any seed that has been dampened, moldy, or suffered any other damage in transit or storage.

3. Seed Schedule

COMMON NAME	MIN SEED PURITY	MIN GERMINATION	MAX WEED SEED
Bermuda	90%		1.00%
Fescue tall, (Ky, 31)	98%		1.00%
Wheat	98%	MIN 90%	0.10%
German Millet	98%	MIN 90%	0.10%

POUNDS PER ACRE				
	K-31 Fescue	**German Millet**	**Bermuda Hulled**	**Bermuda Unhulled**
March 15 – Sept 15	100	25	25	--
	K-31 Fescue	**Wheat**	**Bermuda Hulled**	**Bermuda Unhulled**
Sept 15 – March 15	100	30		30

4. Once the seed is applied, the area shall be very lightly raked, either by hand or by mechanical means. All road right-of-ways and/or private grounds shall also be reseeded or sodded with the same type of grass previously found. The seed mixture specifications shall be used as a guide and the Contractor is charged with the responsibility of seeding areas with the proper type of grass existing.
5. All seeded areas will be mulched with 4000 pounds per acre of small grain straw spread uniformly. Approximately 1/4 of the ground should be visible to avoid smothering seedlings. Asphalt emulsion may be used to anchor the straw applied at 150 gal/ton of straw. If asphalt emulsion is used, the Contractor shall not deface buildings, curbs or plantings with asphalt materials. 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.

3.02 CLEANING

A. Any soil or similar material which has been brought into paved areas by hauling operations or otherwise shall be removed promptly, keeping these areas clean at all times.

B. Upon completion of work under this section, all excess stones, debris, and soil resulting from work under this section which have not previously been cleaned up shall be cleaned up and removed from the project site.

C. All pavements shall be broomed and hosed clean.

3.03 CONTRACT CLOSEOUT

A. Final Inspection:
1. Prior to requesting final inspection, Contractor shall have completed all of the work of seeding. All seeding areas shall be cleaned of all rubbish and debris, all adjacent pavement or surfaces shall be clean, and entire work shall be neat and presentable.
2. The final inspection will be made upon request and upon notification that all work installation is completed.
3. Approval will be given upon satisfactory findings in the final inspection or upon satisfactory correction of any deficiencies disclosed by the final inspection.

[redacted]

END OF SECTION 02951