SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Schedule of values.

B. Applications for payment.

C. Change procedures.

D. Defect assessment.

E. Unit prices.

F. Alternates.

G. Cash allowances.

H. Contingency allowances.

I. Testing and inspection allowances.

1.2 SCHEDULE OF VALUES

A. Submit printed schedule on EJCDC C-620 or other approved form. Contractor's standard form or electronic media printout will be considered.

B. Submit Schedule of Values in duplicate within 15 days after date established in Notice to Proceed.

C. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of major specification Section. Identify site mobilization, bonds and insurance.

D. Include in each line item, amount of Allowances specified in this Section. For unit cost allowances, identify quantities taken from Contract Documents multiplied by unit cost to achieve total for each item.

E. Include within each line item direct proportional amount of Contractor's overhead and profit.

F. Revise schedule to list approved Change Orders, with each Application for Payment.

1.3 APPLICATIONS FOR PAYMENT

A. Submit three (3) copies of each application on EJCDC C-620 or other approved form. Contractor's electronic media driven form will be considered.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Submit updated construction schedule with each Application for Payment.

D. Payment Period: Submit at intervals stipulated in the Agreement.

E. Submit with transmittal letter as specified for Submittals in Section 01 33 00 – Submittal Procedures.

F. Substantiating Data: When Engineer requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:

1. Current construction photographs specified in Section 01 33 00 – Submittal Procedures.
2. Partial release of liens from major subcontractors and vendors.
3. Record documents as specified in Section 01 70 00 – Execution and Closeout Requirements, for review by Owner which will be returned to Contractor.
4. Affidavits attesting to off-site stored products.
5. Construction progress schedules, revised and current as specified in Section 01 33 00 – Submittal Procedures. Construction schedules will be required to be submitted at the start of construction at the pre-construction conference. The first Construction schedule should include a presumed date for the Notice to Proceed. Construction Progress schedules should be updated monthly and provided to all parties at monthly progress meetings.

1.4 CHANGE PROCEDURES

A. Submittals: Submit name of individual authorized to receive change documents and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. The Engineer will advise of minor changes in the Work not involving adjustment to Contract Price or Contract Time by issuing supplemental instructions.

C. The Engineer may issue a Notice of Change including a detailed description of proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with stipulation of overtime work required and the period of time during which the requested price will be considered valid. Contractor will prepare and submit estimate within 15 days.

D. Contractor may propose changes by submitting a request for change to Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change, and effect on Contract Price and Contract Time with full documentation and a statement describing effect on Work by separate or other Contractors. Document requested substitutions in accordance with Section 01 60 00 - Product Requirements.

E. Stipulated Price Change Order: Based on Notice of Change and Contractor's fixed price quotation or Contractor's request for Change Order as approved by Engineer.

F. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute Work under Work Change Directive. Changes in Contract Price or Contract Time will be computed as specified for Time and Material Change Order.

G. Maintain detailed records of work done on Force Account basis. Provide full information required for evaluation of proposed changes and to substantiate costs for changes in the Work.

H. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation.

I. Change Order Forms: EJCDC C-941 Change Order.

J. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

K. Correlation Of Contractor Submittals:
1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Price.
2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
3. Promptly enter changes in Project Record Documents.

1.5 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct appropriate remedy or adjust payment.

C. The defective Work may remain, but unit price will be adjusted to new price at discretion of Owner.

D. Defective Work will be partially repaired to instructions of Owner, and unit price will be adjusted to new price at discretion of Owner.

E. Individual specification sections may modify these options or may identify specific formula or percentage sum/price reduction.

F. Authority of Engineer to assess defects and identify payment adjustments is final.

G. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from transporting vehicle.
4. Products placed beyond lines and levels of required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected products.

1.6 PRICES

A. Authority: Measurement methods are delineated in individual Specification Sections.

B. Measurement methods delineated in individual Specification Sections complement criteria of this Section. In event of conflict, requirements of individual Specification Section govern.

C. Engineer or Owner will take measurements and compute quantities accordingly. Provide assistance in taking of measurements.

D. Unit Quantities: Quantities and measurements indicated in Bid Form are for contract purposes only. Actual quantities provided shall determine payment.
1. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities at unit sum/prices contracted.

E. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals, erection, application or installation of item of the Work, overhead, and profit.

F. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Engineer multiplied by unit sum/price for Work incorporated in or made necessary by the Work.

G. Measurement of Quantities:
1. Weigh Scales: Inspected, tested, and certified by applicable State Weights and Measures Department within past year.
2. Platform Scales: Of sufficient size and capacity to accommodate conveying vehicle.
3. Metering Devices: Inspected, tested, and certified by applicable State Department within past year.
4. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
5. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
6. Measurement by Area: Measured by square dimension using mean length and width or radius.

7. Linear Measurement: Measured by linear dimension at item centerline or mean chord.
8. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.

H. Price Schedule: Refer to Bid Form.

1.7 MEASUREMENT AND PAYMENT OF BID ITEMS

A. UNIT PRICE BID:

1. Mobilization / Demobilization / Bonds

   Measurement and Payment shall be Lump Sum as stated within the Bid Form. Payment shall be for the preparatory operations including; moving and removing personnel and equipment to the project site (regardless of the number of times such moves are made); paying bonds and insurance premiums; set-up, delivery, any rental or usage fees for facilities necessary for work on the project; and all other preparatory work or costs incurred before beginning work on the project. This work is an ancillary item to furnish and install all water main and associated improvements and consequently there is no separate measurement and payment for mobilization/demobilization. The mobilization cost shall not exceed 5% of Subtotal of 42-inch Water Main Along Rimer Pond Road. The contractor may include request for payment on the first partial pay request after mobilization has begun.

2. Traffic Control

   Measurement and Payment shall be Lump Sum as stated within the Bid Form. Payment shall be for furnishing, installation, signage, notifications, personnel, material delivery, bore and jack work by major roads, cut and patch work at major roads, and coordination with SCDOT and Richland County plus all incidental work including all labor, materials, tools and equipment. Traffic Control work to include, but not be limited to the three (3) open cuts identified in the Contact Documents, Loading and unloading of pipe SCDOT ROW or property, management of traffic adjacent to bore and jacks, when working or unloading materials in SCDOT ROWs and other control in other areas that become obvious during construction.

3. Clearing and Grubbing

   Measurement and Payment shall be per Acre or partial acre as stated within the Bid Form up to the included quantity. Payment shall be for furnishing all equipment for clearing and grubbing, clearing and grubbing, removal and proper disposal of all disturber materials, plus all incidental work including all labor, materials, tools and equipment to complete all work associated with this bid item included in the contract documents. Clearing shall be completed on all permanent easement except in areas that are specifically excluded. Clearing to include any trees within the SCDOT ROW that might block access to the City of Columbia's Permanent Exclusive Water Main Easement. Contractor shall review all executed easement documents (included in Appendix C of the Contract Documents) to determine what if any specific trees are to remain with the Owner's Exclusive Easement.

4. Temporary Grassing

   Measurement and Payment shall be per Acre as stated within the Bid Form. Payment shall be for furnishing and installation of temporary grassing including seeding plus all incidental work including all labor, materials, tools and equipment. It is anticipated that the selected Contractor will backfill and compact the trenches adjacent to the completed work as soon as the work is completed. The Contractor should include a unit price for temporary grassing and will be paid based on how much grassing is installed along the line. Periodically, it is suggested on a weekly basis or no longer than every 10 calendar days, the Contractor install temporary grassing (seeding) over the newly installed pipe once pipe in the area has been installed. It is anticipated that the Contractor will seed up to the approximate quantity illustrated in the bid form. Measurement will be made in conjunction with the length of pipe that has been installed. The Contractor will be paid one (1) time for temporary grassing / seeding over the complete project alignment in all disturbed areas.

5. Sediment and Erosion Control (including silt fencing, temporary inlet protection and rip rap apron)

   Measurement and Payment shall be Lump Sum as stated within the Bid Form. Payment shall be for furnishing, excavation, installation, and required maintenance/repair plus all incidental work including all labor, materials, tools and equipment; silt fencing, temporary inlet protection, rip rap aprons; timber matting, creek crossing, other SCDOT/SCDHEC approved sediment and erosion control methods. Work for payment shall include additional BMPs required by SCDHEC, County, City, or the Engineers inspectors in areas that prove to require additional controls as the project progresses. Payment for maintenance of the BMPs shall be included under this pay item. All BMPs will be maintained from the start of the project to the final completion of the project. Payment for this item should be included in the anticipated schedule submitted to the Owner and Engineer at the Pre-Construction Conference.

6. Connection to Existing 42-inch Stub-out

   Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be for furnishing, laying, bedding, testing, disinfecting, excavation, de-watering, sheeting and shoring for trenches of all depths, removal of existing plug, connection to existing water main, backfill and compaction, joint restraints plus all incidental work including all labor, materials, tools and equipment. This connection is located adjacent to Station 0+00 on the Rimer Pond Road Alignment and is illustrated in the Construction Plans.

7. Connection to Existing 24-inch Stub-out

   a. Measurement and Payment shall be per Each as stated within the Bid Form. Connection located at the termination of the Hard Scrabble Road alignment north of Rice Creek, adjacent to commercial lots south of the Lake Carolina Entrance. Payment shall be for furnishing, laying, bedding, testing, and disinfecting, excavation, de-watering, sheeting and shoring for trenches of all depths, removal of existing plug, connection to existing water main, backfill and compaction, and joint restraints plus all incidental work including all labor, materials, tools and equipment. Any and all work required to make a complete, working connection in

compliance with all details and plan and profile views in the Construction Plans.

8. Connection to Existing 12-inch Stub-out

   Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be for furnishing, laying, bedding, testing, disinfecting, excavation, de-watering, sheeting and shoring for trenches of all depths, removal of existing plug, connection to existing water main, backfill and compaction, joint restraints plus all incidental work including all labor, materials, tools and equipment for the completion of the connection to the 12-inch stub-out on the north side of Rimer Pond Road approximately across from Station 8+00 on the Rimer Pond Road Alignment as illustrated on the Construction Plans.

9. 42-inch DIP WM, CL150

   a. Measurement and Payment shall be per Linear Foot as stated within the Bid Form. Payment will be based upon the actual number of linear feet installed to the nearest foot. The pipeline shall be measured along the centerline of the pipe, through all valves and fittings, from the centerline of the fittings or centerline of valves on ends of pipe to the centerline of fittings, centerline of valves on ends of pipe, or to the end of pipe for all through runs of pipe. Measurement of branch line pipe shall start at centerline of valve at connection to the main. No deduction in length will be made for the space occupied by valves or fittings. Payment shall be for traffic control; walking pre-construction videotaping of the project area; field measurements; excavation; pot holing; clearing and grubbing; grading; construction staking; protection of existing utilities; protection of existing trees; trenching (regardless of depth); sheeting, shoring and bracing; dewatering; sedimentation and erosion control; mucking out saturated soils; disposal of excess and unsuitable material; laying and jointing water pipeline in a trench; bedding; connections; consumer notification of service interruption; select backfill, backfilling (regardless of depth), and compaction; tap, plugging taps; temporary steel plating; restoration of ground surfaces; restoration of existing site improvements; line marker; bracing, supporting, and protecting utility poles; sodding / seeding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; flushing, disinfection, sampling and laboratory analysis (de-chlorination, if necessary); pressure and leakage testing; installation and removal of temporary valves needed for proper testing of new water main; remove and reset mailboxes/paperboxes and street signs; remove and replace/relocate plantings; remove and reset lamp posts; SCDOT approved temporary and thermoplastic pavement markings; “as-built” drawings; rock removal; warranties; plus all incidental work for a fully functional water main including all labor, materials, tools and equipment.

   b. No additional payment shall be made for vertical deflection of the proposed pipeline to accommodate the horizontal installation (minimum required cover) of the butterfly valves, but all costs shall be merged with the associated line item in the Proposal. No payment shall be made for additional depth if required at the location of the proposed Air Release Valves along the Rimer Pond Alignment.

10. 24-inch DIP WM, CL 200

a. Measurement and Payment shall be per Linear Foot as stated within the Bid Form. Payment will be based upon the actual number of linear feet installed to the nearest foot. The pipeline shall be measured along the centerline of the pipe, through all valves and fittings, from the centerline of the fittings or centerline of valves on ends of pipe to the centerline of fittings, centerline of valves on ends of pipe, or to the end of pipe for all through runs of pipe. Measurement of branch line pipe shall start at centerline of valve at connection to the main. No deduction in length will be made for the space occupied by valves or fittings. Payment shall be for traffic control; walking pre-construction videotaping of the project area; field measurements; excavation; pot holing; clearing and grubbing; grading; construction staking; protection of existing utilities; protection of existing trees; trenching (regardless of depth); sheeting, shoring and bracing; dewatering; sedimentation and erosion control; mucking out saturated soils; disposal of excess and unsuitable material; laying and jointing water pipeline in a trench; bedding; connections; consumer notification of service interruption; select backfill, backfilling (regardless of depth), and compaction; tap, plugging taps; temporary steel plating; restoration of ground surfaces; restoration of existing site improvements; line marker; bracing, supporting, and protecting utility poles; sodding / seeding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; flushing, disinfection, sampling and laboratory analysis (de-chlorination, if necessary); pressure and leakage testing; installation and removal of temporary valves needed for proper testing of new water main; remove and reset mailboxes/paperboxes and street signs; crossing of all storm drainage infrastructure as shown on the plans or as recently added by the SCDOT as part of "field changes associated with the SCDOT Hard Scrabble Road Widening / Improvements Project"; remove and replace/relocate plantings; remove and reset lamp posts; SCDOT approved temporary and thermoplastic pavement markings; "as-built" drawings; warranties; plus all incidental work for a fully functional water main including all labor, materials, tools and equipment.

b. No additional payment shall be made for vertical deflection of the proposed pipeline to accommodate the vertical installation (minimum required cover) of the gate valves, but all costs shall be merged with the associated line item in the Proposal. No additional payment shall be made for storm drain crossings either shown on the Construction Plans or added as a field change to the SCDOT ongoing roadway widening / improvement project. No additional payment shall be made for coordination / scheduling / planning with the SCDOT project management team for the associated SCDOT project along Hard Scrabble Road.

11. 42-inch R.J. DIP WM, CL 150

a. Measurement and Payment shall be per Linear Foot as stated within the Bid Form. Payment will be based upon the actual number of linear feet installed to the nearest foot. The pipeline shall be measured along the centerline of the pipe, through all valves and fittings, from the centerline of the fittings or centerline of valves on ends of pipe to the centerline of fittings, centerline of valves on ends of pipe, or to the end of pipe for all through runs of pipe. Measurement of branch line pipe shall start at centerline of valve at connection to the main. No deduction in length will be made for the space occupied by valves or fittings. Payment shall be for traffic control; walking pre-construction videotaping of the project area; field measurements; excavation; pot holing; clearing and grubbing; grading; construction staking; protection of existing utilities; protection of existing trees; trenching (regardless of depth); sheeting, shoring and bracing; dewatering; sedimentation and erosion control; mucking out saturated soils; disposal of excess and unsuitable material; laying and jointing water pipeline in a trench; bedding; connections; consumer notification of service interruption; mechanical joint/thrust restraint/restraint joint; concrete thrust restraint; thrust collar; select backfill, backfilling (regardless of depth), and compaction; tap, plugging taps; temporary steel plating; restoration of ground surfaces; restoration of existing site improvements; line marker; bracing, supporting, and protecting utility poles; sodding / seeding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; flushing, disinfection, sampling and laboratory analysis (de-chlorination, if necessary); pressure and leakage testing; installation and removal of temporary valves needed for proper testing of new water main; remove and reset mailboxes/paperboxes and street signs; remove and replace/relocate plantings; remove and reset lamp posts; SCDOT approved temporary and thermoplastic pavement markings; “as-built” drawings; warranties rock removal; plus all incidental work for a fully functional water main including all labor, materials, tools and equipment.

b. No additional payment shall be made for vertical deflection of the proposed pipeline to accommodate the vertical installation (minimum required cover) of the butterely valves, but all costs shall be merged with the associated line item in the Proposal.

12. 24-inch R.J. DIP WM, CL 200

a. Measurement and Payment shall be per Linear Foot as stated within the Bid Form. Payment will be based upon the actual number of linear feet installed to the nearest foot. The pipeline shall be measured along the centerline of the pipe, through all valves and fittings, from the centerline of the fittings or centerline of valves on ends of pipe to the centerline of fittings, centerline of valves on ends of pipe, or to the end of pipe for all through runs of pipe. Measurement of branch line pipe shall start at centerline of valve at connection to the main. No deduction in length will be made for the space occupied by valves or fittings. Payment shall be for traffic control; walking pre-construction videotaping of the project area; field measurements; excavation; pot holing; clearing and grubbing; grading; construction staking; protection of existing utilities; protection of existing trees; trenching (regardless of depth); sheeting, shoring and bracing; dewatering; sedimentation and erosion control; mucking out saturated soils; disposal of excess and unsuitable material; laying and jointing water pipeline in a trench; bedding; connections; consumer notification of service interruption; mechanical joint/thrust restraint/restraint joint; concrete thrust restraint; thrust collar; select backfill, backfilling (regardless of depth), and compaction; tap, plugging taps; temporary steel plating; restoration of ground surfaces; restoration of existing site improvements; line marker; bracing, supporting, and protecting utility poles; sodding / seeding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; flushing, disinfection, sampling and laboratory analysis (de-chlorination, if necessary); pressure and leakage testing; installation and removal of temporary valves needed for proper testing of new water main; remove and reset mailboxes/paperboxes and street signs; remove and replace/relocate plantings; remove and reset lamp posts; SCDOT approved temporary and thermoplastic pavement markings; “as-built” drawings; warranties, rock removal; plus all incidental work for a fully functional water main including all labor, materials, tools and equipment.

b. No additional payment shall be made for vertical deflection of the proposed pipeline to accommodate the vertical installation (minimum required cover) of the gate valves, but all costs shall be merged with the associated line item in the Proposal.

13. Bore & Jack 60-inch Steel Casing with 42-inch R.J. Carrier Pipe
    a. Measurement and Payment shall be per Linear Foot as stated within the Bid Form. Payment shall be per linear foot steel casing pipe containing carrier pipe actually installed, measured along the centerline of the casing pipe. Measurement shall be from end of casing to end of casing. Payment shall be for mobilization/demobilization; field measurements; clearing and grubbing; traffic control; construction staking; protection of existing utilities; sedimentation and erosion control; trenching; sheeting, shoring and bracing; excavation and backfill; dewatering; mucking out saturated soil; removal and disposal of excess and unsuitable material; removal and disposal of drilling fluids; mechanical joint/thrust restraint; concrete thrust restraint; flowable fill; temporary steel plating ;locator wire; casing pipe; carrier pipe, bore; jacking; casing spacers; carrier pipe joint restraints; end seals; clean-up; shaping and evening of uneven and rough areas; re-shaping ditch sections; restoration of ground surfaces; restoration of existing site improvements; testing; “as-built” drawings; warranties;, plus all incidental work including all labor, materials, tools and equipment.
    b. However, the bore shall be paid one time on a linear foot basis and no extra compensation will be paid for failures and the subsequent withdrawal and re-jacking attempts. Lines either off grade or alignment shall be rejected or corrected in a manner approved by the Owner or its designee. The cost of the carrier pipe, spacers, restraints, and all appurtenances are to be included.
14. Bore & Jack 36-inch Steel Casing with 24-inch R.J. Carrier Pipe
    a. Measurement and Payment shall be per Linear Foot as stated within the Bid Form. Payment shall be per linear foot steel casing pipe containing carrier pipe actually installed, measured along the centerline of the casing pipe. To ensure payment, Contractor shall coordinate with City’s Inspection Personnel and Engineer’s Construction Observation staff for installation quantity verification / concurrence. Measurement shall be from end of casing to end of casing. Payment shall be for mobilization/demobilization; field measurements; clearing and grubbing; traffic control; construction staking; protection of existing utilities; sedimentation and erosion control; trenching; sheeting, shoring and bracing; excavation and backfill; dewatering; mucking out saturated soil; removal and disposal of excess and unsuitable material; removal and disposal of drilling fluids; mechanical joint/thrust restraint; concrete thrust restraint; flowable fill; temporary steel plating ;locator wire; casing pipe; carrier pipe, bore; jacking; casing spacers; carrier pipe joint restraints; end seals; clean-up; shaping and evening of uneven and rough areas; re-shaping ditch sections; restoration of ground surfaces; restoration of existing site improvements; testing; “as-built” drawings; warranties;, plus all incidental work including all labor, materials, tools and equipment.
    b. However, the bore shall be paid one time on a linear foot basis and no extra compensation will be paid for failures and the subsequent withdrawal and re-jacking attempts. Lines either off grade or alignment shall be rejected or corrected in a manner approved by the Owner or its designee. The cost of the carrier pipe and any all restraints, spacers and

required appurtenances for the installation of the carrier pipe is to be included in this bid item.

15. Bore & Jack 24-inch Steel Casing with 12-inch R.J. Carrier Pipe
    a. Measurement and Payment shall be per Linear Foot as stated within the Bid Form. Payment shall be per linear foot steel casing pipe containing carrier pipe actually installed, measured along the centerline of the casing pipe. Measurement shall be from end of casing to end of casing. Payment shall be for mobilization/demobilization; field measurements; clearing and grubbing; traffic control; construction staking; protection of existing utilities; sedimentation and erosion control; trenching; sheeting, shoring and bracing; excavation and backfill; dewatering; mucking out saturated soil; removal and disposal of excess and unsuitable material; removal and disposal of drilling fluids; mechanical joint/thrust restraint; concrete thrust restraint; flowable fill; temporary steel plating ;locator wire; casing pipe; carrier pipe, bore; jacking; casing spacers; carrier pipe joint restraints; end seals; clean-up; shaping and evening of uneven and rough areas; re-shaping ditch sections; restoration of ground surfaces; restoration of existing site improvements; testing; “as-built” drawings; warranties;, plus all incidental work including all labor, materials, tools and equipment.
    b. However, the bore shall be paid one time on a linear foot basis and no extra compensation will be paid for failures and the subsequent withdrawal and re-jacking attempts. Lines either off grade or alignment shall be rejected or corrected in a manner approved by the Owner or its designee. The cost of the carrier pipe, spacers, restraints, and all appurtenances are to be included.
16. 24-inch DIP, CL 350 (Directional Drill Under Wetlands)
    a. Measurement and Payment shall be per Linear Foot as stated within the Bid Form. Payment will be based upon the actual number of linear feet of hydraulic directional drill installed to the nearest foot. Payment shall be for any additional pre-installation design by the pipe supplier or drilling contractor, connections made back to the new 24-inch CL200 piping (restrained or un-restrained), traffic control; walking pre-construction videotaping of the project area; field measurements; excavation; pot holing; clearing and grubbing; grading; construction staking; protection of existing utilities; protection of existing trees; trenching (regardless of depth); sheeting, shoring and bracing; dewatering; sedimentation and erosion control; mucking out saturated soils; disposal of excess and unsuitable material; hydraulic directional drill of water pipeline; bedding; connections; consumer notification of service interruption; mechanical joint/thrust restraint/restraint joint; concrete thrust restraint; thrust collar; select backfill, backfilling (regardless of depth), and compaction; tap, plugging taps; temporary steel plating; restoration of ground surfaces; restoration of existing site improvements; line marker; bracing, supporting, and protecting utility poles; sodding / seeding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; flushing, disinfection, sampling and laboratory analysis (de-chlorination, if necessary); pressure and leakage testing; installation and removal of temporary valves needed for proper testing of new water main; remove and reset mailboxes/paper boxes and street signs; remove and replace/relocate plantings; remove

and reset lamp posts; SCDOT approved temporary and thermoplastic pavement markings; "as-built" drawings; warranties.

17. Polyethylene Wrap on 42-inch Pipe
    a. Measurement and Payment shall be per Linear Foot as stated within the Bid Form. Payment shall be per linear feet actually furnished and installed. Payment shall be for furnishing and installation of polyethylene wrap on water main, plus all incidental work including all labor, materials, tools and equipment for a complete installation.
18. 42-inch Butterfly Valve
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, laying, bedding, testing, and disinfecting, excavation, de-watering, sheeting and shoring for trenches of all depths, backfill and compaction, joint restraints, valve, valve box/valve vault/manhole, valve marker, valve box concrete protection ring (donut); spool piece(s), operators; support beneath and around valve; and as-builts, plus all incidental work including all labor, materials, tools and equipment.
19. 24-inch Butterfly Valve
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, laying, bedding, testing, and disinfecting, excavation, de-watering, sheeting and shoring for trenches of all depths, backfill and compaction, joint restraints, valve, valve box/valve vault/manhole, valve marker, valve box concrete protection ring (donut); spool piece(s), operators; support beneath and around valve; and as-builts, plus all incidental work including all labor, materials, tools and equipment.
20. 12-inch Gate Valve
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. This gate valve should be installed adjacent to the Tee and 12-inch connection to the Copper River Subdivision Water Supply Main adjacent to Station 18+00 of the Rimer Pond Road Alignment. Payment shall be for furnishing, laying, bedding, testing, and disinfecting, excavation, de-watering, sheeting and shoring for trenches of all depths, backfill and compaction, joint restraints, valve, valve box/valve, valve marker, valve box concrete protection ring (donut); spool piece(s), operators; support beneath and around valve; and as-builts, plus all incidental work including all labor, materials, tools and equipment.
21. 42-inch Air Valve Assembly
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, laying, bedding, testing, and disinfecting, excavation, de-watering, sheeting and shoring for trenches of all depths, backfill and compaction, joint restraints, factory fabricated outlet connection on pipe, tapped cap, ball valve, vault/manhole, all pipe for proper installation of Air Release Valve Assembly; proper valve support; and as-builts, plus all incidental work including all labor, materials, tools and equipment.

22. 24-inch Air Valve Assembly
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, laying, bedding, testing, and disinfecting, excavation, de-watering, sheeting and shoring for trenches of all depths, backfill and compaction, joint restraints,), factory fabricated outlet connection on pipe, valve, valve box/valve vault/manhole, valve marker, valve box concrete protection ring (donut); spool piece(s), operators; support beneath and around valve; and as-builts, plus all incidental work including all labor, materials, tools and equipment.
23. 24-inch Weighted Check Valve
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, laying, bedding, testing, and disinfecting, excavation, de-watering, sheeting and shoring for trenches of all depths, backfill and compaction, joint restraints, valve, spool piece(s), operators; support beneath and around valve; and as-builts, plus all incidental work including all labor, materials, tools and equipment.
24. 8’ x 8’ Pre-Cast Concrete Valve Vault w/ 4’ x 4’ Hatch Cast in Lid
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be for furnishing, clearing and grubbing, excavation, sheeting and shoring for trenches of all depths, de-watering, laying, bedding, backfill, compaction, testing, installation, valve vault, hatches, penetrations, sealing of penetrations, operators; support beneath and around valve vault and as-builts, plus all incidental work for a fully functional water main and check valve including all labor, materials, tools and equipment.
25. 42-inch Fire Hydrant Assembly
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring, dewatering, extension piping, valve(s), valve box and cover, valve box concrete protection ring (donut), factory fabricated outlet connection on pipe, fittings, restraints, thrust blocking, hydrant assembly, spool piece(s), flushing and disinfection, temporary steel plating, restoration of ground surfaces, restoration of existing site improvements; sodding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; testing and as-builts, plus all incidental work including all labor, materials, tools and equipment.
26. 24-inch Fire Hydrant Assembly
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring, dewatering, extension piping, valve(s), valve box and cover, valve box concrete protection ring (donut), factory fabricated outlet connection on pipe, fittings, restraints, thrust blocking, hydrant assembly, spool piece(s), flushing and disinfection, temporary steel plating, restoration of ground surfaces, restoration of existing site improvements; sodding; cleanup; shaping and evening of uneven and rough areas; re-shaping

ditch sections; testing and as-builts, plus all incidental work including all labor, materials, tools and equipment.

27. 42-inch Flushing Valve Assembly
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be for furnishing, laying, bedding, testing, and disinfecting, excavation, de-watering, sheeting and shoring for trenches of all depths, tapping, tapping saddle(s), factory fabricated outlet connection on pipe, tee(s), bend(s), associated piping, valve(s), blind flange, rip-rap with filter fabric, appurtenances associated with dechlorination, backfill and compaction, joint restraints, concrete marker, temporary steel plating, restoration of ground surfaces, restoration of existing site improvements; sodding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; testing and as-builts, plus all incidental work including all labor, materials, tools and equipment.
28. 24-inch Flushing Valve Assembly
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be for furnishing, laying, bedding, testing, and disinfecting, excavation, de-watering, sheeting and shoring for trenches of all depths, tapping, tapping saddle(s), factory fabricated outlet connection on pipe, tee(s), bend(s), associated piping, valve(s), blind flange, rip-rap with filter fabric, appurtenances associated with dechlorination, backfill and compaction, joint restraints, valve box/valve vault/manhole, concrete marker, temporary steel plating, restoration of ground surfaces, restoration of existing site improvements; sodding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; testing and as-builts, plus all incidental work including all labor, materials, tools and equipment.
29. 42" x 24" Tee, Restrained M.J. (Longstown Road East and water mains connection)
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring for trenches of all depths, de-watering, laying, bedding, restraints, thrust blocking, backfill, compaction, testing, disinfecting and as-builts, plus all incidental work including all labor, materials, tools and equipment.
30. 42" x 12" Tee, Restrained M.J. (Coopers Pond and Autumn Pond)
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring for trenches of all depths, de-watering, laying, bedding, restraints, thrust blocking, backfill, compaction, testing, disinfecting and as-builts, plus all incidental work including all labor, materials, tools and equipment.
31. 24" x 24" Tee, Restrained M.J. (Check Valve Assembly)
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring for trenches of all depths, de-watering, laying, bedding, restraints, thrust blocking, backfill, compaction, testing, disinfecting and as-builts, plus all incidental work including all labor, materials, tools and equipment.

32. 24" x 12" Tee, Restrained M.J. (Autumn Pond)
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring for trenches of all depths, de-watering, laying, bedding, restraints, thrust blocking, backfill, compaction, testing, disinfecting and as-builts, plus all incidental work including all labor, materials, tools and equipment.
33. 42” 22.5 Degree Bend, Restrained M.J.
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring for trenches of all depths, de-watering, laying, bedding, restraints, thrust blocking, backfill, compaction, testing, disinfecting and as-builts, plus all incidental work including all labor, materials, tools and equipment.
34. 42” 11.25 Degree Bend, Restrained M.J.
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring for trenches of all depths, de-watering, laying, bedding, restraints, thrust blocking, backfill, compaction, testing, disinfecting and as-builts, plus all incidental work including all labor, materials, tools and equipment.
35. 24” 90 Degree Bend, Restrained M.J. (HS Rd B&J and Check Valve Assembly)
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring for trenches of all depths, de-watering, laying, bedding, restraints, thrust blocking, backfill, compaction, testing, disinfecting and as-builts, plus all incidental work including all labor, materials, tools and equipment.
36. 24” 22.5 Degree Bend, Restrained M.J.
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring for trenches of all depths, de-watering, laying, bedding, restraints, thrust blocking, backfill, compaction, testing, disinfecting and as-builts, plus all incidental work including all labor, materials, tools and equipment.
37. 42-inch R.J. Plug (Termination of 42-inch WM – Kelley Mill Rd)
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring for trenches of all depths, de-watering, laying, bedding, joint restraints, thrust blocking, backfill, compaction, testing, disinfecting and as-builts, plus all incidental work including all labor, materials, tools and equipment.
38. 24-inch R.J. Plug (Longstown Road East)
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually furnished and installed. Payment shall be for furnishing, excavation, sheeting and shoring for trenches of all depths, de-watering, laying, bedding, joint restraints, thrust blocking, backfill, compaction, testing, disinfecting and as-builts, plus all incidental work including all labor, materials, tools and equipment.

39. 1” Water Service on 42-inch Main (Short – short services are defined as those on the same side of the roadway as the water main being installed)
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be per each actually installed. Payment shall be for field measurements, grading, traffic control, construction staking, protection of existing utilities, protection of existing trees, trenching; sheeting, shoring and bracing; dewatering; sedimentation and erosion control; mucking out saturated soils; locater wire; boring; furnishing and installing necessary fittings; furnishing and installing a new water service, installing new service saddle and corporation stop; replacement or installation of new curb stop, boring; insert stiffeners; bedding; flowable fill; excavation, select backfill, backfill and compaction; temporary steel plating; flushing and disinfection; restoration of ground surfaces; restoration of existing site improvements; sodding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; reset mailboxes/paper boxes and street signs; remove and reset lamp posts; “as-built” drawings; warranties; other items as listed above to complete the water service installation to one customer plus all incidental work including all labor, materials, tools and equipment.
40. Existing Water Meter Relocate / Re-set
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be for coordination with utility owners, removal, replacement and stabilization of existing water meters, plus all incidental work of utility relocation including, all labor, materials, tools and equipment.
41. Power Pole Hold
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be for coordination with utility owners to hold and stabilize power poles during construction as needed, plus all incidental work of utility relocation including, all labor, materials, tools and equipment.
42. Power Pole Relocation
    a. Measurement and Payment shall be per Each as stated within the Bid Form. Payment shall be for coordination with utility owners, all fees associated with the relocations, removal, replacement and stabilization of power poles, plus all incidental work of utility relocation including, all labor, materials, tools and equipment.

43. Fence / Landscaping / Property Restoration (all Easement Conditions)
    a. Measurement and Payment shall be per Lump Sum as stated within the Bid Form. Payment shall be for coordination with property owners, removal, replacement, repair and other construction required to complete easement conditions as stated in the final easement documents, plus all incidental work of fence relocation / repair / replacement, landscaping restoration, sod, driveway gate and brick column relocation / repair, and all other conditions listed in final easement documents including all labor, materials, tools and equipment. Contractor shall include benchmark bill in schedule of values to be provided to the Engineer and Owner.
44. Cut and Patch Asphalt Pavement at Roadway Crossings for 42-inch Main (Shoal Creek Ln, Coatbridge Dr, Tawney Forrest Rd)
    a. Measurement and Payment shall be per Ton as stated within the Bid Form. Payment shall be all work necessary to restore roadway to conditions required by the Roadways Owner (Richland County, SCDOT, et Cetera). Payment shall be for furnishing, excavation, cutting and removal of existing asphalt pavement with proper disposal, construction of sub-base / base course / asphalt combination including placement, compaction, traffic control; tack coat; tack coat on all joints flowable fill requirements, backfill and compaction requirements, pavement cuts; cleaning up the site; and temporary and final striping plus all incidental work including all labor, materials, tools and equipment. This pay item shall include all work to fully repair each roadway crossing to its original condition.
    b. Truck tickets will be required to verify quantities. Contractor to provide tickets to the City's Inspector or the Engineers Construction Observation Personnel.
45. Cut and Repair Asphalt Driveway (2 in.)
    a. Measurement and Payment shall be per Ton as stated within the Bid Form. Payment shall be for cubic yard actually removed and replaced with a maximum width being the trench width or as otherwise indicated on the drawings, unless otherwise authorized by the Owner in writing. Payment shall be for furnishing, excavation, removal of existing driveway with proper disposal, fine grading, placement and compaction of base material, placement and compaction of asphalt, testing; temporary steel plating; restoration of ground surfaces; restoration of existing site improvements; seeding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; testing; "as-built" drawings; warranties; plus all incidental work including all labor, materials, tools and equipment.
    b. Truck tickets will be required to verify quantities. Contractor to provide tickets to the City's Inspector or the Engineers Construction Observation Personnel.

46. Cut and Repair Concrete Driveway (6 in.)
    a. Measurement and Payment shall be per Cubic Yard with a thickness of 6-inches as stated within the Bid Form. Payment shall be for square yard actually removed and replaced with a maximum width from Construction Joint to Construction Joint or as otherwise indicated on the drawings, unless otherwise authorized by the Owner in writing. Payment shall be for furnishing, excavation, removal of existing driveway with proper disposal, fine grading, placement and compaction of base material, construction of replacement concrete driveway including forming and vibrating (if required); Portland cement concrete, reinforcing steel, if required; joint templates; joint materials; signing; curing concrete; backfill, and compaction; testing; temporary steel plating; restoration of ground surfaces; restoration of existing site improvements; seeding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; testing; "as-built" drawings; warranties; plus all incidental work including all labor, materials, tools and equipment. Although thickness is defined as 6", Contractor's repair / replacement thickness shall be consistent with the existing concrete driveway thickness.
    b. Truck tickets will be required to verify quantities. Contractor to provide tickets to the City's Inspector or the Engineers Construction Observation Personnel.
47. Cut and Repair Gravel Driveway (8 in.)
    a. Measurement and Payment shall be per Ton as stated within the Bid Form. Payment shall be for cubic yard actually removed and replaced with a maximum width being the trench width or as otherwise indicated on the drawings, unless otherwise authorized by the Owner in writing. Payment shall be for furnishing, excavation, removal of existing driveway with proper disposal, fine grading, placement and compaction of base material, construction of replacement gravel driveway including forming and vibrating (if required); signing; backfill, and compaction; testing; temporary steel plating; restoration of ground surfaces; restoration of existing site improvements; seeding; cleanup; shaping and evening of uneven and rough areas; re-shaping ditch sections; testing; "as-built" drawings; warranties; plus all incidental work including all labor, materials, tools and equipment.
    b. Truck tickets will be required to verify quantities. Contractor to provide tickets to the City's Inspector or the Engineers Construction Observation Personnel.
48. Cut and Repair Concrete Sidewalk (4 in.)
    a. Measurement and Payment shall be per Cubic Yard as stated within the Bid Form. Payment shall be for cubic yard actually removed and replaced with a maximum width being the trench width or as otherwise indicated on the drawings plan and profile sheet, as well as the detail sheets, unless otherwise authorized by the Owner in writing. Payment shall be for furnishing, excavation, cutting and removal of existing driveway with proper disposal, fine grading, placement and compaction of base material, constructing new concrete sidewalk; formwork; welded wire fabric; Portland cement concrete (SCDOT Class 3000); reinforcing steel, if required; joint templates; jointing material; curing concrete; backfilling; detectable pedestrian warning surfaces; SCDOT pedestrian ramps and associated curbing; testing, if required; "as-built" drawings;

and warranties, plus all incidental work including all labor, materials, tools and equipment. In areas where sidewalks are to be repaired, Contractor will be paid for replacement of damaged concrete sections from construction joint to construction joint. Contractor will not be paid for sections of concrete that have been cut and replace at any place other than construction joints.

b. Truck tickets will be required to verify quantities. Contractor to provide tickets to the City's Inspector or the Engineers Construction Observation Personnel.

49. Cut and Repair Concrete Curb and Gutter

a. Measurement and Payment shall be per Linear Foot as stated within the Bid Form. Payment shall be for linear foot actually removed and replaced with a maximum width being the trench width or as otherwise indicated on the drawings, unless otherwise authorized by the Owner in writing. Payment shall be for cutting and removing concrete curb and gutter, disposing of debris at appropriate permitted location, constructing new concrete curb and gutter; fine grading; compacting sub-grade; formwork; portland cement concrete (SCDOT Class 3000); joint templates; jointing material; curing concrete; backfilling; testing, if required; "as-built" drawings; and warranties, plus all incidental work including all labor, materials, tools and equipment.

b. Truck tickets will be required to verify quantities. Contractor to provide tickets to the City's Inspector or the Engineers Construction Observation Personnel.

50. Grassing (Hydroseeding)

a. Measurement and Payment shall be per Acre as stated within the Bid Form. Payment shall be for furnishing and installation of hydroseeding including hydroseeding much and seeding plus all incidental work including all labor, materials, tools and equipment. Contractor shall be paid once for areas that are hydroseeded. Contractor will install / temporarily grass disturbed areas immediately after construction is completed in the area. Hydroseeding shall take place as a final stabilization measure. Additional hydroseeding that is deemed necessary by the Owner and Engineer to serve as a temporary stabilization measure shall be paid per acre under this pay item. Contractor shall inform both the City's Inspection Personnel and Engineer's Construction Observation Personnel prior to the start of hydroseeding for quantity verification purposes. Payment will not be made for hydroseeding that occurs when notification has not been given to the referenced personnel.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination.

B. Field engineering.

C. Preconstruction meeting.

D. Progress meetings.

E. Pre-installation meetings.

1.2 COORDINATION

A. Coordinate scheduling, submittals, and Work of various specification sections to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify utility requirements and characteristics of operating equipment are compatible with existing utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's occupancy or partial occupancy.

E. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 FIELD ENGINEERING

A. Employ Professional Land Survey licensed in State of South Carolina. Contractor is responsible for all water main layout and staking. Contractor shall employ referenced surveyor for staking and layout of the project to ensure project is constructed within the City of Columbia Permanent Exclusive Easements.

B. Locate and protect survey control and reference points. Promptly notify Engineer of discrepancies discovered.

C. Control datum for survey is that indicated on Drawings.

D. At the completion of the work, Contractor shall submit copy of an as-built survey sealed and signed by a Professional Land Surveyor licensed in South Carolina certifying that elevations and locations of the Work are in conformance with Contract Documents. A digital AutoCADD file and point file shall be provided to the Engineer.

E. Maintain complete and accurate log of control and survey work as Work progresses.

F. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

G. Promptly report to Engineer loss or destruction of reference point or relocation required because of changes in grades or other reasons.

H. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Engineer.

1.4 PRECONSTRUCTION MEETING

A. Owner with conjunction with Engineer will schedule meeting after Contract time starts to run.

B. Attendance Required: Owner, Engineer, and Contractor.

C. Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
5. Designation of personnel representing parties in Contract, Engineer, independent testing firm.
6. Procedures and processing of field decisions, submittals, and substitutions, applications for payments, proposal requests, Change Orders, and Contract closeout procedures.
7. Contractor’s submittal initial project Schedule.
8. Contractor’s list of work to be completed in the first 30-days after the issuance of the Notice to Proceed is issued.
9. Discuss scheduling of initial project meeting and establish a one day during each month for progress meetings that will work for all parties.
10. Refer to the City of Columbia front end Documents for additional topics to be discussed.

D. Engineer will record minutes and distribute copies within three (3) business days after meeting to participants, with two copies to Engineer, Owner, Contractor, and those affected by decisions made.

1.5 PROGRESS MEETINGS

A. Progress Meetings will be held on a monthly basis. The first progress meeting will be discussed and pre-scheduled at the Pre-Construction Conference.

B. Engineer will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings and administer meetings. Engineer will record minutes and distribute copies within three (3) business days after each progress meeting.

C. Schedule: Throughout progress of the Work at monthly intervals. On site meetings may be necessary and scheduled if Work dictates the need.

D. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, Engineer, City of Columbia Inspector, WK Dickson's Construction Observation Personnel and others as appropriate to agenda topics for each meeting.

E. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems impeding planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Review and presentation by Contractor of any changes that mat be required during the upcoming 30-day period.
14. Review of Contractor Red Line Drawings during the previous 30-days of work.
15. Other business relating to Work.

F. Engineer will record minutes and distribute copies within three (3) business days after meeting to participants, with two (2) copies to Owner, Contractor, and those affected by decisions made.

1.6 PRE-INSTALLATION MEETINGS

A. When required in individual specification sections, convene pre-installation meetings at Project site prior to commencing work of specific Section.

B. Require attendance of parties directly affecting, or affected by, Work of specific Section.

C. Notify Engineer four (4) days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of installation, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within three (3) business days after meeting to participants, with two copies to Engineer, Owner, and those affected by decisions made.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes.
   1. Submittal procedures.
   2. Product data.
   3. Shop drawings.
   4. Samples.
   5. Design data.
   6. Test reports.
   7. Certificates.
   8. Manufacturer's instructions.
   9. Manufacturer's field reports.
   10. Construction progress schedules.
   11. Proposed products list.
   12. Erection drawings.
   13. Construction photographs.

1.2 SUBMITTAL PROCEDURES

A. Submit number of copies per the Contractor’s own requirement, plus two (2) copies Engineer will retain. Submittals may be accepted electronically if agreed upon by all parties during the pre-construction conference.

B. Deliver to Engineer at business address.

C. For each submittal for review, allow 20 days excluding delivery time to and from Contractor.

D. Transmit each submittal with Engineer accepted form.

E. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

F. Identify Project, Contractor, subcontractor and supplier, pertinent drawing and detail number, and specification Section number appropriate to submittal.

G. Apply Contractor's stamp signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents. Contractor must review and certify that product meets or exceeds City and Engineer’s Specifications prior to submittal to Engineer.

H. Schedule submittals to expedite Project. Submittal schedule shall be discussed during the pre-construction conference. Coordinate submission of related items.

I. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work. If product submittal differs from the Technical Specifications, the Specification Section should be included with the Contractor's Submittal. Items that meet the specification requirements shall be checked off. In areas that different than what has been specified, the Contractor shall note the variations on the copy of the specification section.

J. Allow space on submittals for Contractor and Engineer review stamps.

K. When revised for resubmission, identify changes made since previous submission.

L. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

M. Submittals not requested will not be recognized or processed.

1.3 PRODUCT DATA

A. Product Data: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.4 SHOP DRAWINGS

A. Shop Drawings: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
   1. Include signed and sealed calculations to support design.
   2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
   3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. Submit number of copies described in SUBMITTAL PROCEDURES article.

1.5 SAMPLES

A. Samples: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Submit number of samples specified in individual specification sections; Engineer will retain one sample.

C. Samples for selection as specified in product sections:
   1. Submit to Engineer for aesthetic, color, or finish selection.
   2. Submit samples of finishes from full range of manufacturers' standard colors, in custom colors selected, textures, and patterns for Engineer selection.

D. Submit samples to illustrate functional and aesthetic characteristics of Products with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

E. Include identification on each sample with full Project information.

F. Reviewed samples which may be used in the Work are indicated in individual specification sections.

G. Samples will not be used for testing purposes unless specifically stated in specification section.

H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 70 00 - Execution and Closeout Requirements.

1.6 DESIGN DATA

A. Submit for Engineer's knowledge as contract administrator or for Owner.

B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.7 TEST REPORTS

A. Submit for Engineer's knowledge as contract administrator or for Owner. Certified est reports submitted to the Engineer by the Contractor may be utilized for the purpose of obtaining operational permits for the project.

B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.8 CERTIFICATES

A. When specified in individual specification Sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Engineer.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product but must be acceptable to Engineer.

1.9 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing to Engineer for delivery to Owner.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.10 MANUFACTURER'S FIELD REPORTS

A. Submit reports for Engineer's knowledge as contract administrator or for Owner.

B. Submit report within 72 hours of observation to Engineer for information.

C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.11 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedules within 15 days after date established in Notice to Proceed. After review, resubmit required revised data within 10 days. Contractor shall have a preliminary schedule prepared prior to the Pre-Construction Conference. Contractor shall present the preliminary schedule to the Engineer at the Pre-Construction Conference.

B. Submit revised Progress Schedules with each Progress Meeting or Application for Payment, but not less than monthly.

C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.

D. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

E. Submit computer generated horizontal bar chart with separate line for each major portion of Work or operation, identifying first workday of each week.

F. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.

G. Indicate estimated percentage of completion for each item of Work at each submission.

H. Submit separate schedule of submittal dates for shop drawings, product data, and samples. Indicate dates reviewed submittals will be required from Engineer. Indicate decision dates for selection of finishes.

I. Indicate delivery dates for Owner furnished products and products identified under Allowances if required.

J. Revisions to Schedules:
   1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
   2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
   3. Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect, including effect of changes on schedules of separate contractors.

1.12 PROPOSED PRODUCTS LIST

A. Within 15 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.13 CONSTRUCTION PHOTOGRAPHS

A. Provide digital photographs of site prior to, and throughout construction progress documenting Work as acceptable to Engineer and sufficient to document pre-existing conditions. In addition, photos shall be taken to meet all condition of the Contract Documents

B. Submit photographs weekly or more frequently if required in order t document milestones of Work.

C. Take photographs as evidence of existing project conditions.

D. Identify each print on front. Identify name of Project, contract number, location/orientation of view, date and time of view.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Quality control and control of installation.
2. Tolerances.
3. References.
4. Testing and inspection services.
5. Manufacturers' field services.
6. Labeling.
7. Mock-up requirements.
8. Examination.
9. Preparation.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. When manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

A. For products or Work specified by association, trades, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving Bids, (date of Owner-Contractor Agreement when there are no Bids), except where specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. When specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

E. Contractual relationships, duties, and responsibilities of parties in Contract and those of Engineer shall not be altered from Contract Documents by mention or inference otherwise in reference documents.

1.5 TESTING AND INSPECTION SERVICES

A. Coordinate services of an independent firm selected by the Owner and Engineer to perform specified testing and inspections.
   1. The Owner has pre-arranged for soils testing and associated cost. However, Contractor must coordination with testing agency fulfill all testing requirements outlined in specifications.
   2. Refer to Special Provisions and front end documents for additional information and requirements.

B. Contractor to Employ Independent firm that will perform tests (other than those included in 1.5.A, the special provisions or the front end documents of this document), inspections and other services specified in individual specification sections and as required by Engineer.
   1. Laboratory: Authorized to operate in State of Project location.
   2. Laboratory Staff: Maintain full time registered Engineer and necessary specialists on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

C. Contractor shall pay for and employ an independent testing agency for testing that includes, but is not limited to, collection and analysis of bacteriological samples prior to the start up of the new water system components.

D. Testing and inspections may occur on or off project site. Perform off-site testing as required by Engineer or Owner.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify Engineer and Testing Firm 24-hours prior expected time for operations requiring services.
   2. Make arrangements with independent and pay for additional samples and tests required for Contractor's use or any repeat testing required to prove compliance with these specifications.
   3. Contractor will be responsible for payment for any retesting due to failure or noncompliance with specification requirements.

F. Testing and employment of independent firm does not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm upon instructions by the Engineer.
   1. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum / Price. This applies to all testing including that initially to be paid for by Owner.
   2. Submit final report indicating correction of Work previously reported as non-compliant.

H. Independent Firm Responsibilities:
   1. Test samples submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
   6. Perform additional tests required by Engineer.

I. Limits on Independent Firm:
   1. May not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. May not approve or accept any portion of the Work.
   3. May not assume duties of Contractor.
   4. Has no authority to stop the Work.

J. Engineer and City shall hire an independent testing firm for all compaction and materials testing as it relates to soils. Independent firm hired by City and Engineer shall be a geotechnical engineering company.

K. Contractors testing requirements include but are not limited to pressure testing of the completed water mains, bacteriological sampling and testing (shall be conducted by independent lab licensed in the state of South Carolina).

1.6 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to:
   1. Observe site conditions.
   2. Observe conditions of surfaces.
   3. Review installation and quality of Work.
   4. Review start-up of equipment.
   5. Review testing, adjusting and balancing of equipment.
   6. Initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

1.7 LABELING

A. Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.

B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.
   1. Model number.
   2. Serial number.
   3. Performance characteristics.

1.8 MOCK-UP REQUIREMENTS

A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Where mock-up has been accepted by Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Engineer.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Examine and verify specific conditions described in individual specification sections.

C. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

1.1 SECTION INCLUDES

A. Temporary Utilities:
   1. Temporary electricity.
   2. Temporary lighting for construction purposes.
   3. Temporary heating, ventilation, and cooling.
   4. Telephone, facsimile, and internet service.
   5. Temporary water service.
   6. Temporary sanitary facilities.

B. Construction Facilities:
   1. Project identification.
   2. Vehicular access.
   3. Parking.
   4. Progress cleaning and waste removal.
   5. Traffic regulation.
   6. Fire prevention facilities.

C. Temporary Controls:
   1. Barriers.
   2. Enclosures and fencing.
   3. Security.
   4. Water control.
   5. Dust control.
   6. Erosion and sediment control.
   7. Noise control.
   8. Pest and rodent control.
   9. Pollution control.

D. Removal of temporary utilities, facilities, and controls.

1.2 TEMPORARY ELECTRICITY

A. Provide and pay for power service required from utility source as needed for construction operation.

B. Provide temporary electric feeder from electrical service at location as directed by Owner. Do not disrupt Owner's use of service.

C. Complement existing power service capacity and characteristics as required for construction operations.

D. Provide power outlets, with branch wiring and distribution boxes located as required for construction operations. Provide flexible power cords as required for portable construction tools and equipment.

E. Provide main service disconnect and over-current protection at convenient location or feeder switch at source distribution equipment.

F. Permanent convenience receptacles may not be utilized during construction.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain lighting for construction operations.

B. Provide and maintain one (1) watt / square foot lighting to exterior staging and storage areas after dark for security purposes.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.

D. Maintain lighting and provide routine repairs.

1.4 TEMPORARY WATER SERVICE

A. The City will provide a metered hydrant for Contractor's water needs for this specific project. Water from City will be provided from a City Fire Hydrant through a City Bulk Meter. Refer to Special Provisions for additional information. Note that some project areas are not served by the City. In areas not served by the City of Columbia, the Contractor shall be responsible for coordinating water service through alternate providers.

B. Contractor will be required to provide water trucks, trailer tanks or other equipment necessary to store and transport water to areas along the project alignment. The Contractor shall not connect any hoses or piping besides the required meter and backflow preventor to the City's Fire Hydrant.

1.5 TEMPORARY SANITARY FACILITIES

A. Contractor shall provide portable toilets for the project. Contractor is responsible for getting appropriate permission for placement of portable facilities. Contractor shall contract with the supplier to accommodate cleaning at appropriate intervals. Due to the length of the project (approximately 6-miles), multiple portable units will be required the location will depend on the location of the ongoing work.

B. At end of construction, the location of the portable toilets shall be in pre-construction condition.

C. The Contractor shall retain all responsibility and liability for any leakage, spills, or overturns resulting in discharge of raw sewage on site.

1.6 PROJECT IDENTIFICATION

A. Project Identification Sign:
   1. One (1) painted sign, 32 square foot area, and bottom 6'-0" above ground.
   2. Content:
      a. Project number, title, logo and name of Owner as indicated on Contract Documents.
      b. Names and titles of authorities.

c. Names and titles of Engineer and Consultants.
d. Name of Prime Contractor and major Subcontractors.

3. Graphic Design, Colors, Style of Lettering: Designated by Engineer.

B. Project Informational Signs:
1. Painted informational signs of same colors and lettering as Project Identification sign, or standard products; size lettering for legibility at 100'-0" distance.
2. Provide one (1) sign at the City of Columbia's Composite elevated storage tank on Rimer Pond Road near station 0+00 on the Rimer Pond Road Water Main Alignment. Provide one (1) sign at the intersection of Rimer Pond Road and Hard Scrabble Road. The sign located at the intersection shall be two (2) sided and visible while traveling by vehicle from east to west along Rimer Pond Road and while traveling by vehicle south to north along Hard Scrabble Road.
3. No other signs are allowed without Owner's permission except those required by law.

C. Design sign and structure to withstand 90 miles / hour wind velocity.

D. Sign Painter: Experienced as professional sign painter for minimum three (3) years.

E. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

F. Sign Materials:
1. Structure and Framing: New wood or metal, structurally adequate.
2. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4" thick, standard large sizes to minimize joints.
3. Rough Hardware: Galvanized, aluminum, or brass.
4. Paint and Primers: Exterior quality, two (2) coats; sign background of color as selected.
5. Lettering: Exterior quality paint, contrasting colors as selected.

G. Installation:
1. Install project identification sign within 15 days after date fixed by Notice to Proceed.
2. Erect at designated location.
3. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
4. Install sign surface plumb and level, with butt joints. Anchor securely.
5. Paint exposed surfaces of sign, supports, and framing.

H. Maintenance: Maintain signs and supports clean, repair deterioration and damage.

I. Removal: Remove signs, framing, supports, and foundations at completion of Project and restore area.

1.7 VEHICULAR ACCESS

A. Construct temporary all-weather access roads from public thoroughfares to serve construction area, of width and load bearing capacity to accommodate unimpeded traffic for construction purposes.

B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.

C. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.

D. Location as indicated on the drawings or approved by Engineer.

E. Provide unimpeded access for emergency vehicles. Maintain 20'-0" wide driveways with turning space between and around combustible materials.

F. Provide and maintain access to fire hydrants and control valves free of obstructions.

G. Provide means of removing mud from vehicle wheels before entering streets.

1.8 PARKING

A. Provide temporary gravel surface parking areas to accommodate construction personnel.

B. Locate as indicated on the drawings or as approved by Engineer.

C. When site space is not adequate, provide additional off-site parking.

D. Use of designated areas of existing parking facilities by construction personnel is not permitted.

E. Do not allow heavy vehicles or construction equipment in parking areas.

F. Do not allow vehicle parking on existing pavement.

G. Designate one parking space for Owner and Engineer.

H. Permanent Pavements and Parking Facilities:
1. Prior to Substantial Completion, bases for permanent roads and parking areas may be used for construction traffic.
2. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.
3. Use of permanent parking structures is not permitted.

I. Maintenance:
1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
2. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

J. Removal, Repair:
1. Remove temporary materials and construction at Substantial Completion.
2. Remove underground work and compacted materials to depth of 2'-0", fill and grade site as specified.
3. Repair existing or permanent facilities damaged by use, to original or specified condition.

K. Mud from Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.9 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Remove debris and rubbish from City of Columbia Easements, SCDOT Right-of-Ways and private property adjacent to the active construction areas.

C. Collect and remove waste materials, debris, and rubbish from site at a minimum of weekly intervals and dispose off-site.

1.10 TRAFFIC REGULATION

A. Signs, Signals, and Devices:
   1. Post Mounted and Wall Mounted Traffic Control and Informational Signs: As approved by authority having jurisdiction.
   2. Automatic Traffic Control Signals: As approved by local jurisdictions.
   3. Traffic Cones and Drums, Flares and Lights: As approved by authority having jurisdiction.
   4. Flagperson Equipment: As required by authority having jurisdiction.

B. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

C. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

D. Haul Routes:
   1. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.
   2. Use haul routes and site access as indicated on the drawings.
   3. Confine construction traffic to designated haul routes.
   4. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

E. Traffic Signs and Signals:
   1. Provide signs at approaches to site and on site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
   2. Provide, operate, and maintain automatic traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.
   3. Relocate as Work progresses, to maintain effective traffic control.

F. Removal:
   1. Remove equipment and devices when no longer required.
   2. Repair damage caused by installation.
   3. Remove post settings to depth of 2'-0".

1.11 FIRE PREVENTION FACILITIES

A. Designate area on site where smoking is permitted. Provide approved ashtrays in designated smoking areas.

B. Establish fire watch for cutting and welding and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.

C. Portable Fire Extinguishers: NFPA 10; 10 pound capacity, 4A-60BC UL rating.
   1. Provide one (1) fire extinguisher at each stair on each floor of buildings under construction and demolition.
   2. Provide minimum one (1) fire extinguisher in every storage shed / laydown yard.
   3. Provide minimum one (1) fire extinguisher on roof during roofing operations using heat producing equipment.

1.12 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.13 ENCLOSURES AND FENCING

A. Construction: Commercial grade chain link fence.

1.14 SECURITY

A. Security Program:
   1. Protect Work and existing premises from theft, vandalism, and unauthorized entry.
   2. Initiate program at project mobilization.
   3. Maintain program throughout construction period until Owner acceptance precludes need for Contractor security.

B. Entry Control:
   1. Restrict entrance of persons and vehicles into Project site and existing facilities.
   2. Allow entrance only to authorized persons with proper identification.
   3. Maintain log of workers and visitors, make available to Owner on request.

4. Coordinate access of Owner's personnel to site in coordination with Owner's security forces.

C. Restrictions:
1. Do not allow cameras on site or photographs taken except by written approval of Owner.
2. Do no work on days indicated as non-work days in Owner-Contractor Agreement.

1.15 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.16 DUST CONTROL

A. Execute Work by methods to minimize raising dust from construction operations.

B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

1.17 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize surface area of bare soil exposed at one time.

C. Provide temporary measures including berms, dikes, and drains, and other devices as indicated to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

F. Contractor responsible for meeting all conditions of the Land Disturbance permitting.

G. Contractor to install and track daily rainfall on site. Engineer’s Construction Observer or City’s Inspector will conduct weekly stormwater pollution prevention plan inspections as required in Land Disturbance Contract.

1.18 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by construction operations.

1.19 PEST AND RODENT CONTROL

A. Provide methods, means, and facilities to prevent pests, insects, and rodents from damaging the Work.

1.20 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.21 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials prior to Substantial Completion inspection.

B. Remove underground installations to minimum depth of 2'-0". Grade site as indicated on Drawings.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

1.2 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

C. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.6 PRODUCT SUBSTITUTION PROCEDURES

A. The City of Columbia Instructions to Bidders and General Specifications outlines procedures for product substitutions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes the following:
   1. Closeout procedures.
   2. Final cleaning.
   3. Project record documents.
   4. Manual for materials and finishes.

1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.

B. Provide submittals to Engineer required by authorities having jurisdiction.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean site; sweep paved areas, rake clean landscaped surfaces.

C. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings: Contractor to legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Field changes of dimension and detail.
   3. Details not on original contract drawings.

G. As-Built Survey: Contractor to provide As-Built survey to be completed by a licensed Professional Land Surveyor in the State of South Carolina.
   1. Survey to be in South Carolina State Plane Coordinates NAVD 88
   2. Engineer can provide, upon request, design drawings in AUTOCADD format for use by the Surveyor.
   3. As-Built Survey to include location of installed water main in the x, y, and z plains and include all appurtenances. If necessary, the Contractor may survey installation depths during the construction of the project.
   4. As-Built survey to include all recorded easements associated with this project, SCDOT or County Rights-of-Way, and all structures, appurtenances, markers, and unique items within each of the easements.
   5. Survey should include the start and end point of all bore and jack and horizontal directional drill installations included as part of this project.
   6. Additional survey requirements are included in the Special Provisions and may be included in the front-end documents.
   7. Final Completion will not be considered reached until the submittal and acceptance of the As-Built survey by the Owner and Engineer.

H. Shop Drawings: Submit one (1) copy of all approved shop drawings at the conclusion of construction of the project.

I. Submit documents to Engineer.

1.5 MANUAL FOR MATERIALS AND FINISHES

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within 10 days after acceptance.

C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

E. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

F. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

G. Additional Requirements: As specified in individual product Specification Sections.

H. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE ACI

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Formwork and accessories.
2. Shoring, bracing, and anchorage.
3. Reinforcing bars.
4. Welded wire fabric.
5. Inserts and accessories.
6. Cast-in-place concrete.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 305 - Hot Weather Concreting.
4. ACI 306.1 - Standard Specification for Cold Weather Concreting.
5. ACI 308.1 - Standard Specification for Curing Concrete.
6. ACI 318 - Building Code Requirements for Structural Concrete.
7. ACI 530.1 - Specifications for Masonry Structures.
8. ACI SP-66 - ACI Detailing Manual.

B. American Forest and Paper Association:
1. AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association:
1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

D. ASTM International:
1. ASTM A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
2. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
3. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
4. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
5. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire for Reinforcement.
6. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
7. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
8. ASTM C33 - Standard Specification for Concrete Aggregates.

9. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
10. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
11. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
12. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
13. ASTM C150 - Standard Specification for Portland Cement.
14. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
15. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
16. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
17. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
18. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
19. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
20. ASTM C685 - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
21. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
22. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
23. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
24. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
25. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
26. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
27. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
28. ASTM D3963 - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.
29. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
30. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
31. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
32. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

E. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel
   2. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

F. Concrete Reinforcing Steel Institute:
   1. CRSI - Manual of Standard Practice.
   2. CRSI - Placing Reinforcing Bars.

G. West Coast Lumber Inspection Bureau:
   1. WCLIB - Standard No. 17 Grading Rules for West Coast Lumber.

1.3 PERFORMANCE REQUIREMENTS

A. Vapor Retarder Permeance: Maximum 0.3 perm when tested in accordance with ASTM E96, Procedure A.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on joint devices, attachment accessories, and admixtures.

C. Shop Drawings: Indicate bar sizes, spacing, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

D. Certificates: Submit AWS qualification certificate for welders employed on the Work.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
   1. Submit certified copies of mill test report of reinforcement materials analysis.

F. Concrete Design Data:
   1. Submit a concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
      a. Hot and cold weather concrete work.
      b. Air entrained concrete work.
   2. Identify mix ingredients and proportions, including admixtures.
   3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

G. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

H. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.

B. For wood products furnished for work of this Section, comply with AF&PA.

C. Prepare shop drawings in accordance with ACI SP-66.

D. Conform to ACI 305 when concreting during hot weather.

E. Conform to ACI 306.1 when concreting during cold weather.

F. Acquire cement and aggregate from one source for Work.

1.6 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain concrete temperature after installation at minimum 50°F for minimum 7 days.

B. Maintain high early strength concrete temperature after installation at minimum 50°F for minimum 3 days.

1.8 COORDINATION

A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Products storage and handling requirements.

B. Deliver void forms and installation instructions in manufacturer's packaging. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Softwood Plywood: APA/EWA PS 1, C Grade, Group 2.

B. Lumber Forms:
1. Application: Use for edge forms and unexposed finish concrete.
2. Boards: 6" or 8" in width, ship lapped or tongue and groove, "Standard" Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four (4) sides.

C. Plywood Forms:
1. Application: Use for exposed finish concrete.
2. Forms: Conform to PS 1; full size 4'-0" x 8'-0" panels; each panel labeled with grade trademark of APA/EWA.
3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8" thick; APA/EWA "B-B Plyform Structural I Exterior" grade.
4. Plywood where "Smooth Finish" is required, as indicated on the drawings: APA/EWA "HD Overlay Plyform Structural I Exterior" grade, minimum of 3/4" thick.

2.2 PREFABRICATED FORMS

A. Manufacturers:
   1. Aluma-Systems Inc., Burke Co.
   2. Economy Forms Corp.
   3. Molded Fiber Glass Concrete Forms Co.
   4. Perma Tubes.
   5. Sonoco Products Co.
   6. Symons Corp. Product Western Forms, Inc.
   7. Product Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Preformed Steel Forms: Minimum 16 gauge matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

D. Pan Type: Steel or glass fiber of size and profile required.

E. Tubular Column Type: Round, spirally wound laminated fiber material; surface treated with release agent, non-reusable, sizes as indicated on the drawings.

F. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 4" thick.

G. Steel Forms: Sheet steel, suitably reinforced and designed for particular use indicated on the drawings.

H. Form Liners: Smooth, durable, grainless, and non-staining hardboard, unless otherwise indicated on the drawings.

I. Framing, Studding, and Bracing: Stud or No. 3 structural light framing grade.

2.3 ARCHITECTURAL FORM LINERS

A. Architectural Form Liners: As indicated on the drawings.

2.4 FORMWORK ACCESSORIES

A. Form Ties: Removable type, adjustable length, with waterproofing washer, free of defects capable of leaving holes larger than 1 inch in concrete surface, and leaving no metal within 1" of exposed surface.

B. Spreaders: Standard non-corrosive metal form clamp assembly of type acting as spreaders and leaving no metal within 1" of concrete face. Wire ties, wood spreaders, or through bolts are not permitted.

C. Form Anchors and Hangers:
   1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
   2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
   3. Penetration of structural steel members is not permitted.

D. Form Release Agent: Colorless mineral oil that will not stain concrete or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.
   1. Manufacturers:
      a. Arcal Chemical Corporation, Arcal-80.
      b. Industrial Synthetics Company, Synthex.
      c. Nox-Crete Company, Nox-Crete Form Coating.
      d. Substitutions: Section 01 60 00 - Product Requirements.

E. Corners exposed to view: Fillet and Chamfer; rigid plastic or wood strip type; 3/4" x 3/4" size; maximum possible lengths.

F. Vapor Retarder: Where indicated on the drawings, 6 mil thick polyethylene sheet.

G. Bituminous Joint Filler: ASTM D1751.

H. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength, and character to maintain formwork in place while placing concrete.

I. Water Stops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50°F to plus 175°F working temperature range, width as shown on the drawings, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

2.5 REINFORCEMENT

A. Deformed Reinforcement: ASTM A615; 60 ksi yield strength, steel bars, unfinished or epoxy coated finish as indicated on the drawings.

B. Welded Deformed Steel Bar Mats: ASTM A184; fabricated from ASTM A615 60 ksi yield strength, steel bars, unfinished or epoxy coated finish as indicted on the drawings.

C. Steel Welded Wire Reinforcement, Plain, for Concrete: ASTM A185; in flat sheets or coiled rolls; unfinished or epoxy coated finish as indicated on the drawings.

2.6 REINFORCEMENT ACCESSORIES

A. Tie Wire: Minimum 16 gauge annealed type, epoxy coated.

B. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel type; size and shape to meet Project conditions.

D. Reinforcing Splicing Devices: Exothermic welding type or mechanical threaded type; full tension and compression; sized to fit joined reinforcing.

E. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.7 REINFORCEMENT FABRICATION

A. Fabricate concrete reinforcement in accordance with ACI 318.

B. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks; and seismic hooks as indicated on the drawings.

C. Form reinforcement bends with minimum diameters in accordance with ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form spiral column reinforcement from minimum 3/8" diameter continuous deformed bar or wire.

F. Form ties and stirrups from the following:
1. For bars No. 10 and Smaller: No. 3 deformed bars.
2. For bars No. 11 and Larger: No. 4 deformed bars.

G. Weld reinforcement in accordance with AWS D1.4.

H. Epoxy-Coated Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI.

I. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with Engineer.

2.8 SHOP FINISHING

A. Epoxy Coated Finish for Steel Bars: ASTM A775; ASTM A934 if coating is applied after fabrication.

B. Epoxy Coated Finish for Steel Wire: ASTM A884, Class A using ASTM A775; ASTM A934 if coating is applied after fabrication.

2.9 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection, and analysis requirements.

B. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents. Specified shop tests are not required for Work performed by approved fabricator.

2.10 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal, Type IA - Air Entraining, Type II - Moderate, Type IIA - Air Entraining, or Type V - Sulfate Resistant Portland type.

B. High Early Strength Cement: ASTM C150, Type III or Type III - Air Entraining only when indicated on the drawings.

C. Normal Weight Aggregates: ASTM C33.
   1. Coarse Aggregate Maximum Size: In accordance with ACI 318.

D. Water: ACI 318; potable, without deleterious amounts of chloride ions.

2.11 CONCRETE ADMIXTURES

A. Manufacturers:
   1. Degussa Admixtures, Inc. (Master Builders).
   2. Euclid Chemical Co.
   3. Fritzpak Concrete Admixtures Co.
   4. Grace Construction Products.
   5. Larsen Products Corp.
   6. L & M Construction Chemicals.
   7. Sika Chemical Co.
   8. W.R. Meadows Inc.
   9. Substitutions: Section 01 60 00 - Product Requirements.

B. Air Entrainment: ASTM C260.

C. Chemical: ASTM C494:
   1. Type A - Water Reducing.
   2. Type B - Retarding.
   3. Type C - Accelerating.
   4. Type D - Water Reducing and Retarding.
   5. Type E - Water Reducing and Accelerating.
   6. Type F - Water Reducing, High Range.
   7. Type G - Water Reducing, High Range and Retarding.

D. Fly Ash: ASTM C618, Class F or C.

E. Plasticizing: ASTM C1017, Type I - Plasticizing or Type II - Plasticizing and retarding.

2.12 CONCRETE ACCESSORIES

A. Bonding Agent:
   1. Not exposed to water after placement: Polyvinyl Acetate.
   2. Exposed to water after placement: Latex emulsion or epoxy adhesive.

B. Vapor Retarder: ASTM E1745 Class A; 6 mil thick clear polyethylene film; type recommended for below grade application. Furnish joint tape recommended by manufacturer.

C. Non-Shrink Grout: ASTM C1107, Grade A or B; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4,000 psi in 3 days and 7,000 psi in 28 days.

2.13 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler: ASTM D1751 or ASTM D994; Preformed asphalt impregnated fiberboard or felt, thickness as indicated on Drawings; tongue and groove profile.

B. Sealant: ASTM D6690, Type III.

2.14 CONCRETE MIX

A. The concrete mix shall conform to Class 4000 concrete per Division 700 of the SCDOT Standard Specifications.

B. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94.

C. Site Mixed Concrete: Mix concrete in accordance with ACI 318.

2.15 CURING COMPOUNDS

A. Membrane Curing Compound: ASTM C309 Type 1, Class B.
   1. Manufacturers:
      a. Degussa Admixtures, Inc., Confilm.
      b. Euclid Chemical Co., Kurez W VOX.
      c. W. R. Meadows, Inc., 1100-Clear Series.
      d. Substitutions: Equal per Section 01 60 00 - Product Requirements.

B. Water: Potable, not detrimental to concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with epoxy.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates.

D. Remove water from areas receiving concrete before concrete is placed.

E. Earth Forms:
   1. Trench earth forms neatly, accurately, and at least 2" wider than footing widths indicated on the drawings.
   2. Trim sides and bottom of earth forms.
   3. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
   4. Form sides of footings where earth sloughs.
   5. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.

F. Formwork - General:
   1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
   2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
   3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
   4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
   5. Complete wedging and bracing before placing concrete.

G. Forms for Smooth Finish Concrete:
   1. Use steel, plywood or lined board forms.
   2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
   3. Install form lining with close-fitting square joints between separate sheets without springing into place.
   4. Use full size sheets of form lines and plywood wherever possible.
   5. Tape joints to prevent protrusions in concrete.
   6. Use care in forming and stripping wood forms to protect corners and edges.
   7. Level and continue horizontal joints.
   8. Keep wood forms wet until stripped.

H. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

I. Framing, Studding and Bracing:
   1. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
   2. Distribute bracing loads over base area on which bracing is erected.
   3. When placed on ground, protect against undermining, settlement, or accidental impact.

J. Erect formwork, shoring, and bracing to achieve design requirements in accordance with requirements of ACI 318.

K. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

L. Obtain Engineer's approval before framing openings in structural members not indicated on Drawings.

M. Install fillet and chamfer strips on external corners of exposed corners.

N. Install void forms in accordance with manufacturer's recommendations.

O. Do not reuse wood formwork with damaged faces or edges for concrete surfaces to be exposed to view. Do not patch formwork.

3.3 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install water stops continuous without displacing reinforcement. Heat seal joints watertight.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

H. Form Ties:
   1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
   2. Place ties at least 1 inch away from finished surface of concrete.
   3. Leave inner rods in concrete when forms are stripped.
   4. Space form ties equidistant, symmetrical, and aligned vertically and horizontally unless otherwise shown on the drawings.
   5. Set with waterstops.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:
   1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
   2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
   3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
   4. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:
   1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
   2. Do not embed wood or uncoated aluminum in concrete.
   3. Obtain installation and setting information for embedded items furnished under other Specification sections.
   4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
   5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:
   1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
   2. Coordinate work to avoid cutting and patching of concrete after placement.
   3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:
   1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
   2. Slope slabs to drain where required or as shown on the drawings.
   3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:
   1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad, or base type screed supports which will not puncture membrane.
   2. Staking through membrane is not permitted.

O. Cleanouts and Access Panels:
   1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris, and waste material.
   2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

A. Clean forms as erection proceeds to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads or removal has been approved by Engineer.

B. Leave forms in place for minimum number of days as specified in ACI 347.

C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

D. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

E. Twist ties off, point and patch holes with non-shrink grout within 48 hours of form removal.

3.7 ERECTION TOLERANCES

A. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.

B. Camber slabs and beams in accordance with ACI 318.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify Engineer after placement of reinforcing steel in forms but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

3.9 PLACEMENT

A. Place, support, and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
   1. Do not weld crossing reinforcement bars for assembly except as permitted by Engineer.

B. Do not displace or damage vapor retarder.

C. Accommodate placement of formed openings.

D. Space reinforcement bars with minimum clear spacing in accordance with ACI 318.

E. Maintain concrete cover around reinforcement as indicated in Drawings with a minimum cover as follows:

Reinforcement Location		Minimum Concrete Cover
Footings and concrete formed against earth		3"
Concrete exposed to earth or weather	No. 6 bars and larger	2"
	No. 5 bars and smaller	1-1/2"
Supported slabs, walls, and joists	No. 14 bars and larger	1-1/2"
	No. 11 bars and smaller	3/4"
Beams and columns		1-1/2"
Shell and folded plate members	No. 6 bars and larger	3/4"
	No. 5 bars and smaller	1/2"

F. Splice reinforcing only where indicated on the drawings or approved by Engineer. Splice in accordance with splicing device manufacturer's instructions.

3.10 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

Reinforcement Depth	Depth Tolerance	Concrete Cover Tolerance
Greater than 8"	± 3/8"	± 3/8"
Less than 8"	± 1/2"	± 1/2"

C. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

3.11 PLACING CONCRETE

A. Place concrete in accordance with ACI 318.

B. Notify testing laboratory and Engineer minimum 48 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion, and contraction joints are not disturbed during concrete placement.

D. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643. Lap joints minimum 6" and seal watertight by taping edges and ends.

E. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6" and seal watertight.

F. Separate slabs on grade from vertical surfaces with 1/2" thick joint filler.

G. Place joint filler in slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

H. Extend joint filler from bottom of slab to within 1/2" of finished slab surface.

I. Install construction joint devices in coordination with slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

J. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.

K. Install joint covers in longest practical length, when adjacent construction activity is complete.

L. Deposit concrete at final position. Prevent segregation of mix.

M. Place concrete in continuous operation for each panel or section determined by predetermined joints.

N. Consolidate concrete.

O. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken. Keep records on site in Contractor's office or file with Engineer.

P. Place concrete continuously between predetermined expansion, control, and construction joints.

Q. Do not interrupt successive placement; do not permit cold joints to occur.

R. Place floor slabs in pattern indicated.

S. Saw cut joints prior to concrete set. Thickness and depth as indicated on the drawings

T. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/4" in 10'-0".

3.12 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing and other items to be cast in.

C. Apply bonding agent to substrate.

D. Place concrete floor toppings to required lines and levels.

E. Screed toppings level, maintaining surface flatness of maximum 1/8" in 10'-0".

3.13 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed smooth rubbed, sand float, or sack rubbed finish as indicated on the drawings.

B. Finish concrete floor surfaces in accordance with ACI 318.

C. Steel trowel surfaces which are indicated to be exposed.

D. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8" per 1'-0" nominal or as indicated on the drawings.

3.14 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Protect concrete footings from freezing for minimum five (5) days.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

D. Cure concrete in accordance with ACI 308.1 using method approved by Engineer.

E. Maintain 100% coverage over floor slab areas continuously for seven (7) days.

3.15 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform field inspection and testing in accordance with ACI 318.

C. Provide free access to Work and cooperate with appointed firm.

D. Reinforcement Inspection:
   1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
   2. Welding: Inspect welds in accordance with AWS D1.1 AWS D1.4.
   3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
   4. Continuous Weld Inspection: Inspect reinforcement as required by ACI 318.
   5. Periodic Weld Inspection: Other welded connections.

E. Concrete Inspections:
   1. Continuous Placement Inspection: Inspect for proper installation procedures.
   2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

F. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. Cylinder Molding and Curing Procedures: ASTM C31, cylinder specimens, standard cured or field cured.
   3. Sample concrete and make one set of four (4) cylinders for every 50 cubic yards or less of each class of concrete placed each day and for every 5,000 square feet of surface area for slabs and walls.
   4. When volume of concrete for any class of concrete would provide less than five (5) sets of cylinders, take samples from five (5) randomly selected batches or from every batch when less than five (5) batches are used.

G. Field Testing:
   1. Slump Test Method: ASTM C143.
   2. Air Content Test Method: ASTM C173 or ASTM C231.
   3. Temperature Test Method: ASTM C1064.
   4. Measure slump and temperature for each compressive strength concrete sample.
   5. Measure air content in air entrained concrete for each compressive strength concrete sample.

H. Cylinder Compressive Strength Testing:
   1. Test Method: ASTM C39.
   2. Test Acceptance: In accordance with ACI 318.
   3. Test one (1) cylinder at seven (7) days.

4. Test one (1) cylinder at fourteen (14) days.
5. Test one (1) cylinder at twenty-eight (28) days.
6. Retain one (1) cylinder for testing when requested by Engineer.
7. Dispose remaining cylinders when testing is not required.

I. Core Compressive Strength Testing:
   1. Sampling and Testing Procedures: ASTM C42.
   2. Test Acceptance: In accordance with ACI 318.
   3. Drill three cores for each failed strength test from concrete represented by failed strength test.

J. Water Soluble Chloride Ion Concentration Test Method: ASTM C1218; tested at twenty-eight (28) days.
   1. Maximum Concentration: As permitted by applicable code.

K. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.16 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections as directed by Engineer in accordance with ACI 318.

3.17 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.

B. Repair or replacement of defective concrete will be determined by Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.18 SCHEDULE - CONCRETE TYPES AND FINISHES

A. Concrete Paving: In accordance with the SCDOT Standard Specifications.

B. Concrete Curb and Gutter: In accordance with the SCDOT Standard Specifications.

3.19 SCHEDULE - REINFORCEMENT

A. Reinforcement for Foundation Wall Framing Members and Slab-on-Grade: Deformed bars and wire fabric, unfinished.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Removing surface debris.
   2. Removing designated paving, curbs and slabs.
   3. Removing designated trees, shrubs, and other plant life.
   4. Removing abandoned utilities and structures where indicated.
   5. Plugging abandoned utilities and filling abandoned structures where indicated.
   6. Protecting plant life and structures designated to remain.

B. Related Sections:
   1. Section 31 23 16 - Excavation and Fill: Topsoil and subsoil removal, proof rolling.
   2. Section 31 25 13 - Erosion Controls: Controlling sediment and erosion from Work of this section.

1.2 REFERENCES

A. SCDOT Standard Specifications:
   1. Standard Specifications for Highway Construction, 2007 or latest edition, published by the South Carolina Department of Transportation.

1.3 QUALITY ASSURANCE

A. Section 01 40 00 - Quality Requirements.

B. Perform Work in accordance with Section 201 of the SCDOT Standard Specifications.

C. Maintain one copy of document on site.

D. Conform to applicable code for environmental requirements and disposal of debris.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verification of existing conditions before starting work.

C. Identify waste area or salvage area for placing removed materials when materials are indicated to remain on site.

3.2 PREPARATION

A. Call local utility line information service indicated on the drawings not less than three (3) working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

3.3 PROTECTION

A. Locate, identify, and protect from damage utilities indicated to remain.

B. Protect trees, plant growth, and features designated to remain as final landscaping.

C. Protect benchmarks and survey control points from damage or displacement.

3.4 CLEARING

A. Remove trees and shrubs within areas indicated on the drawings. In general, all exclusive City of Columbia Water Main Easements are to be cleared.
   1. Contractor to acknowledge and satisfy all easement agreements between City of Columbia and property owners.

B. Contractor to thoroughly review all easement documents for conditions related to clearing on individual properties. It shall be the Contractors responsibility to ensure that trees schedule to be kept, be marked and protected during construction. If, for any reason, the Contractor identifies a conflict with trees, landscaping or shrubbery required to be preserved as a condition of one or more of the recorded easement documents, the Owner and Engineer shall be notified immediately upon that discovery. It is expected that the Contractor will notify the Owner and Engineer in a timely manner such that construction is not interrupted or slowed. Once notified, the Owner and Engineer will address in a timely manner.

C. Contractor to remove trees located within the SCDOT Right-of-way in areas along the alignment where a narrow band of trees would otherwise be left, limiting the Owner's access to the water main in the future.

D. Remove stumps, main root ball, root system, surface rock, and pavements where necessary for water main installation along the proposed water mains alignment along both Rimer Pond Road and Hard Scrabble Road.

E. Clear undergrowth and deadwood without disturbing subsoil.

3.5 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Remove paving, curbs, and site slabs.

C. Remove abandoned utilities. Indicate removal termination point for underground utilities on Record Documents.

D. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

E. Do not burn or bury materials on site unless authorized in writing by authority having jurisdiction.

F. Leave site in clean condition.

END OF SECTION

SECTION 31 23 16

EXCAVATION AND FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Excavating topsoil.
2. Excavating subsoil for buildings, pavements, and landscape.
3. Backfilling site structures to subgrade elevations.
4. Filling under pavements or slabs-on-grade.
5. Undercutting and filling over-excavation.
6. Disposal of excess material.

B. Related Sections:
1. Section 03 30 00 - Cast-in-Place Concrete.
2. Section 31 10 00 - Site Clearing: Clearing site prior to excavation.
3. Section 31 23 17 - Trenching: Excavating and Backfilling for Utilities.
4. Section 31 25 13 - Erosion Controls: Controlling sediment and erosion from Work of this section.

1.2 REFERENCES

A. SCDOT Standard Specifications:
1. Standard Specifications for Highway Construction, latest edition, published by the South Carolina Department of Transportation.

B. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

C. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
6. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
7. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
8. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. United States Army Corps of Engineers:
   1. Nationwide Permit Regional Conditions for South Carolina.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Dewatering Plan: Describe dewatering methods to be used to keep excavations dry if required.

D. Samples: Submit, in air-tight containers, 10-pound sample of each type of fill to testing laboratory.

E. Materials Source DOT Approval: Submit certification that aggregate and soil material suppliers are approved by the State Department of Transportation.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

A. Section 01 40 00 - Quality Requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: Original surface soil typical of the area which is capable of supporting native plant growth. It shall be free of large stones, roots, waste, debris, contamination, or other unsuitable material which might hinder plant growth.

B. Subsoil: Clean natural soil with a plasticity index of 15 or less that is free of clay, rock, or gravel lumps larger than 2" in any dimension, debris, waste, frozen material, and any other deleterious material that might cause settlement. Suitable material excavated from the site may be used as subsoil fill under optimum moisture conditions.

C. Granular Fill: Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SW, SP, SP-SM, or SP-SC.

D. Structural Fill: Clean coarse aggregate Gradation No. 57 conforming to Sections 801 of the SCDOT Standard Specifications.

E. Flowable Fill: Per Section 31 23 24 – Flowable Fill

F. Borrow Material: Conform to subsoil requirements.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-woven, non-biodegradable, conforming to Section 804 of the SCDOT Standard Specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify survey benchmark and intended elevations for the Work are as indicated on the drawings.

C. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

D. Verify underground structures are anchored to their own foundations to avoid flotation after backfilling.

E. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION FOR EXCAVATION

A. Call local utility line information service as indicated on the drawings not less than three (3) working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove and relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, rock outcropping, and other features remaining as portion of final landscaping.

F. Protect benchmarks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, re-landscaped, or regraded without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site and protect from erosion.

D. Remove from site excess topsoil not intended for reuse.

3.4 SUBSOIL EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work.

B. Excavate subsoil to accommodate building foundations, structures, slabs-on-grade, paving, landscaping, and construction operations.

C. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity.

D. Slope banks with machine to angle of repose or less until shored.

E. Do not interfere with 45-degree bearing splay of foundations.

F. Grade top perimeter of excavation to prevent surface water from draining into excavation.

G. Trim excavation. Remove loose matter.

H. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume.

I. Notify Engineer and testing agency of unexpected subsurface conditions.

J. Correct areas over excavated with granular fill and compact as required for fill areas.

K. Remove excess and unsuitable material from site.

L. Repair or replace items indicated to remain damaged by excavation.

M. Excavate subsoil from areas to be further excavated, re-landscaped, or regraded.

N. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

O. Remove from site excess subsoil not intended for reuse.

P. Benching Slopes: Horizontally bench existing slopes greater than 3:1 to key placed fill material into slope to provide firm bearing.

Q. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 EXCAVATION IN WETLANDS

A. In accordance with USACE permit(s) conditions and all other applicable agencies permit conditions.

B. During excavation the top vertical foot of material will be stored (piled) separately from material below one foot. See section 3.11 for backfilling in wetlands.

3.6 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches in accordance with Occupational Safety and Health Administration requirements. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design of positive excavation shoring systems shall be the responsibility of the Contractor. Shoring to be designed, detailed, and sealed by a Professional Engineer licensed in South Carolina.

D. Design sheeting and shoring to be removed at completion of excavation work unless approved by Engineer/Owner.

E. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

F. Repair damage to new and existing Work from settlement, water, or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.7 SURFACE WATER CONTROL

A. Control and remove unanticipated water seepage into excavation.

B. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Section 31 25 13.

C. Divert surface water and seepage water within excavation areas into sumps or settling basins prior to pumping water into drainage channels and storm drains.

3.8 DEWATERING

A. Design and provide dewatering system to permit Work to be completed on dry and stable subgrade.

B. Operate dewatering system continuously until backfill is minimum 2'-0" above normal ground water table elevation.

C. When dewatering system cannot control water within excavation, notify Engineer and stop excavation work.
   1. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
   2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.

D. Modify dewatering systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.

E. Discharge ground water and seepage water within excavation areas into sumps or settling basins prior to pumping water into drainage channels and storm drains.

F. Remove dewatering and surface water control systems after dewatering operations are discontinued.

3.9 PROOF ROLLING

A. Proof roll areas to receive fill, pavement and building slabs to identify areas of soft yielding soils.
   1. Use loaded tandem-axle pneumatic tired dump truck or large smooth drum roller.
   2. Load equipment to maximum 50 tons gross weight and make a minimum of four passes with two passes perpendicular to the others.

B. Undercut such areas to firm soil, backfill with granular fill, and compact to density equal to or greater than requirements for subsequent fill material.

C. Do not proof roll or undercut until soil has been dewatered.

3.10 BACKFILLING

A. Scarify subgrade surface to depth of 4".

B. Compact subgrade to density requirements for subsequent backfill materials.

C. Backfill areas to contours and elevations with unfrozen materials.

D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

E. Place fill material in continuous layers and compact in accordance with Schedule at end of this Section.

F. Employ placement method that does not disturb or damage other work.

G. Maintain optimum moisture content of backfill materials to attain required compaction density.

H. Support foundation walls and structures prior to backfilling.

I. Backfill simultaneously on each side of unsupported foundation walls and structures until supports are in place.

J. Slope grade away from building minimum 2 percent slope for minimum distance of 10'-0", unless noted otherwise.

K. Make gradual grade changes. Blend slope into level areas.

L. Spread backfill materials on-site outside of wetland areas.

3.11 BACKFILLING IN WETLANDS

A. In accordance with USACE permit(s) conditions and all other applicable agencies permit conditions.

B. The material excavated below one foot will be backfilled first, and the top foot of surface material will be placed back on top of the trench.

3.12 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling within Building and Paved Areas: ± 1" from required elevations.

C. Top Surface of Backfilling Within Landscape Areas: ± 2" from required elevations.

3.13 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

D. Repair or replace items indicated to remain damaged by excavation or filling.

3.14 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Independent laboratory, field inspecting, testing, adjusting, and balancing.

B. Request visual inspection of bearing surfaces by Engineer and inspection agency before installing subsequent work.

C. Laboratory Material Tests: In accordance with ASTM D1557 or AASHTO T180.

D. In-Place Compaction Tests: In accordance with the following:
   1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

F. Frequency of Tests:
   1. Building and Pavement Areas: Twice per lift for every 5,000 square feet.
   2. Landscape Areas: Twice per lift for every 10,000 square feet.

3.15 SCHEDULE OF COMPACTION

A. Cover pipe and bedding shall be in accordance with Type 5 requirements on the Contract Drawings.

B. Compact uniformly to a minimum of 95% of maximum density of Standard Proctor.

END OF SECTION

SECTION 31 23 17

TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Excavating trenches for utilities and utility structures.
2. Bedding.
3. Backfilling and compacting to subgrade elevations.
4. Sheeting and Shoring.
5. Dewatering.
6. Compacting backfill material.

B. Related Sections:

1. Section 31 23 16 - Excavation and Fill: Topsoil and subsoil removal from site surface.
2. Section 31 23 24 - Flowable Fill.
3. Section 31 25 13 - Erosion Controls: Controlling sediment and erosion from Work of this section.
4. Section 33 11 00 - Water Utility Distribution Piping: Water Piping and Bedding.
5. Section 33 12 13 - Water Service Connections: Service Connections.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. SCDOT Standard Specifications:
1. Standard Specifications for Highway Construction, latest edition, published by the South Carolina Department of Transportation.

D. United States Army Corps of Engineers:
1. Nationwide Permit Regional Conditions for South Carolina.

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Utility Structures: Manholes, catch basins, inlets, valve vaults, hand holes, and other utility access structures as indicated on Drawings.

C. Trench Terminology:
1. Foundation: Area under bottom of trench supporting bedding.
2. Bedding: Fill placed under utility pipe.
3. Haunching: Fill placed from bedding to center line of pipe.
4. Initial Backfill: Fill place from center line to 6" to 12" above top of pipe.
5. Final Backfill: Fill placed from initial backfill to subgrade.

D. Unified Soil Class:
1. Class I
   a. ¼” – 1-1/2” well graded stone including coral, slag, cinders, crushed stone and crushed shells
2. Class II
   a. GM Coarse gravel well graded stone and crushed shells
   b. GP Coarse gravel poorly graded
   c. SW Coarse sands well graded
   d. SP Coarse sands poorly graded
3. Class III
   a. GM Silty-sandy gravel
   b. GC Clayey-sandy gravel
   c. SM Silty-sands
   d. SC Clayey-sands
4. Class IV
   a. ML Inorganic silts and fine sands
   b. CL Inorganic clays – low plasticity
5. Fill material shall exhibit a plasticity index of less than 15 and Standard Proctor maximum density at optimum moisture greater than 90 pounds per cubic foot. The following materials are unacceptable:
6. Class IV
   a. MH Inorganic elastic silts
   b. CH Inorganic clays – high plasticity
7. Class V
   a. OL Organic silts
   b. OH Organic clays
   c. PT Highly organic soil

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of South Carolina.

C. Dewatering Plan if required: Describe methods of dewatering and disposal of water.

D. Product Data: Submit data for geotextile fabric indicating fabric and construction.

E. Samples: Submit to testing laboratory, in air-tight containers, 10-pound sample of each type of fill.

F. Materials Source: Submit name of imported fill material suppliers.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Section 01 40 00 - Quality Requirements.

B. Perform Work in accordance with Division 200 of SCDOT Standard Specifications.

C. Maintain one (1) copy of document on site.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 BACKFILL MATERIALS

A. Subsoil Fill: Class II, III, or IV - Clean natural soil with a plasticity index of 15 or less that is free of clay, rock, or gravel lumps larger than 2" in any dimension; debris; waste; frozen material; and any other deleterious material that might cause settlement. Suitable

material excavated from the site may be used as subsoil fill under optimum moisture conditions.

B. Granular Fill: Class II, III - Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SW, SP, SP-SM or SP-SC.

C. Foundation Stone: Class I - Clean course aggregate Gradation No. 57 conforming to Section 801 of the SCDOT Standard Specifications.

D. Flowable Fill: Per Section 31 23 24 - Flowable Fill.

E. Bedding, Haunching, Initial Backfill, and Final Backfill materials: Per the Contract Drawings.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-woven, non-biodegradable conforming to Section 804 of the SCDOT Standard Specifications.

B. Concrete: Concrete conforming to Section 701 of the SCDOT Standard Specifications.

PART 3 EXECUTION

3.1 PREPARATION

A. Call local utility line information service indicated on the drawings not less than three (3) working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, rock outcropping, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.2 LINES AND GRADES

A. Excavate to lines and grades indicated on the drawings.
   1. Owner reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.3 TRENCHING

A. Excavate subsoil required for utilities.

B. Remove lumped subsoil, boulders, and rock up of 1/3 cubic yard, measured by volume.

C. Perform excavation within 48" of existing utility service in accordance with utility's requirements.

D. Do not advance open trench more than 200'-0" ahead of installed pipe.

E. Remove water or materials that interfere with Work.

F. Trench Width: Excavate bottom of trenches maximum 16" wider than outside diameter of pipe or as indicated on the drawings.

G. Excavate trenches to depth indicated on the drawings. Provide uniform and continuous bearing and support for bedding material and pipe.

H. Maintain vertical faces to an elevation equal to 12" above top of pipe.
   1. When Project conditions permit, side walls may be sloped or benched above this elevation.
   2. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this Section.

I. Support Utilities and Structures:
   1. Keep trench width at top of trench to practical minimum to protect adjacent or crossing utility lines
   2. Support utilities crossing trench by means acceptable to utility company.
   3. Do not interfere with 45-degree bearing splay of foundations.
   4. Provide temporary support for structures above and below ground.

J. When subsurface materials at bottom of trench are loose or soft, excavate to firm subgrade or to depth directed by Engineer.
   1. Cut out soft areas of subgrade not capable of compaction in place.
   2. Backfill with foundation stone and compact to density equal to or greater than requirements for subsequent backfill material.

K. Trim Excavation: Hand trim for bell and spigot pipe joints where required. Remove loose matter.

L. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

M. Place geotextile fabric over trench foundation stone prior to placing subsequent bedding materials.

3.4 TRENCHING IN WETLANDS

A. In accordance with USACE permit(s) conditions and all other applicable regulatory agencies permit conditions.

B. During excavation the top vertical foot of material will be stored (piled) separately from material below one foot. See section 3.10 for backfilling in wetlands.

3.5 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches in accordance with Occupational Safety and Health Administration requirements. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design of positive excavation shoring systems shall be the responsibility of the Contractor. Shoring to be designed, detailed, and sealed by a Professional Engineer licensed in South Carolina.

D. Design sheeting and shoring to be removed at completion of excavation work unless approved by Engineer/Owner.

E. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

F. Repair damage to new and existing Work from settlement, water, or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.6 SURFACE WATER CONTROL

A. Control and remove unanticipated water seepage into excavation.

B. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Section 31 25 13 – Erosion Controls.

C. Divert surface water and seepage water within excavation areas into sumps or settling basins prior to pumping water into drainage channels and storm drains.

3.7 DEWATERING

A. Design and provide dewatering system to permit Work to be completed on dry and stable subgrade.

B. Operate dewatering system continuously until backfill is minimum 2'-0" above normal ground water table elevation.

C. When dewatering system cannot control water within excavation, notify Engineer and stop excavation work.
   1. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
   2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.

D. Modify dewatering systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.

E. Discharge ground water and seepage water within excavation areas through filter bags or into settling basins prior to pumping water into drainage channels and storm drains.

F. Remove dewatering and surface water control systems after dewatering operations are discontinued.

3.8 BEDDING, HAUNCHING, AND INITIAL BACKFILL

A. See Contract Drawings.

3.9 FINAL BACKFILLING TO SUBGRADE

A. See Contract Drawings.

3.10 BACKFILLNG IN WETLANDS

A. In accordance with USACE permit(s) conditions and all other applicable regulatory agencies permit conditions.

B. Following water main installation, the surface material will be backfilled last. The material excavated below 1'-0" will be backfilled first, and the top 1'-0" of surface material will be placed back on top of the trench.

3.11 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess material offsite and legally.

B. Furnish Engineer with certificate of disposal site or agreement from private property owner.

3.12 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling: Plus or minus 1 inch from required elevations.

3.13 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with ASTM D1557 or AASHTO T180.

C. Perform in place compaction tests in accordance with the following:
1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
2. Moisture Tests: ASTM D3017.

D. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

E. Frequency of Tests: Two tests per lift for every 1,000'-0" of trench.

3.14 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.15 SCHEDULE OF COMPACTION

A. Bedding and backfill shall be placed and compacted in accordance with the Contract Drawings.

B.

END OF SECTION

SECTION 31 23 24

FLOWABLE FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Flowable fill for:
      a. Structure backfill.
      b. Utility bedding.
      c. Utility backfill.
      d. Filling abandoned utilities.

B. Related Requirements:
   1. Section 31 23 16 - Excavation and Fill.
   2. Section 31 23 17 - Trenching: Soil and aggregate backfill for utility trenches.
   3. Section 31 25 13 - Erosion Controls: Controlling sediment and erosion from Work of this section.
   4. Section 33 11 00 - Water Utility Distribution Piping: Water Piping and Bedding.
   5. Section 33 12 13 - Water Service Connections: Service Connections.

1.2 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, manhole, tank, or cable.

1.3 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM C33 - Standard Specification for Concrete Aggregates.
   2. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   3. ASTM C150 - Standard Specification for Portland Cement.
   4. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
   5. ASTM C403/C403M - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.
   6. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
   7. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
   8. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
   9. ASTM C1040 - Standard Test Methods for Density of Unhardened and Hardened Concrete in Place by Nuclear Methods.
   10. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

B. SCDOT Standard Specifications:
   1. Standard Specifications for Highway Construction, latest edition, published by the South Carolina Department of Transportation.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Field Quality-Control Submittals:
   1. Mix Design:
      a. Furnish flowable fill mix design for each specified strength.
      b. Furnish separate mix designs when admixtures are require for the following:
         1) Flowable fill Work during hot and cold weather.
         2) Air entrained flowable fill Work.
      c. Identify design mix ingredients, proportions, properties, admixtures, and tests.
   2. Furnish test results to certify flowable fill mix design properties meet or exceed specified requirements.

D. Delivery Tickets: Furnish duplicate delivery tickets indicating actual materials delivered to Project Site.

E. Qualifications Statements: Section 01 40 00 - Quality Requirements.

1.5 QUALITY ASSURANCE

A. Comply with the applicable sections of the South Carolina Department of Transportation's Standard Specifications for Highway Construction.

1.6 QUALIFICATIONS

A. Supplier:
   1. Company specializing in supplying products specified in this Section with minimum three years documented experience.
   2. Product source approved by the Engineer.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements specifies product storage and handling.

B. Minimum Conditions: Do not install flowable fill during inclement weather or when ambient temperature is less than 40°F.

1.8 FIELD MEASUREMENTS

A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide a slurry of the specified portland cement, fly ash, sand, and water.
   1. Use portland cement complying with ASTM C150, Type I or Type II.
   2. Use fly ash approved by the manufacturer of the flowable fill.

B. Additives:
   1. Admixtures for entrained air may be used if specifically recommended by the manufacturer.
   2. Do not use calcium chloride.

C. Water: Use water which is potable and free from deleterious amounts of alkali, acid, and organic materials which would adversely affect the setting time or strength of the concrete.

D. Sand: Use fine aggregate conforming to ASTM C33-82.

E. Design the mix to obtain a compressive strength of 150 psi at 28 days with an ultimate strength not to exceed 200 psi in accordance with SCDOT Standard Specifications.

F. Slump:
   1. 7" to 10".
   2. Provide lower slump fill around pipelines to a point above the top of the pipe to prevent floating.

2.2 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Test and analyze properties of flowable fill design mix and certify results for the following:
   1. Design mix proportions by weight of each material.
   2. Aggregate: ASTM C33 for material properties and gradation.
   3. Properties of plastic flowable fill design mix including:
      a. Temperature.
      b. Slump.
      c. Air entrainment.
      d. Wet unit mass.
      e. Yield.
      f. Cement factor.
   4. Properties of hardened flowable fill design mix including:
      a. Compressive strength at one (1) day, seven (7) days, and twenty-eight (28) days. Report compressive strength of each specimen and average specimen compressive strength.

b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

C. Prepare delivery tickets containing the following information:
1. Project designation.
2. Date.
3. Time.
4. Class and quantity of flowable fill.
5. Actual batch proportions.
6. Free moisture content of aggregate.
7. Quantity of water withheld.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting Work.

B. Verify trenching specified in Section 31 23 17 is complete.

C. Verify utility installation is complete and tested before placing flowable fill.

D. Verify excavation is dry and dewatering system is operating.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.

C. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.

D. Protect utilities to prevent intrusion of flowable fill.

3.3 INSTALLATION - FILL, BEDDING, AND BACKFILL

A. Place flowable fill by chute, pumping or other methods approved by the Engineer.
1. When required, place flowable fill under water using tremie procedure.
2. Do not place flowable fill through flowing water.

B. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.

C. Place flowable fill evenly on both sides of utilities to maintain alignment.

D. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.

3.4 INSTALLATION - FILLING ABANDONED UTILITIES

A. Verify pipes and conduits are not clogged and are sufficiently empty to permit gravity installation of flowable fill for entire length indicated to be filled.

B. Seal lower end of pipes and conduits by method to contain flowable fill and to vent trapped air caused by filling operations.

C. Place flowable fill using method to ensure there are no voids.
   1. Fill pipes and conduits from high end.
   2. Fill manholes, tanks, and other structures from grade level access points.

D. After filling pipes and conduits seal both ends.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Perform inspection and testing according to ASTM C94/C94M.
   1. Take samples for tests for every 150 cu yd of flowable fill, or fraction thereof, installed each day.
   2. Sample, prepare and test four compressive strength test cylinders according to ASTM D4832. Test one (1) specimen at three (3) days, one (1) at seven (7) days, and two (2) at twenty-eight (28) days.
   3. Measure temperature at point of delivery when samples are prepared.

D. Defective Flowable Fill: Fill failing to meet the following test requirements or fill delivered without the following documentation.
   1. Test Requirements:
      a. Minimum temperature at point of delivery.
      b. Compressive strength requirements for each type of fill.
   2. Documentation: Duplicate delivery tickets.

3.6 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Remove spilled and excess flowable fill from Project Site.

C. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION

SECTION 31 25 13

EROSION CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes installing, maintaining and removing:
   1. Silt fence.
   2. Temporary construction entrances.
   3. Inlet protection.
   4. Site stabilization.

B. Related Sections:
   1. Section 31 10 00 - Site Clearing.
   2. Section 31 23 16 - Excavation and Fill.
   3. Section 31 23 17 - Trenching.

1.2 REFERENCES

A. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
   2. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   3. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

B. SCDOT Standard Specifications:
   1. Standard Specifications for Highway Construction, latest edition, published by the South Carolina Department of Transportation.

C. SCDHEC Best Management Practices:
   1. SCDHEC Storm Water Management BMP Handbook, latest edition, published by the South Carolina Department of Health and Environmental Control.
   2. "South Carolina Storm Water Management and Sedimentation Control Handbook for Land Disturbance Activities", August 2003 or latest edition.

1.3 SUBMITTALS

A. Product Data: Submit data on geotextile, posts, woven wire, concrete mix design, and pipe.

B. Manufacturer's Certificate: Certify products and aggregates meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Standard of quality shall conform to the standards and practices set forth in: "South Carolina Storm Water Management and Sedimentation Control Handbook for Land Disturbance Activities", August 2003 or latest edition and "South Carolina Department of Health and Environmental Control Storm Water Management Best Management Practices", July 2005 or latest edition.

B. Maintain one copy of document on site.

PART 2 PRODUCTS

2.1 GEOTEXTILE MATERIALS

A. Engineering Fabric Materials: Non-biodegradable conforming to Section 815 of SCDOT Standard Specifications:
   1. Silt Fence: Type 3, Class A or B Engineering Fabric.
   2. Under Rip Rap or Construction Entrances: Type 2 Engineering Fabric.

2.2 STONE, AGGREGATE, AND SOIL MATERIALS

A. Aggregate for Construction Entrance: Coarse aggregate, Gradation No. 1 or larger with an average size of 2" - 3", conforming to the "South Carolina Department of Health and Environmental Control Storm Water Management Best Management Practices", July 2005 or latest edition.

B. Stone for Sediment Trap and Check Dam: Class B riprap conforming to Division 800 of the SCDOT Standard Specifications.

C. Stone for RipRap Apron: Class A riprap conforming to Division 800 of the SCDOT Standard Specifications.

D. Stone for Rock Pipe Inlet Protection: Class B riprap conforming to Division 800 of the SCDOT Standard Specification. No 5 or No. 57 washed stone conforming to Division 800 of the SCDOT Standard Specifications as shown on detail in construction drawings.

E. Soil Fill: Clean natural soil with a plasticity index of 15 or less that is free of clay, rock, or gravel lumps larger than 2" in any dimension; debris; waste; frozen material; and any other deleterious material that might cause settlement. Suitable material excavated from the site may be used as soil fill under optimum moisture conditions.

2.3 PLANTING MATERIALS

A. General Seeding: Conform to the South Carolina Department of Health and Environmental Conservation: Appendix C and Section 810 of the SCDOT Standard Specifications for seeding types, rates, and specifications. Refer to the US Army Corps of Engineers Permit for specific planting requirements to be established at the permitted creek crossing on the Rimer Pond Road Alignment.

B. Riparian:
   1. Virginia Wildrye *(Elymus virginicus)*.
   2. Switchgrass *(Punicum virgutum)*.
   3. Little Bluestem *(Schizachyrium scopurium)*.
   4. Soft Rush *(Junus effusus)*.

C. Live Cuttings:
   1. Silky Dogwood *(Cornus amomum)*.
   2. Silky Willow *(Salix sericum)*.
   3. Black Willow *(Salix nigra)*.

D. Native Bare Root Plantings:
   1. Green Ash *(Fraxinus pennsylvanica)*.
   2. American Sycamore *(Platanu*s occidentalis).
   3. Sweetbay *(Magnolia virginiana).*
   4. Wax Myrtle (*Myricum cerifera).*

E. Temporary Seed Mixture:
   1. Fall, winter and early spring: Rye (grain), Ryegrass, and Browntop Millet.
   2. Summer: Browntop Millet.

F. Fertilizer: 10-10-10 Fertilizer unless soil tests are performed and indicate different requirements.

G. Lime: Ground course textured agricultural limestone.

H. Mulch: Small grain straw, free from weeds, foreign matter detrimental to plant life, and dry. If anchoring is required, use netting or hydromulches. Other typical mulches include wood fiber, BFM, and FGM.

2.4 ACCESSORIES

A. Posts for Silt Fence and Inlet Protection: Steel posts 4'-0" long, 1-3/8" wide, minimum weight 1.25 lbs/ft. conforming to SCDHEC Storm Water Management BMP Handbook, published by the SCDHEC, July 2005 or latest edition.

B. Woven Wire Fence for Silt Fence: Minimum 32" high, minimum 5 horizontal wires, vertical wires spaced 12" apart, minimum 10 gauge top and bottom wires, and minimum 12-1/2 gauge.

C. Attachment Devices for Silt Fence: No. 9 staple, minimum 1-1/2" long, or other approved attachment devices.

D. Hardware Cloth for Inlet Protection: 23 gauge, 1/4" mesh opening hardware cloth.

2.5 SOURCE QUALITY CONTROL (AND TESTS)

A. Perform tests on cement, aggregates, and mixes to ensure conformance with specified requirements.

B. Make rock available for inspection at producer's quarry prior to shipment. Notify Owner/Engineer at least seven (7) days before inspection is allowed.

C. Allow witnessing of inspections and tests at manufacturer's test facility. Notify Owner/Engineer at least seven (7) days before inspections and tests are scheduled.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.

B. Verify gradients and elevations of base or foundation for other work are correct.

3.2 SILT FENCE

A. Install according to with SCDHEC Storm Water Management BMP Handbook at locations shown on Drawings.

B. Use wire fence with fabric appearing on SCDOT Approval Sheet #34.

3.3 TEMPORARY CONSTRUCTION ENTRANCES

A. Excavate and compact subgrade as specified in Section 31 23 16 – Excavation and Fill.

B. Construction entrances to be provided at all locations where construction traffic accesses paved roadway.

C. Mound aggregate near intersection with public road to prevent site runoff entering road.

D. Periodically dress entrances with 2" thick course aggregate when aggregate becomes clogged with soil.

3.4 INLET PROTECTION

A. Type "F" inlet tube (wattle) per SCDHEC and SCDOT specifications.

3.5 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the drawings into the Project at the earliest practicable time.

B. Construct, stabilize, and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stockpile and waste pile heights shall not exceed 35'-0". Slope stockpile sides at 2:1 or flatter.

D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
   1. During non-germinating periods, apply mulch at recommended rates.
   2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year with temporary grassing.
   3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year with permanent grassing

E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.6 FIELD QUALITY CONTROL

A. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

B. Perform laboratory material tests in accordance with ASTM D698.

C. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

D. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

E. Frequency of Tests: Twice per lift for every 10,000 square feet.

3.7 CLEANING

A. When sediment accumulation in sedimentation structures has reached a point one-half depth of sediment structure or device, remove and properly dispose of sediment.

B. Do not damage structure or device during cleaning operations.

C. Do not permit sediment to erode into construction or site areas or natural waterways.

D. Clean channels when depth of sediment reaches approximately one-half channel depth.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Aggregate base course on a prepared subgrade.

B. Related Sections:
   1. Section 31 23 16 - Excavation and Fill: Preparing subgrade under base course.
   2. Section 32 12 16 - Asphalt Paving: Binder and finish asphalt courses.
   3. Section 32 13 13 - Concrete Paving: Compacted Base for Paving.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-pound) rammer and a 457-mm (18-inch) drop.

B. ASTM International:
   1. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
   2. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   3. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. SCDOT Standard Specifications:
   1. Standard Specifications for Highway Construction, latest edition, published by the South Carolina Department of Transportation.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit to testing laboratory 10-pound sample of each type of aggregate in airtight containers.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Division 300 of SCDOT Standard Specifications.

B. Maintain one copy of document on site.

C. Furnish each aggregate material from single source throughout the Work.

D. Use sources listed on the SCDOT Qualified Products List for each aggregate required.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate Base Course: Graded aggregate base course (GABC) conforming to Section 305 of SCDOT Standard Specifications.

B. Fine Aggregate: Fine Aggregate with gradations conforming to Division 305 of SCDOT Standard Specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verify existing conditions before starting work.

B. Verify substrate has been inspected and gradients and elevations are correct and dry.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and recompacting as specified in Section 32 12 16 - Asphalt Paving or 32 13 13 - Concrete Paving.

B. Proofroll subgrade prior to placement of base coarse using a loaded tandem dump truck or other equipment of equal ground pressure. Proofrolling should consist of enough passes to cover entire area having base course placed.

C. Any areas observed to "pump", deflect excessively, or display instability of any kind should be removed and replaced with properly compacted dry suitable material. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Place aggregate in minimum 4" and maximum 10" layers and roller compact to specified density. When total thickness is 10" or less, place in one (1) layer. When total thickness is greater than 10", place in two (2) equal layers.

B. Have each layer of material compacted and approved prior to placing succeeding layers.

C. Level and contour surfaces to elevations and gradients indicated on the drawings.

D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Use mechanical tamping equipment in areas inaccessible to roller compaction equipment.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Thickness: 1/2".

C. Maximum Variation from Elevation: 1/2".

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Independent laboratory, field inspecting, testing, adjusting, and balancing.

B. Laboratory Material Tests: Conform to Modified Proctor ASTM D1557 or AASHTO T180.

C. In-place Compaction Tests: Conform to:
   1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

D. Compaction:
   1. 100% of maximum when measured in-place by standard methods.
   2. 98% of maximum when measured in-place by nuclear methods.

E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

F. Frequency of Compaction Tests: Two tests per layer for every 5,000 tons of aggregate base course.

3.6 SCHEDULES

A. See Pavement Section Details on the Contract Drawings.

B. SCDOT R/W - 8" Asphalt Aggregate Base Course (Type A) (on 12" subgrade compacted to 100% standard proctor maximum dry density).

C. In Fill Areas - In fill areas below the 12" subgrade, contractor to compact to 95% standard proctor maximum dry density.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Asphaltic Concrete Paving: Surface, binder, and base courses.
   2. Prime Coat and Tack Coat.
   3. Surface Sealer.
   4. Quality Control and Testing.

B. Related Sections:
   1. Section 31 23 16 - Excavation and Fill: Compacted subbase for paving.
   2. Section 32 11 23 - Aggregate Base Courses: Compacted base for paving.

1.2 REFERENCES

A. SCDOT Standard Specifications:
   1. Standard Specifications for Highway Construction, latest edition, published by the South Carolina Department of Transportation.

B. SCDOT Construction Manual:
   1. Construction Manual, latest edition, published by the South Carolina Department of Transportation.

C. SCDOT Supplemental Specifications:
   1. Supplemental Specification for Emulsified Coal-Tar Pitch Pavement Sealer For Bituminous Pavements, July 13, 1989, published by the South Carolina Department of Transportation.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit product information and mix design.

C. Manufacturer's Certification: Certify products are produced at a plant approved by SCDOT and that products meet or exceed specified requirements.

D. Installer Certification: Certify installer is on list of SCDOT approved contractors with an approved Quality Control Plan.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Division 400 of SCDOT Standard Specifications.

B. Maintain on site one (1) copy of each document.

C. Obtain materials from same source throughout.

D. Installer Qualification: Company specializing in performing work of this Section with minimum five (5) years experience.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not place asphalt base course or intermediate course when ambient air or road surface temperature is less than 35°F or surface is wet or frozen.

C. Do not place asphalt surface course when ambient air or road surface temperature is less than 50°F or wet.

D. Place bitumen mixture when temperature is not more than 15°F below temperature at when initially mixed and not more than maximum specified temperature.

PART 2 PRODUCTS

2.1 MATERIALS

A. Asphalt Plant Mix Materials: Conform to Division 400 of SCDOT Standard Specifications.

B. Prime Coat and Tack Coat: Conform to Division 400 of SCDOT Standard Specifications.

C. Reclaimed Asphalt Pavement (RAP): Processed material obtained by milling or full depth removal of existing asphalt concrete pavements. Conform to Division 400 of SCDOT Standard Specifications.

D. Sand: Fine aggregate, gradation conforming to Division 300 of SCDOT Standard Specifications.

2.2 ASPHALT PAVING MIX

A. General:
   1. Use HMA Type B mix design conforming to Section 403 of SCDOT Standard Specifications.

B. Base Course: Graded Aggregate Base Course (GABC).

C. Intermediate Course: Type B (for SCDOT R/W Section only).

D. Surface Course: Type B Hot Laid Asphalt Concrete Surface Course (see schedule).

E. Wedging or Leveling Mix: HMA Type C.

F. Sealer: Use Emulsified Coal-Tar Pitch Pavement Sealer conforming to Supplemental Specification July 13, 1989 of SCDOT Standard Specifications.

2.3 SOURCE QUALITY CONTROL AND TESTS

A. Section 00 14 00 - Quality Requirements: Testing, inspection, and analysis requirements.

B. Submit proposed mix design of each class of mix for review prior to beginning Work.

C. Obtain materials from plant approved by SCDOT.

D. Test plant samples in accordance with Section 401 of SCDOT Standard Specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted subgrade and aggregate base is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Verify utility structure frames and lids are installed in correct position and elevation.

3.2 PRIME COAT

A. Apply primer on aggregate base course at uniform rate in accordance with SCDOT Standard Specifications.

B. Apply primer to contact surfaces of curbs and gutters.

C. Use clean sand to blot excess primer.

3.3 TACK COAT

A. Apply tack coat on asphalt or concrete surfaces at uniform rate of 0.05 to 0.15 gallons/square yard in accordance with Section 401 of SCDOT Standard Specifications.

B. Apply tack coat to contact surfaces of curbs and gutters.

C. Coat surfaces of utility structures with oil to prevent bond with asphalt pavement. Do not tack-coat these surfaces.

3.4 PLACING ASPHALT PAVEMENT

A. Install Work in accordance with Section 401 of SCDOT Standard Specifications.

B. Place asphalt within 24 hours of applying prime coat or tack coat.

C. Place asphalt in courses to the thicknesses and dimensions shown on the Drawings.

D. Place binder and intermediate courses.

E. Place surface course within 2 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.

F. Place surface course to thicknesses and dimensions shown on the drawings.

G. Compact each course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

H. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.5 JOINTS

A. Traverse Joints:
   1. When Work is suspended long enough to allow mixture to chill, construct transverse joint.
   2. Use butt joint when traffic will not pass over pavement.
   3. Use sloped wedge ahead of the end of pavement when traffic will pass over pavement. Place paper parting strip to removal of wedge.

4. Tack coat edge of pavement prior to placing adjoining pavement.

B. Longitudinal Joints:
1. Tack the edge of longitudinal joints prior to placing adjoining pavement.
2. Pinch joint by rolling immediately behind the paver.
3. Offset longitudinal joints in each layer by approximately 6".

3.6 SEALER

A. Emulsified Coal-Tar Pitch Pavement Sealer in accordance with SCDOT Supplemental Specification, "Emulsified Coal-Tar Pitch Pavement Sealer for Bituminous Pavements", dated July 13, 1989, http://www.scdot.org/doing/pdfs/Sup_Specs/89-07-13.pdf.

3.7 TOLERANCES

A. Density Compaction: Minimum of 92% of Maximum Specific Gravity (G_{mm}).

B. Flatness: Maximum variation of 1/8" measured with 10'-0" straight edge.

C. Compacted Thickness: Within 1/4".

D. Variation from Indicated Elevation: Within 1/2".

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Independent testing firm, field testing, and inspecting.

B. Perform Contractor Quality Control Program in accordance with Appendix C of the SCDOT Construction Manual, May 2004, published by the South Carolina Department of Transportation.

C. Take compaction tests every 1,000 square feet or fraction thereof per day on pavement placed at the paver lay down width.

D. Take 6" diameter full depth pavement cores every 1,000 square feet or fraction thereof per day on pavement placed at the paver lay down width.

E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

3.9 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Immediately after placement, protect pavement from mechanical injury for seven days or until surface temperature is less than 140°F.

3.10 Schedules

A. See Pavement Section Details on the Contract Drawings.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Concrete sidewalks.
2. Concrete driveway repair: all driveway repairs shall be from existing expansion to existing expansion joint. Concrete driveways shall not be cut repair and replacement is otherwise not possible.
3. Concrete integral curbs and gutters.
4. Concrete median barriers.
5. Concrete base and surface for parking areas and roads.
6. Small miscellaneous slabs.

B. Related Sections:
1. Section 31 23 16 - Excavation and Fill: Compacted subgrade for paving.
2. Section 32 11 23 - Aggregate Base Courses: Compacted base for paving.
3. Section 32 12 16 - Asphalt Paving: Asphalt wearing course.
4. Section 33 05 13 - Manholes and Structures: Frames and lids in paving.

1.2 REFERENCES

A. American Association of State Highway Transportation Officials (AASHTO):
1. AASHTO M 31 - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
2. AASHTO M 32 - Standard Specification for Steel Wire, Plain for Concrete Reinforcement.
3. AASHTO M 148 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
4. AASHTO M 282 - Standard Specification for Joint Sealants, Hot Poured, Elastomeric-Type, for Portland Cement Concrete Pavements.

B. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. ASTM International:
1. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
2. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
3. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

5. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
6. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
7. ASTM D3406 - Standard Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements.

D. SCDOT Standard Specifications:
   1. Standard Specifications for Highway Construction, latest edition, published by the South Carolina Department of Transportation.

E. SCDOT Construction Manual:
   1. Construction Manual, May 2004/ latest edition, published by the South Carolina Department of Transportation.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Concrete Mix Design: Submit concrete mix design 30 days prior to use of concrete.

C. Product Data: Submit data on joint materials, admixtures, and curing compounds.

D. Manufacturer's Certification: Certify products are produced at a plant approved by SCDOT and that products meet or exceed specified requirements.

E. Installer Certification: Certify installer is on list of SCDOT prequalified contractors with an approved Quality Control Plan.

F. Process Control Plan: Submit process control plan for delivering and placing concrete.

G. Samples: Submit two (2) sample panels, 2" x 12" in size, illustrating exposed aggregate finish.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Division 500 of SCDOT Standard Specifications.

B. Maintain on site one (1) copy of each document.

C. Obtain cementitious materials from same source throughout.

D. Installer Qualification: Company specializing in performing work of this Section with minimum five (5) years experience.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not place concrete when base surface temperature or air temperature in the shade is 40°F and falling or surface is wet or frozen.

C. Do not place concrete when air temperature in the shade is 95°F and rising or when concrete temperature is greater than 95°F.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Slip Form Methods: Use slip form methods wherever possible.

B. Fixed Form Materials: Conforming to SCDOT Standard Specifications.

2.2 JOINT MATERIALS

A. General: Conform to SCDOT Standard Specifications.

B. Joint Filler: Sponge rubber or cork type conforming to ASTM D1751 (AASHTO M213) or bituminous, non-extruding, resilient type conforming to ASTM D1752 (AASHTO M153), Type 1; thickness as indicated on the drawings.

C. Silicone Sealant: Low modulus, cold applied, single component, chemically curing silicone material.
   1. Type NS: Non-sag silicone, toolable.
   2. Type SL: Self-leveling silicone, tooling not required.

D. Rubber Asphalt Sealant: Hot poured rubber asphalt joint sealer conforming to AASHTO M282 (ASTM D3406).

E. Bond Breaker:
   1. General: Product that does not stain or adhere to the sealant and is chemically inert and resistant to oils, gasoline, solvents, and primer.
   2. For On-Grade Pavements: Circular backer rod, diameter 25% larger than joint width.
      a. Type L, For Cold Pour Sealants Only: Closed cell expanded polyethylene foam. Use with Type NS silicone only.
      b. Type M, For Cold or Hot Pour Sealants: Closed cell polyolefin with closed skin over an open cell core.

2.3 REINFORCEMENT

A. General: Conform to SCDOT Standard Specifications. Include all proposed reinforcement in concrete paving submittals.

B. Reinforcing Steel: ASTM A615 (AASHTO M 31); 60 ksi yield grade; deformed billet steel bars; epoxy coated finish.

C. Dowels and Tie Bars: ASTM A615 (AASHTO M 31); 60 ksi yield grade, plain steel, epoxy coated finish.

D. Welded Wire Fabric Steel: Deformed type, ASTM A497; unfinished.

2.4 CONCRETE MATERIALS

A. Concrete Materials: Provide fine aggregate, coarse aggregate, Portland cement, fly ash, ground granulated blast furnace slag, water, air entraining agent, and chemical admixtures in accordance with SCDOT Standard Specifications.

2.5 ACCESSORIES

A. Curing Compound: ASTM C309 (AASHTO M-148), Type 1 clear or translucent or Type 2 white pigmented.

2.6 CONCRETE MIX

A. Mix and deliver concrete in accordance with Section 500 of the SCDOT Standard Specifications. Include concrete mix in submittals. Mix submittals must be labeled for the application Contractor intends to use them for, i.e., driveway repair, sidewalk repair, et cetera.

B. Class 4000 Concrete per Section 700 SCDOT Standard Specifications for sidewalk, concrete driveway, curb, curb and gutter, and other incidental site concrete:

C. Use accelerating admixtures in cold weather only when approved by the Engineer in writing. Use of admixtures will not relax cold weather placement requirements.

D. Use calcium chloride only when approved by the Engineer in writing.

E. Use set retarding admixtures during hot weather only when approved by the Engineer in writing.

2.7 SOURCE QUALITY CONTROL AND TESTS

A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services.

B. Contractor shall be responsible for paying for and employing concrete testing services firm.

C. Submit proposed mix design of each class of concrete to independent firm for review prior to commencement of Work.

D. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

E. Test samples in accordance with ACI 301 for compressive strength (cylinders) and flexural strength (beams).

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted base course is acceptable and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Verify utility structure frames and lids are installed in correct position and elevation.

3.2 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole, catch basin, and other utility structure frames with oil to prevent bond with concrete pavement.

C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.3 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.4 REINFORCEMENT

A. Place reinforcement as indicated on the drawings.

B. Interrupt reinforcement at contraction and expansion joints.

C. Place dowels to achieve pavement and curb alignment as detailed.

D. Provide doweled joints 18" on center at transverse joints with one end of dowel set in capped sleeve to allow longitudinal movement.

3.5 PLACING CONCRETE

A. Place concrete in accordance with SCDOT Standard Specifications.

B. Place concrete using the slip form technique wherever possible.

C. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

E. Place concrete to pattern indicated on the drawings.

3.6 PAVEMENT JOINTS

A. Provide expansion, contraction, and construction joints as indicated on Drawings.

B. Place expansion joints at 60'-0" maximum intervals. Place contraction joins at 20'-0" maximum intervals. Align pavement joints with curb, gutter, and sidewalk joints.

C. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/2" for backer rod and sealant placement.

D. Saw cut contraction joints 3/16" wide or as indicated at an optimum time after finishing. Cut 1/3 into depth of slab.

3.7 SIDEWALK, CURB, AND CURB AND GUTTER JOINTS

A. Provide sawn joints at 5'-0" intervals. Provide 3/4" expansion joint at 30'-0" maximum and between sidewalks and curbs and structures.

B. Align sidewalk, curb and gutter joints with pavement joints.

3.8 FINISHING

A. Area Paving: Heavy broom.

B. Sidewalk Paving: Light broom. Brush to 6" radius with smooth trowel joint edges.

C. Median Barrier: Light broom and trowel joint edges.

D. Curbs and Gutters: Light broom.

E. Inclined Vehicular Ramps: V-grooves with mechanical equipment and spring tines, perpendicular to slope.

F. Concrete Driveways: Finish of driveway repair shall match to the extent possible, the specific existing driveway to be repaired.

3.9 CURING

A. Place curing compound on concrete surfaces immediately after finishing.

B. Cover with burlap or polyethylene film to protect from cold weather and rain.

3.10 JOINT SEALING

A. Separate pavement from vertical surfaces with 1/2" thick joint filler.

B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

C. Extend joint filler from bottom of pavement to within 1/2" of finished surface.

3.11 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4" in 10'-0".

B. Maximum Variation from True Position: 1/2".

C. Maximum Variation in thickness: 1/2".

3.12 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Prepare three concrete test beams for every 1,333 or less square yards of pavement for each class of concrete placed each day.

C. Prepare one (1) additional test beam during cold weather and cured on site under same conditions as concrete it represents.

D. One (1) slump test will be taken for each set of test cylinders taken.

E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

F. Take one (1) 4" diameter core for every 1,333 square yards or less of pavement for each class of concrete placed each day.

3.13 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian or vehicular traffic over pavement for seven (7) days minimum after finishing.

3.14 SCHEDULES

A. Concrete Sidewalks: In accordance with Section 720 of the SCDOT Standard Specifications. Sidewalk sections should be replaced from construction joint / expansion joint to construction joint / expansion joint.

B. Roadway Pavement Concrete: In accordance with Section 501 of the SCDOT Standard Specifications.

C. Concrete Driveway Repair: Concrete driveway repair should include removal of concrete back to nearest expansion / construction joint. Repairs that are not completed in segments as they were originally poured will not be accepted. If conditions in the field are such that the Contractor feels is not possible, the specific sections should be brought to the attention of the Owner's Construction Inspector and the Engineers Construction Observation personnel onsite to agree upon resolution.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Fertilizing.
2. Seeding.
3. Hydroseeding.
4. Mulching.
5. Maintenance.

B. Related Sections:
1. Section 31 10 00 - Site Clearing.
2. Section 31 23 16 - Excavation and Fill.
3. Section 31 23 17 - Trenching.
4. Section 31 25 13 - Erosion Control.

1.2 REFERENCES

A. ASTM International:
1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. SCDOT Standard Specifications:
1. Standard Specifications for Highway Construction, latest edition, published by the South Carolina Department of Transportation.

C. SC DHEC Best Management Practices.
1. SCDHEC Storm Water Management BMP Handbook, latest edition, published by the South Carolina Department of Health and Environmental Control.
2. "South Carolina Stormwater Management and Sedimentation Control Handbook for Land Disturbance Activities", August 2003 or latest edition.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for seed mix, fertilizer, mulch, and other accessories.

C. Test Reports: Indicate topsoil nutrient and pH levels with recommended soil supplements and application rates.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Invoices or proof of purchase to verify quantities specified.

F. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; and, types, application frequency, and recommended coverage of fertilizer.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Section 810 of SCDOT Standard Specifications.

B. Maintain copy of document on site.

1.5 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing products specified in this Section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this Section with minimum 5 years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver grass seed mixture in sealed containers showing percentage of seed mix, germination, inert matter and weeds; year of production; net weight; date of packaging; and location of packaging. Seed in damaged packaging is not acceptable.

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

1.7 MAINTENANCE SERVICE

A. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition for minimum of three (3) cuttings.

PART 2 PRODUCTS

2.1 TOPSOIL MATERIALS

A. Topsoil: Original surface soil typical of the area, which is capable of supporting native plant growth; free of large stones, roots, waste, debris, contamination, or other unsuitable material, which may be detrimental to plant growth; pH value of 5.4 to 7.0.

2.2 SEED MIXTURE

A. General Seeding: Furnish materials in accordance with South Carolina Board of Agriculture rules and regulations as specified in Section 810 of the SCDOT Standard Specifications and South Carolina Department of Health and Environmental Control Best Management Practices Handbook: Appendix C.

1. Application Rates: See Construction Plans.

B. Riparian:
1. Virginia Wildrye *(Elymus virginicus)*.
2. Switchgrass *(Punicum virgutum)*.
3. Little Bluestem *(Schizachyrium scopurium)*.
4. Soft Bush *(Junus effusus)*.

2.3 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis. When test is not available, use 10-10-10 mixture of Nitrogen, phosphoric acid, and soluble potash.

C. Lime: ASTM C602, Class T or Class O agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

D. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

E. Erosion Fabric: As specified per the plan details.

F. Herbicide: As required to combat type of weeds encountered.

G. Stakes: Softwood lumber, chisel pointed.

H. String: Inorganic fiber.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting Work.

B. Verify prepared soil base and topsoil are ready to receive the Work of this Section.

3.2 FERTILIZING

A. Apply lime at application rate recommended by soil analysis. Work lime into top 6" of soil.

B. Apply fertilizer at application rate recommended by soil analysis.

C. Apply after smooth raking of topsoil and prior to roller compaction.

D. Do not apply fertilizer at same time or with same machine used to apply seed.

E. Mix fertilizer thoroughly into upper 2" of topsoil.

F. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 SEEDING

A. Apply seed evenly in two (2) intersecting directions at the rates shown above. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

D. Roll seeded area with roller not exceeding 112 lbs/linear foot.

E. Immediately following seeding and rolling, apply mulch to thickness of 1/8 inch. Maintain clear of shrubs and trees.

F. Apply water with fine spray immediately after each area has been mulched. Saturate to 4" of soil.

3.4 HYDROSEEDING

A. Apply fertilizer, mulch and seeded slurry with hydraulic seeder at rate of 6 lbs. per 1,000 square feet evenly in one (1) pass.

B. Apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4" of soil and maintain moisture levels 2" to 4".

C. If temporary grassing and final grassing seed mixtures are the same and temporary grassing covers greater than 85% of temporarily grassed area, Owner may choose to forgo hydroseeding in certain areas of the permanent easement. Contractor to notify Owner and Engineer prior to final grassing.

3.5 SEED PROTECTION

A. Identify seeded areas with stakes and string around area periphery. Set string height to 12". Space stakes at 5'-0" on center.

B. Cover seeded slopes where grade is greater than 3 H:1 V with erosion fabric. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in 6" deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12". Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edges and overlaps at 36" intervals with stakes.

E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6".

3.6 MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2-1/2". Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when grass is 40% higher than desired height. Contractor shall be responsible for maintenance until final completion has been reached.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.

D. Water to prevent grass and soil from drying out.

E. Roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

G. Immediately reseed areas showing bare spots.

H. Repair washouts or gullies.

I. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

SECTION 32 92 23
SODDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fertilizing.
   2. Sod installation.
   3. Maintenance.

B. Related Sections:
   1. Section 32 92 19 - Seeding.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Sodded Areas:
   1. Basis of Measurement: By square yard.
   2. Basis of Payment: Includes fertilizing, sodding, watering, mowing, and maintenance to specified time limit.

1.3 REFERENCES

A. ASTM International:
   1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. SCDOT Standard Specifications:
   1. SCDOT Standard Specifications for Highway Construction, latest edition, published by the SC Department of Transportation.

C. Turfgrass Producers International:
   1. TPI - Guideline Specifications to Turfgrass Sodding.

1.4 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

1.5 SUBMITTALS

A. Product Data: Submit data for sod grass species, fertilizer, mulch, and other accessories.

B. Test Reports: Indicate topsoil nutrient and pH levels with recommended soil supplements and application rates.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Invoices or proof of purchase to verify quantities specified.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.7 QUALITY ASSURANCE

A. Sod: Root development capable of supporting its own weight without tearing, when suspended vertically by holding upper two corners.

B. Perform Work in accordance with SCDOT Standard Specifications for Highway Construction, latest edition, published by the SC Department of Transportation.

C. Maintain one copy of document on site.

1.8 QUALIFICATIONS

A. Sod Producer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration.

B. Do not deliver more sod than can be laid within 24 hours.

1.10 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.

B. Maintain sodded areas immediately after placement until grass is well established and exhibits vigorous growing condition for three cuttings.

PART 2 PRODUCTS

2.1 GENERAL

A. Furnish materials in accordance with South Carolina Board of Agriculture rules and regulations as specified in SCDOT Standard Specifications for Highway Construction, latest edition, published by the SC Department of Transportation.

2.2 TOPSOIL MATERIALS

A. Original surface soil typical of the area, which is capable of supporting native plant growth; free of large stones, roots, waste, debris, contamination, or other unsuitable material, which may be detrimental to plant growth; pH value of 5.4 to 7.0.

2.3 SOD

A. Sod: TPI defined Field grown; cultivated grass sod; type indicated below; with strong fibrous root system, free of stones, burned or bare spots; containing no more than five weeds per 1,000 square feet.

Cool Season Grasses	**Varieties**	**Region**
Kentucky Bluegrass Blend		Mountains
Tall Fescue Blend	Adventure, Brookston, Falcon, Finelawn, Galway, Houndog, Jaguar, Olympic, Rebel	Mountains and Piedmont
Tall Fescue/Kentucky Bluegrass Blend		Mountains and Piedmont
Warm Season Grasses	**Varieties**	**Region**
Hybrid Bermuda Grass	Vamont, Tifway, Tifway II, Tifgreen	Piedmont and Coastal Plain
Zoysia Grass	Emerald, Meyer	Piedmont and Coastal Plain
Centipede Grass	No improved varieties	Piedmont and Coastal Plain
St. Augustine Grass	Raleigh	Piedmont and Coastal Plain

2.4 ACCESSORIES

A. Fertilizer: Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis. When test is not available, use 10-10-10 mixture of Nitrogen, phosphoric acid, and soluble potash.

B. Lime: ASTM C602, Class T or Class O agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

C. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of grass.

D. Herbicide: As required to combat type of weeds encountered.

E. String: Inorganic fiber.

F. Wood Pegs: Softwood, sufficient size and length to anchor sod on slope.

G. Surface Mesh: Interwoven hexagonal plastic mesh of 2 inch size.

2.5 HARVESTING SOD

A. Machine cut sod and load on pallets in accordance with TPI guidelines.

B. Cut sod in area not exceeding 1 sq yd, with minimum 1/2 inch and maximum 1 inch topsoil base.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

B. Verify prepared soil base and topsoil are ready to receive the Work of this Section.

3.2 FERTILIZING

A. Apply lime at the application rate recommended by topsoil analysis or 2 tons per acre (100 pounds per 1000 square feet). Work lime into top 6 inches of soil.

B. Apply fertilizer at application rate recommended by soil analysis or 1,000 lbs per acre (25 pounds per 1,000 square feet) of 10-10-10 fertilizer in fall or 5-10-10 fertilizer in spring.

C. Apply after smooth raking of topsoil and prior to roller compaction.

D. Do not apply fertilizer at same time sod is applied.

E. Mix fertilizer thoroughly into upper 2 inches of topsoil.

F. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Lay sod within 48 hours of being cut and within 24 hours after topsoil is prepared and fertilized.

C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.

D. Lay smooth. Align with adjoining grass areas.

E. Place top elevation of sod 1/2 inch below adjoining paving.

F. On slopes 6 inches per foot and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. When using “big roll”, lay sod parallel to slope. Drive pegs flush with soil portion of sod.

G. Do not place sod when temperature is lower than 32 degrees F.

H. Prior to placing sod, on slopes exceeding 8 inches per foot or where indicated, place surface mesh over topsoil. Securely anchor mesh in place with wood pegs sunk firmly into ground.

I. Water sodded areas immediately after installation. Saturate soil to 4 inches.

J. After sod and soil have dried, roll sodded areas to bond sod to soil and to remove minor depressions and irregularities. Roll sodded areas with roller not exceeding 112 pounds.

K. Roll before first watering.

3.4 MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.

D. Water to prevent grass and soil from drying out.

E. Roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

G. Immediately reseed areas showing bare spots.

H. Repair washouts or gullies.

I. Protect sodded areas with warning signs during maintenance period.

3.5 SCHEDULE

A. Lawn Area: Sod Type 1, 4-inch top soil.

B. Pond Slopes: Sod Type 2, 4-inch top soil.

END OF SECTION

SECTION 33 05 13

UTILITY MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Precast reinforced concrete manholes and structures with tongue-and-groove joints with masonry transition to frames, lids, grates, anchorage, and accessories.
2. Masonry manhole and structure sections with masonry transition to frames, lids, grates, anchorage, and accessories.
3. Cast-in-place concrete manholes and structures with masonry transition to frames, lids, grates, covers, anchorage, and accessories.
4. Structure connections to existing public utility lines.
5. Bedding and backfill materials.

B. Related Sections:
1. Section 33 05 17 - Precast Concrete Valve Vaults and Meter Boxes.
2. Section 33 11 00 - Water Utility Distribution Piping.
3. Section 33 12 13 - Water Service Connections.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 530/530.1 - Building Code Requirements for Masonry Structures and Specifications for Masonry Structures.

B. ASTM International:
1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
3. ASTM C55 - Standard Specification for Concrete Brick.
4. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
5. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
6. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
7. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.

8. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
9. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
10. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

C. National Precast Concrete Association:
1. NPCA Quality Control Manual for Precast Plants.
2. NPCA Plant Certification Program.

D. SCDOT Standard Specifications:
1. Standard Specifications for Highway Construction, 2007 or current edition, published by the South Carolina Department of Transportation.

1.3 SUBMITTALS

A. General Specifications, Special Provisions, and Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
1. Standard Fabrication: Indicate structure locations, elevations, sections, equipment support, piping sizes, and elevations of penetrations.
2. Custom Fabrication: Indicate design, construction and installation details, typical reinforcement and additional reinforcement at openings for each custom type, size and configuration.

C. Product Data: Submit manhole frames and lids, accessories, component construction, features, configuration, dimensions, and joint data.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Project Record Documents: Record actual locations of manholes and structures with rim and invert elevations. Point Description should include Air Release Valve for Water.

F. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 QUALITY ASSURANCE

A. Section 01 40 00 - Quality Requirements.

B. Obtain precast concrete utility structures from single source.

C. Perform Work in accordance with Section 719 of SCDOT Standard Specifications.

D. Maintain one copy of document on site.

1.5 QUALIFICATIONS

A. Manufacturer: Certified by NPCA Plant Certification Program prior to and during Work of this section.

B. Installer: Company specializing in performing work of this Section with minimum five (5) years experience.

C. Design custom utility structures under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of South Carolina.

1.6 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with precast concrete manufacturer's instructions and ASTM C913 for unloading, storing and moving precast manholes and drainage structures.

C. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.

D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer and identifying symbols, and numbers shown on the drawings to indicate its intended use.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Masonry Work: Maintain materials and surrounding air temperature to minimum 50°F prior to, during, and 48 hours after completion of masonry work.

B. Cold Weather Requirements: ACI 530/530.1.

PART 2 PRODUCTS

2.1 PRECAST REINFORCED MANHOLES AND STRUCTURES

A. Precast Manhole and Structure Sections: Reinforced precast concrete in accordance with ASTM C478.
   1. Joints for Precast Manholes and Structures for Other Utility uses: Butyl rubber gaskets in accordance with ASTM C990.

2.2 MASONRY CONSTRUCTION

A. Concrete Brick: ASTM C55, Grade S, Type II - Non-moisture controlled; except that the absorption of brick shall not exceed 10 lbs / cubic foot.

B. Clay or Shale Brick: ASTM C32, Grade SW, solid units.

C. Mortar: Conform to Division 700 of SCDOT Standard Specifications proportioned as described below. Do not add more water than is necessary to make a workable mixture.
   1. Mix No. 1: One (1) part Portland cement, 1/4 part hydrated lime, and 3-3/4 parts mortar sand (maximum).
   2. Mix No. 2: One (1) part Portland cement, 1 part masonry cement, and 6 parts mortar sand (maximum).

D. Grout: Non-shrink, non-metallic in accordance with Division 700 of SCDOT Standard Specifications with a compressive strength of at least 5,000 psi at 3 days.

2.3 CAST-IN-PLACE CONCRETE

A. Concrete: Class 4000 Concrete conforming to Division 700 of the SCDOT Standard Specifications.

2.4 FRAMES AND COVERS

A. Product Description: Grey cast iron ASTM A48, Class 30B; size and shape as indicated on the drawings. Live load rating of HS 20. Manhole covers shall be marked, “Air Release Valve” with the standard City of Columbia Water Logo.

2.5 CONFIGURATION

A. Provide size and shape as indicated on the drawings.

B. Foundation Slab: Cast-in-place or precast reinforced concrete integral with bottom section, level top surface.

2.6 ACCESSORIES

A. Strap Anchors: Stainless steel capable of supporting pipe or accessories indicated on the drawings, minimum 1" wide x 1/8" thick.

B. Geotextile Filter Fabric: Type 1 Engineering fabric in accordance with Section 804 of SCDOT Standard Specifications; non-woven, needle punched, non-biodegradable, and rot-proof.

C. Bituminous Interior Manhole Coating:
   1. Manufacturers: Contractor shall refer to City of Columbia General Specifications for Air Release Valve Access Structures.

D. Watertight Manhole Frame and Cover:
   1. Manufacturers: Contractor to refer to the City of Columbia General Specifications, Special Provisions, and Specifications for Access Structures for Air Release Valves to identify acceptable manufacturers for Air Release Valve manhole frames and covers.

2.7 BEDDING AND BACKFILL MATERIALS

A. Bedding: As detailed per the Contract Drawings and within the City of Columbia Specifications.

B. Backfill: As detailed per the Contract Drawings and within the City of Columbia Specifications

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items provided by other Sections of Work are properly sized and located.

B. Verify built-in items are in proper location and ready for roughing into Work.

C. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Coordinate placement of pipe and/or appurtenances required by other Sections.

B. Do not install manholes and structures where site conditions induce loads exceeding structural capacity of manholes or structures.

C. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify manholes and structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION - GENERAL

A. Excavation and Backfill:
   1. Excavate and backfill for manholes and structures in accordance with the General Specifications in location and to depth shown. Provide clearance around sidewalls of manhole or structure for construction operations, backfill, and placement of geotextile filter fabric if required.
   2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes or structures in dry trench.
   3. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation.

B. Place precast manhole sections plumb and level, trim to correct elevations, anchor to foundation slab.

C. As Work progresses, install steps and other fabricated metal items.

D. Install cast-in-place manholes and structures supported at proper grade and alignment as shown on the drawings.

E. Cut pipe to connect to structure as indicated on the drawings.

F. Set cover frames and covers level without tipping, to correct elevations.

3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

A. Install underground precast utility structures in accordance with ASTM C891.

B. Lift precast manholes and structures at lifting points designated by manufacturer.

C. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and manhole or structure remains clean.

D. Set precast manholes and structures bearing firmly and fully on stone bedding, as shown on the Detail of Sheet D2 of the Construction Plans. Manholes should be 6-ft manholes installed around but not in contact with water main. Manhole should not bear any weight on the new water main.

E. Assemble multi-section manholes and structures by lowering each section into excavation. Install rubber gasket joints between precast sections in accordance with manufacturer's recommendations. Lower, set level, and firmly position base section before placing additional sections.

F. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

G. Joint sealing materials may be installed on site or at manufacturer's plant.

H. Verify air release valves will fit in manhole, with a minimum of 12-inces of clearance, when frame and cover are installed.

I. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with non-shrink grout.

3.5 MASONRY MANHOLE AND STRUCTURE INSTALLATION

A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

B. Lay masonry units in running bond. Course one unit and one mortar joint to equal 8".

C. Form flush mortar joints.

D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other Work.

E. Install joint reinforcement 16" on center.

F. Place joint reinforcement in first and second horizontal joints above base pad and below cover frame opening.

3.6 CAST-IN-PLACE CONCRETE MANHOLE AND STRUCTURE INSTALLATION

A. Prepare crushed stone bedding or other support system shown on the drawings to receive manhole as specified for precast manholes and structures.

B. Erect and brace forms against movement in accordance with Section 719 of SCDOT Standard Specifications.

C. Install reinforcing steel as indicated on Drawings and in accordance with Section 719 of SCDOT Standard Specifications.

D. Place and cure concrete in accordance with Section 719 of SCDOT Standard Specifications.

3.7 CASTINGS INSTALLATION

A. Set frames using mortar and masonry as indicated on the drawings. Install radially laid concrete brick with 1/4" thick vertical joints at inside perimeter. Lay concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.

B. Do not install more than three (3) courses of brick or more than 12" of masonry.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test cast-in-place concrete in accordance with ASTM C39.

C. Test concrete manhole and structure sections in accordance with ASTM C497.

D. Vertical Adjustment of Existing Manholes and Structures:
   1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on the drawings.
   2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
   3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated on the drawings.
   4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete.

END OF SECTION

SECTION 33 05 17

PRECAST CONCRETE VALVE VAULTS AND METER BOXES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Precast concrete valve vaults.

B. Related Sections:
   1. Section 33 11 00 - Water Utility Distribution Piping.
   2. Section 33 12 13 - Water Service Connections.
   3. Section 31 23 16 - Excavation and Fill.
   4. Section 31 23 17 - Trenching.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A48 - Standard Specification for Gray Iron Castings.
   2. ASTM A536 - Standard Specification for Ductile Iron Castings.
   3. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
   4. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
   5. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
   6. ASTM C891 - Standard Practice for Installation of Underground Precast Utility Structures.
   7. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
   8. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joints Sealants.

B. SCDOT Standard Specifications:
   1. Standard Specifications for Highway Construction, 2007, published by the South Carolina Department of Transportation.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawing: Indicate plan, location and inverts of connecting piping.

C. Product Data: Submit data on valve vaults and meter boxes.

D. Manufacturer's Certificates: Submit Statement of Compliance and supporting data from materials suppliers attesting that precast concrete valve vaults and meter boxes provided meet or exceed ASTM Standards and specification requirements.

E. Manufacturer's Installation Instructions: Submit special procedures for precast concrete valve vaults and meter boxes installation.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations and inverts of buried pipe, components and connections.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance SCDOT Standard Specifications.

B. Maintain one copy of document on site.

1.6 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Transport and handle precast concrete units with equipment designed to protect units from damage.

C. Do not place concrete units in position to cause overstress, warp or twist.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE VALVES AND METER BOXES

A. Precast Sections: Reinforced precast concrete in accordance with ASTM C478.
   1. Joints: Butyl rubber gaskets in accordance with ASTM C990.

2.2 FRAMES AND COVERS

A. Manufacturers:
   1. Barry Pattern and Foundry Co., Inc.
   2. East Jordan Iron Works.
   3. McKinley Iron Works.
   4. Neenah Foundry Co.
   5. Or Engineer Approved Equal.

B. Product Description: Grey cast iron ASTM A48/A48M, Class 30B; size and shape as indicated on Drawings. Live load rating of HS 20 in paved areas.

2.3 CONFIGURATION

A. Provide size and shape as indicated on Drawings.

B. Foundation Slab: Cast-in-place or precast reinforced concrete integral with bottom section, level top surface.

2.4 ACCESSORIES

A. Steps: Conform to local agency requirements, minimum 12 inches wide spaced vertically 16 inches on center.

B. Strap Anchors: Stainless steel capable of supporting pipe or accessories indicated on Drawings, minimum 1 inch wide x 1/8 inch thick.

C. Geotextile Filter Fabric: Type 1 Engineering fabric in accordance with Section 713 of the SCDOT Standard Specifications; non-woven, needle punched, non-biodegradable, and rot-proof.

2.5 BEDDING AND BACKFILL MATERIALS

A. Bedding: Clean course aggregate Gradation No. 57 conforming to Section 801 of the SCDOT Standard Specifications.

B. Backfill around Structures: As specified in Section 31 23 16 – Excavation and Fill and Section 31 23 17 -Trenching.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items provided by other Sections of Work are properly sized and located.

B. Verify built-in items are in proper location and ready for roughing into Work.

C. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe.

B. Do not install vaults and structures where site conditions induce loads exceeding structural capacity of vaults.

C. Inspect precast concrete vaults immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION

A. Excavation and Backfill:
   1. Excavate and backfill for vaults and meter boxes in accordance with in Section 31 23 16 – Excavation and Fill and Section 31 23 17 – Trenching in location and to depth shown. Provide clearance around sidewalls of structure for construction operations, backfill, and placement of geotextile filter fabric if required.
   2. When groundwater is encountered, prevent accumulation of water in excavations. Place structures in dry trench.
   3. Where possibility exists of watertight structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation.

B. Place bedding and foundation slab; trowel top surface level if cast-in-place.

C. Install underground precast utility structures in accordance with ASTM C891.

D. Lift precast vaults and structures at lifting points designated by manufacturer.

E. When lowering vaults and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and manhole or structure remains clean.

F. Set precast vaults and structures bearing firmly and fully on stone bedding, 8-inch minimum thickness, compacted to 95 percent maximum density per in Section 31 23 16 – Excavation and Fill and Section 31 23 17 -Trenching or on other support system shown on Drawings.

G. Assemble multi-section vaults and structures by lowering each section into excavation. Install rubber gasket joints between precast sections in accordance with manufacturer's recommendations. Lower, set level, and firmly position base section before placing additional sections.

H. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

I. Joint sealing materials may be installed on site or at manufacturer's plant.

J. Verify vaults and structures installed satisfy required alignment and grade.

K. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with non-shrink grout.

3.4 CASTINGS INSTALLATION

A. Set frames using mortar and masonry as indicated on Drawings. Install radially laid concrete brick with 1/4 inch thick vertical joints at inside perimeter. Lay concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.

B. Do not install more than 3 courses of brick or more than 12 inches of masonry.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform soil compaction tests in accordance with Section 31 23 17 - Trenching.

C. Test concrete manhole and structure sections in accordance with ASTM C497.

D. Vertical Adjustment of Existing Structures:
1. Where required, adjust top elevation of existing vaults and structures to finished grades shown on Drawings.
2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated on Drawings.
4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete.

END OF SECTION

SECTION 33 05 23

TRENCHLESS UTILITY INSTALLATION (JACKING)

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Excavation and backfill for approach trenches and pits.
2. Excavation for casing pipe.
3. Carrier pipe.
4. Disposal of excess materials.

B. Related Sections:
1. Section 03 30 00 - Cast-in-Place Concrete.
2. Section 31 23 17 - Trenching: Excavating and Backfilling Access Pits.
3. Section 33 05 13 - Utility Manholes and Structures.
4. Section 33 11 00 - Water Utility Distribution Piping.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO H20 - Standard Specification for Live Loading.
2. AASHTO M133 - Standard Specification for Preservatives and Pressure Treatment Processes for Timber.

B. American Railway Engineering and Maintenance-of-Way Association:
1. AREMA - Manual for Railway Engineering.

C. ASTM International:
1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A139 - Standard Specification for Electric fusion (Arc) Welded steel Pipe (NPS 4-inch and over).
4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
5. ASTM A449 - Standard Specification for Quenched and Tempered Steel Bolts and Studs.
6. ASTM A1011- Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

D. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

E. National Utility Contractors Association:
1. NUCA - Pipe Jacking and Microtunneling Design Guide.
2. NUCA - Trenchless Excavation Construction Equipment and Methods Manual.

F. SCDOT Standard Specifications:
   1. Standard Specifications for Highway Construction, 2007 or current edition, published by the South Carolina Department of Transportation.

G. Norfolk Southern NSCE-8 Specifications.

1.3 DESIGN REQUIREMENTS

A. The end of casing pipe to extend a minimum of 5'-0" from the edge of pavement / back of curb.

B. The top of the casing pipe shall be a minimum of 4'-0" below the crown of the finished surface asphalt coat on the roadway. Estimated depth to be a minimum of 4’-4” from the Crown of the Pipe to the Crown of the Roadway.

C. For railroad crossings refer to Norfolk Southern NSCE-8 specifications or like CSX specifications.
   1. Casing pipes under Norfolk Southern tracks shall not be less than 5-1/2" from the base of rail to top of pipe at its closest point.
   2. On other portions of the right-of-way, where the pipe is not directly beneath any track, the depth from the ground surface will be 4'-0".

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Prepare scaled shop drawings to supplement drawings, signed and sealed by Professional Engineer.
   1. Include details of casing, jacking head, sheeting, and other falsework for trenches and pits and support for adjacent facilities, field sketches, and other details to complete the Work.
   2. Show relation of proposed installation to adjacent facilities and natural features over installation, angle of installation, right-of-way lines, and general layout of built facilities.
   3. Show cross-section or sections from field survey showing installation in relation to actual profile of ground.

C. Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel.

D. Installation Plan: Submit description of proposed construction plan, dewatering plan, and plan to establish and maintain vertical and horizontal alignment.

E. Submit emergency response procedures to handle situations when conduit is compromised and jeopardizes integrity of installation or safety.

F. Submit written report results of visual check prior to installation of carrier pipe of entire length of casing or liner, to verify there are no voids or defective joints.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of casing or tunnel liner, carrier pipe, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with the latest SCDOT Standard Specifications, the "Utilities Accommodation Manual" dated September 1, 2011, the NUCA Trenchless Excavation Construction Equipment and Methods Manual, NUCA Pipe Jacking and Microtunneling Design Guide, and AREMA when jacking under railroads.

B. Maintain one (1) copy of each document on site.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum five (5) years documented experience.
   1. Work experience: Include projects of similar magnitude and conditions.
   2. Furnish list of references upon request.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this Section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping and jacking systems from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.

D. Accept system components on site in manufacturer's original containers or configuration. Inspect for damage.

E. Use wooden shipping braces between layers of stacked pipe. Stack piping lengths no more than three layers high.

F. Store field joint materials indoors in dry area in original shipping containers. Maintain storage temperature of 60°F to 85°F.

G. Support casing and carrier pipes with nylon slings during handling.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.11 FIELD MEASUREMENTS

A. Verify invert elevations of existing work prior to excavation and installation of casing or tunnel.

PART 2 PRODUCTS

2.1 CASING AND JACKING PIPE MATERIALS

A. Steel Casing Pipe: Steel complying with ASTM A139 for Grade B with minimum yield strength of 35,000 psi.

B. Provide ends suitable for field welding.

C. Minimum wall thickness as follows:

Diameter of Casing (inches)	Minimum Wall Thickness (inches)
6 – 14	0.250
16 – 18	0.3125
20 – 22	0.375
24 – 26	0.4375
28 – 32	0.500
34 – 42	0.5625
44 – 48	0.625
50 – 54	0.750

2.2 CARRIER PIPE MATERIALS

A. As specified within Section 33 11 00 - Water Utility Distribution Piping.

2.3 PIPELINE CASING SPACERS

A. For piping installed in casing provide pipeline casing spacers.

B. Provide a minimum of one (1) spacer per ten (10) linear feet of pipe for ductile iron pipe and a minimum of one (1) spacer per six (6) linear feet for PVC pipe.

C. Provide spacer with shell of 14 gauge T-316 stainless steel

D. Provide shell liner of .090" thick PVC, 85-90 durometer.

E. Provide 5/16" stainless steel connecting bolts and lock nuts, minimum three (3) per flange.

F. Runners from 2'-0" wide ultra-high molecular weight polymer with a high resistance to abrasion and a coefficient of friction of 0.11-0.13 in accordance with ASTM D1894

G. Support runners on 14 gauge reinforced T-316 stainless steel risers welded to shell.

H. All metal surfaces to be fully passivated.

I. The diameter as measured over the runners shall exceed the pipeline bell or coupling outside diameter.

J. Provide pipeline casing spacers as manufactured by Cascade Manufacturing, Pipeline Seal and Insulator, Inc., or approved equal.

2.4 END SEALS

A. Provide 1/8" thick rubber end seal to seal each end of the casing.

B. Secure to casing and carrier pipe with T-316 stainless steel bands.

C. Acceptable Manufacturers: Cascade Manufacturing, Pipeline Seal and Insulator, Inc., or approved equal.

2.5 COVER MATERIALS

A. Soil Backfill for Trench Approaches and Pits to Finish Grade: As specified in Section 31 23 17 - Trenching.

2.6 ACCESSORIES

A. Supports and Insulators:
   1. Steel and Plastic: 14 gage stainless steel band, 5/16" stainless steel flange bolts, heavy duty PVC liner, polyethylene or phenolic skids.
   2. Plastic: Polyethylene casing insulator band and skids with stainless steel bolts.

B. Steel Strapping: ASTM A36.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify connection to existing piping system size, location, and invert elevations are in accordance with the drawings.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities indicated to remain from damage.

C. Notify utility company to remove and relocate utilities.

D. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

F. Establish minimum separation of from other utility piping in accordance with local code.

3.3 EXCAVATION AND BACKFILL

A. Excavate and backfill in accordance with the Contract Drawings, Special Provisions, and Section 31 23 16 - Excavation and Fill.

3.4 DEWATERING

A. Intercept and divert surface drainage precipitation and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps, or other means.

B. Develop substantially dry subgrade for prosecution of subsequent operations.

C. Comply with SCDHEC requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

3.5 EXISTING WORK

A. Maintain access to existing facilities and other remaining active installations requiring access. Modify installation as necessary to maintain access.

3.6 PITS OR APPROACH TRENCHES

A. Excavate approach trenches or pits in accordance with shop drawings and as site conditions require.

B. Ensure casing entrance face as near perpendicular to alignment as conditions permit.

C. Establish vertical entrance face at least 1'-0" above top of casing.

D. Install dewatering measures and excavation supports as specified in Section 31 23 17 - Trenching.

3.7 CASING PIPE INSTALLATION

A. Boring:
   1. Push pipe into ground with boring auger rotating within pipe to remove spoil. Do not advance cutting head ahead of casing pipe except for distance necessary to permit cutting teeth to cut clearance for pipe. Arrange machine bore and cutting head to be removable from within pipe. Arrange face of cutting head to provide barrier to free flow of soft material.
   2. When unstable soil is encountered during boring retract cutting head into casing to permit balance between pushing pressure and ratio of pipe advancement to quantity of soil.
   3. When voids develop greater than outside diameter of pipe by approximately 1", grout to fill voids.
   4. When boring is obstructed, abandon boring, relocate jack or tunnel as directed by Engineer.

B. Jacking:
   1. Construct adequate thrust wall normal to proposed line of thrust.
   2. Impart thrust load to pipe through suitable thrust ring sufficiently rigid to ensure uniform distribution of thrust load on full pipe circumference.

C. Drilling and Jacking:
   1. Use oil field type rock roller bit or plate bit made up of individual roller cutter units solidly welded to pipe which is turned and pushed for its entire length by drilling machine to give bit necessary cutting action.
   2. Inject high density slurry (oil field drilling mud) to head as cutter lubricant. Inject slurry at rear of cutter units to prevent jetting action ahead of pipe.

D. Mining and Jacking: Utilize manual hand mining excavation from within casing pipe as casing is advanced with jacks, allowing minimum ground standup time ahead of casing pipe.

3.8 PRESSURE GROUTING

A. Pressure grout annular space between casing pipe and surrounding earth when rock, rubble or other debris is encountered while completing the bore.

3.9 CARRIER PIPE INSTALLATION

A. Clean, inspect, and handle pipe in accordance with applicable Section for carrier pipe.

B. Exercise care to prevent damage to pipe joints when carrier pipe is placed in casing.

C. Support pipeline within casing so no external loads are transmitted to carrier pipe. Attach supports to barrel of carrier pipe; do not rest carrier pipe on bells.
   1. Use minimum two (2) supports per joint of carrier pipe.

D. Seal ends per paragraph 2.4.

3.10 TOLERANCES

A. Do not over cut excavation by more than 1" greater than outside diameter of casing pipe.

B. Install casing pipe to vertical and horizontal alignment on Drawings within ±3" prior to installation of carrier pipe.

C. Install pipe bells with minimum 1/2" clearance to casing.

3.11 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting and testing.

B. Compaction Testing: As specified in Section 31 23 17 - Trenching.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.12 REMOVAL OF FACILITIES AND CONTROLS

A. Remove temporary facilities for casing installation and jacking operations in accordance with Section 01 50 00 - Temporary Facilities and Controls.

END OF SECTION

SECTION 33 05 24
UTILITY HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavation and backfill for approach trenches and pits.
2. Horizontal directional drilling.
3. Pipe and accessories.
4. Testing of Pipe

B. Related Sections:
1. Section 03 30 10 - Cast-In-Place Concrete.
2. Section 31 23 16 - Excavation and Fill.
3. Section 31 23 17 - Trenching: Excavating and backfilling access pits.
4. Section 33 11 13 - Public Water Utility Distribution Piping.
5. Section 33 13 00 - Disinfection of Water Utility Distribution.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Water Works Association:
1. ANSI/AWWA C104/A21.4 - Cement Mortar Lining For Ductile Iron Pipe and Fittings
2. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. ANSI/AWWA C151/A21.51 - Ductile Iron Pipe, Centrifugally Cast, for Water.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Submit technical data for equipment, method of installation, and proposed sequence of construction.
   2. Include information pertaining to pits, dewatering, method of spoils removal, equipment size and capacity, equipment capabilities including installing pipe on radius, type of drill bit, drilling fluid, method of monitoring line and grade and detection of surface movement, name plate data for drilling equipment, and mobile spoils removal unit.
   3. Contractor to provide at a minimum all pull back calculations, pipe joint specifications, proposed bore hole diameters, proposed entry and exit diameters, proposed pipe layout plan, method of pipe stringing along road ROW.
   4. Contractor shall provide submittals from pipe manufacturer. Manufacturer submittal shall include a certification for pipes suitability for HDD installation for this particular installation.
   5. Contractor to provide a frac-out plan with the Shop Drawings to address any release of any drilling fluids adjacent to or along the installation's alignment.

C. Product Data:
   1. Identify source of water used for drilling.
   2. Submit copy of approvals and permits for use of water source.

D. Installer Qualifications: Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel. Installer qualifications shall include Crew superintendents name, resume, and associated experience on jobs of equal or greater size in length of pipe and diameter. Key drilling personnel resumes should be included with the installer qualifications. Installer qualifications may be submitted after the bid opening; however, the Owner and Engineer reserve the right, if in their judgement the Contractor does not have sufficient experience to complete the project to reject submitted driller and require driller with experience commiserate with the size and scope of the HDD included with this project.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Provide work sequence and schedule in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of pipe and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

D. Record actual depth of pipe at 25 feet intervals.

E. Record actual horizontal and vertical location of installed pipe.

F. Show depth and location of abandoned bores.

G. Record depth and location of drill bits and drill stems not removed from bore.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with the following:
   1. NUCA HDD Installation Guidelines.

B. Maintain one (1) copy of documents on site.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing work of this Section with minimum 5 years documented experience.
   1. Work Experience: Include projects of similar scope and conditions.
   2. Furnish list of references upon request.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Provide temporary end caps and closures on piping and fittings until pipe is installed.

C. Protect pipe from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.

D. Accept products on site in manufacturer’s original containers or configuration. Inspect for damage.

E. Use shipping braces between layers of stacked pipe. Stack piping lengths no more than three layers high.

F. Store field joint materials indoors in dry area in original shipping containers. Maintain storage temperature of 60 to 85 degrees F.

G. Support pipes with nylon slings during handling.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

PART 2 PRODUCTS

2.1 DRILLING FLUID

A. Drilling Fluid: Liquid bentonite clay slurry; totally inert with no environmental risk.

2.2 PIPE

A. DESIGN REQUIREMENTS

A. Ductile Iron Pipe for Horizontal Directional Drilling (HDD):

1. General. Ductile iron pipe used for directional drilling shall meet all requirements of ANSI/AWWA C151/ A21.51 for a minimum pressure class of 350 psi. Unless otherwise specified pipe shall be lined with cement mortar per ANSI/AWWA C104/ A21.4, with all operations completed in a single facility by a one manufacturer. Pipe shall be AMERICAN Flex-Ring® or Engineer approved equal.
2. Pipe Joints - General. Joints used for directional drilling shall be boltless, flexible restrained, with smooth contoured bells and shall have the minimum properties as shown in Table 1. Joints with bulky glands or flanges that may prevent the smooth flow of the drilling fluid/soil slurry over the joint are not acceptable. Pipe shall be AMERICAN Flex-Ring® or Engineer approved equal.
3. Pipe Joints - Rock. Joints used for directional drilling through rock shall be AMERICAN Flex-Ring® or Engineer approved equal
4. Proof-of-Design Tests: The manufacturer shall make available to the Engineer representative proof-of-design tests for each size and type of flexible restrained joint pipe used. These tests shall establish the basis for the maximum allowable pulling loads shown in Table 1. Proof-of-design tests for the pulling heads shall also be made available to the Engineer.
5. External Loads and Buckling. In cases where the bore path alignment is at an extreme depth or if the Contractor anticipates high pumping pressures particularly for larger sizes of pipes, the Contractor shall consult the pipe Manufacturer to assure that the buckling strength of the pipe has been properly evaluated.
6. Pipe Weight - Net Unit Buoyancy. Pipe buoyant force or buoyant weight required in Table1included in this section shall be calculated based on the density of drilling fluid(s) to be used. Any counter-weight placed inside the pipe shall be free from any dirt, grease, oil, or other contaminants that may prevent proper disinfection for waterlines.

Table 1 - Flex-Ring Dimensions and Other Parameters

Nominal Pipe Size (in.)	Maximum Working Pressure[1] (psi)	Pipe Barrel O.D. (in.)	Pipe Bell Outside Diameter (in.)	Unit Weight Lined PC 350 Pipe (lb/ft)	Bulk Density of Empty Pipe (lb/ft3)	Net Unit Buoyancy[2], Empty Pipe in Water (lb/ft)	Allowable Pulling Loads (lbs)	Allowable Deflection (Deg.)
4	350	4.80	7.06	13	100	Minus 5	10,000	5
6	350	6.90	9.19	18	69	Minus 2	20,000	5
8	350	9.05	11.33	25	55	3	30,000	5
10	350	11.10	13.56	31	46	11	45,000	5
12	350	13.20	15.74	40	42	19	70,000	5
14	350	15.30	19.31	53	41	27	75,000	4
16	350	17.40	21.43	65	40	38	95,000	3.75
18	350	19.50	23.70	78	37	52	120,000	3.75
20	350	21.60	25.82	90	35	69	150,000	3.5
24	350	25.80	29.88	122	34	104	210,000	3
30	250	32.00	36.34	173	31	175	220,000	2.5
36	250	38.30	42.86	233	29	266	310,000	2
42	250	44.50	49.92	315	29	359	390,000	2
48	250	50.80	56.36	395	28	484	500,000	2

1 Working pressure is the maximum pressure rating of the joint and is based on its capability to resist thrust due to internal pressure. If higher working pressure is required, check AMERICAN. Pressure rating of the joint is limited by the pressure rating of the parent pipe.
2 Based on weight of empty (full of air) Pressure Class 350 Flex-Ring pipe with standard cement lining immersed in water. Positive numbers indicate such pipe will float.

7. Minimum Radius of curvature. The Contractor shall maintain the bore path alignment and a minimum radius equal to 100-feet per inch of nominal diameter, using 20-foot joint lengths radii that are indicated on the project drawings. Any alternate designs must be submitted to the Engineer for approval prior to commencement of drilling operations and shall be based on a radius of not less than 50-feet per inch of nominal diameter.
8. Bore path inside diameter. The finished inside diameter of the bore path shall be at a minimum nominally 1.5 times the outside diameter of the Flex-Ring bell (see Table 1) for pipe sizes 4-inch through 24-inch. The inside diameter of the bore path for pipe sizes 30-inch through 48-inch shall be at a minimum equal to the outside diameter of the Flex-Ring bell or Engineer Approved Equal (see Table 1) plus 12-inches. To assure proper bore path size and integrity, the bore path shall be swabbed prior to final pipe pullback.

B. Ductile Iron Pipe:
   1. Comply with ANSI/AWWA C151/A21.51 for a minimum pressure class of 350 psi.
   2. Joint: Flex-Ring or approved equal.

2.3 FILL MATERIALS

A. Backfill: Excavated subsoil or granular fill per Section 31 23 17 - Trenching.

2.4 WATER SOURCE

A. Water: Potable.

2.5 UNDERGROUND PIPE MARKERS

A. Trace Wire: Electronic detection materials for non-conductive piping products.
   1. Unshielded 10 gage copper wire.
   2. Conductive tape.

2.6 FLOWABLE FILL

A. Flowable Fill: In accordance with the South Carolina Department of Transportation Standards Specifications, 2007 or current edition.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify connection to existing piping system size, location, and invert elevations are in accordance with Drawings.

3.2 PREPARATION

A. Call Local Utility Line Information service at number shown on Drawings not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Locate, identify, and protect utilities indicated to remain from damage.

C. Notify utility company to remove and relocate utilities.

D. Identify required lines, levels, contours, and datum locations.

E. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

G. Establish minimum separation between utilities in accordance with applicable code.

H. Establish pipe elevations with not less than four (4) feet of cover.

3.3 DEWATERING

A. Intercept and divert surface drainage, precipitation, and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps or other means.

B. Develop and maintain substantially dry subgrade during drilling and pipe installation.

C. Comply with State and Municipal requirements for discharging water to watercourse, preventing stream degradation, and erosion and sediment control.

3.4 EXISTING WORK

A. Maintain access to existing facilities and services indicated to remain. Modify pipe installation to maintain access to existing facilities.

3.5 EXCAVATION

A. Excavate subsoil as specified in Section 31 23 17 - Trenching.

B. Excavate approach trenches and pits in accordance with shop drawings and as site conditions require. Minimize number of access pits.

C. Provide sump areas to contain drilling fluids.

D. Install excavation supports as specified in Section 31 23 17 - Trenching.

E. Restore areas after completion of drilling and carrier pipe installation.

3.6 DRILLING

A. Drill pilot bore with vertical and horizontal alignment as indicated on shop drawings.

B. Guide drill remotely from ground surface to maintain alignment by monitoring signals transmitted from drill bit.
   1. Monitor depth, pitch, and position.
   2. Adjust drill head orientation to maintain correct alignment.

C. Inject drilling fluid into bore to stabilize hole, remove cuttings, and lubricate drill bit and pipe.

D. Continuously monitor drilling fluid pumping rate, pressure, viscosity, and density while drilling pilot bore, back reaming, and installing pipe to ensure adequate removal of soil cuttings and stabilization of bore.
   1. Provide relief holes when required to relieve excess pressure.
   2. Minimize heaving during pullback.

E. Calibrate and verify electronic monitor accuracy during first 50 feet of bore in presence of Engineer before proceeding with other drilling. Excavate minimum of four test pits spaced along first 50 feet bore to verify required accuracy. When required accuracy is not met, adjust equipment or provide new equipment capable of meeting required accuracy.

F. After completing pilot bore, remove drill bit.

3.7 DRILLING OBSTRUCTIONS

A. When obstructions are encountered during drilling, notify Engineer immediately. Do not proceed around obstruction without Engineer's approval.

B. For conditions requiring more than 3-foot deviation in horizontal alignment, submit new shop drawings to Engineer for approval before resuming work.

C. Maintain adjusted bore alignment within easement or right-of-way.

3.8 PIPE INSTALLATION

A. After completing pilot bore, remove drill bit. Install multiple sized reamer as neccessary and pipe pulling head.
   1. Select reamer with minimum bore diameter required for pipe installation as determined by the drilling Contractor.

B. Attach pipe to pipe pulling head. Pull reamer and pipe to entry pit along pilot bore.

C. Inject drilling fluid through reamer to stabilize bore and lubricate pipe.

D. Install piping with horizontal and vertical alignment as shown on Drawings.

E. Protect and support pipe being pulled into bore so pipe moves freely and is not damaged during installation.

F. Do not exceed pipe manufacturer’s recommended pullback forces.

G. Install trace wire continuous with each bore. Splice trace wire only at intermediate bore pits. Tape or insulate trace wire to prevent corrosion and maintain integrity of pipe detection.
   1. Terminate trace wire for each pipe run at structures along pipe system.
   2. Provide extra length of trace wire at each structure, so trace wire can be pulled 3 feet out top of structure for connection to detection equipment.
   3. Test trace wire for continuity for each bore before acceptance.

H. Provide sufficient length of pipe to extend past termination point to allow connection to other pipe sections.

I. Allow minimum of 24 hours for stabilization after installing pipe before making connections to pipe.

J. Mark location and depth of bore with spray paint on paved surfaces, and wooden stakes on non-paved surfaces at 25-foot intervals.

3.9 SLURRY REMOVAL AND DISPOSAL

A. Contain excess drilling fluids at entry and exit points until recycled or removed from site. Provide recovery system to remove drilling spoils from access pits.

B. Remove, transport and legally dispose of drilling spoils off site.
   1. Do not discharge drilling spoils in sanitary sewers, storm sewers, or other drainage systems.
   2. When drilling in suspected contaminated soil, test drilling fluid for contamination before disposal.

C. When drilling fluid leaks to surface, immediately contain leak and barricade area from vehicular and pedestrian travel before resuming drilling operations.

D. Complete cleanup of drilling fluid at end of each work day.

3.10 BACKFILL

A. Install backfill and compact as specified in Section 31 23 17 - Trenching.

B. Backfill approach trenches and pits with subsoil fill to contours and elevations indicated on Drawings or of surrounding existing grade.

3.11 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Horizontal Position: 12 inches.

C. Maximum Variation From Vertical Elevation: 2 inches.

D. Minimum Horizontal and Vertical Clearance from Other Utilities: 12 inches.

E. When pipe installation deviates beyond specified tolerances, abandon bore, remove installed pipe, re-bore, and reinstall pipe in correct alignment.

F. Fill abandoned bores greater than 3 inches in diameter with grout or flowable fill material.

3.12 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Leakage Testing: Upon completion of pipe installation, test pipe in accordance with the following:
   1. 33 11 13 - Public Water Utility Distribution Piping.

C. Disinfection: As specified in Section 33 13 00 – Disinfection of Water Utility Distribution

D. Compaction Testing: As specified in Section 31 23 17 - Trenching.

E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.13 CLEANING

A. Upon completion of drilling and pipe installation, remove drilling spoils, debris, and unacceptable material from approach trenches and pits. Clean up excess slurry from ground.

B. Restore approach trenches and pits to original condition.

C. Remove temporary facilities for drilling operations in accordance with Section 01 50 00 - Temporary Facilities and Controls.

END OF SECTION

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Pipe and fittings for potable water line and fire water line.
2. Valves and valve boxes.
3. Fire hydrants.
4. Tapping sleeves and valves.
5. Air valves.
6. Underground pipe markers.
7. Thrust blocking.
8. Pressure testing

B. Related sections:
1. Section 31 23 17 - Trenching: Excavation and Backfill Requirements.
2. Section 33 05 23 - Trenchless Utility Installation (Jacking): Waterline Installation Under Roadways and Other Obstructions.
3. Section 33 05 24 - Utility Horizontal Direction Drilling. Waterline Installation Under Wetlands and Other Obstructions.
4. Section 33 12 13 - Water Service Connections: Tapping and Backflow Prevention at Water Main.
5. Section 33 13 00 - Disinfecting of Water Utility Distribution: Disinfection of Water Piping.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. American Water Works Association:
1. ANSI/AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. ANSI/AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. ANSI/AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in. for Water and Other Liquids.
4. ANSI/AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C115/A21.15 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. ANSI/AWWA C150/A21.50 - Thickness Design of Ductile-Iron Pipe.
7. ANSI/AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast for Water.
8. ANSI/AWWA C153/A21.53 - Ductile-Iron Compact Fittings, 3 in. through 24 in. and 54 in. through 64 in. for Water Service.

9. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
10. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
11. AWWA C110 - Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in. (76 mm through 1,219 mm), for Water.
12. AWWA C111 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
13. AWWA C115 - Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
14. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
15. AWWA C151 - Standard for Ductile-Iron Pipe, Centrifugally Cast.
16. AWWA C153 - Standard for Ductile-Iron Compact Fittings.
17. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
18. AWWA C502 - Dry-Barrel Fire Hydrants.
19. AWWA C504 - Rubber-Sealed Butterfly Valves.
20. AWWA C509 - Resilient-Seated Gate Valves, 3 in. through 12 in. NPS, for Water and Sewage Systems.
21. AWWA C550 - Protecting Interior Coatings for Valves and Hydrants.
22. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
23. AWWA C605 - Underground Installation of PVC and PVCO Pressure Pipe and Fittings.
24. AWWA C606 - Grooved and Shouldered Joints.
25. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 in. through 12 in. (100 mm through 300 mm), for Water Distribution.

C. ASTM International:
1. ASTM A36 - Standard Specification for Carbon Structural Steel
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
4. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
6. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
7. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
8. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

D. Manufacturer's Standardization Society of the Valve and Fittings Industry:
1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.

E. National Sanitation Foundation:
1. NSF 61 - Drinking Water System Components - Health Effects

F. National Fire Protection Association:
   1. NFPA 281 - Recommended Practice for Fire Flow Testing and Marking of Hydrants.

G. SCDOT Standard Specifications:
   1. Standard Specifications for Roads and Structures, latest edition, published by the South Carolina Department of Transportation.

1.3 DEFINITIONS

A. Utility Company - City of Columbia, South Carolina.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate piping layout, including piping specialties.

C. Product Data: Submit data on pipe materials, pipe fittings, valves, hydrants, and accessories.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

F. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

G. Contractor shall include a pipe layout diagram for the entire project to be provided to them by selected pipe manufacturer. Layout diagram shall include all pipe (restrained or unrestrained), fittings and appurtenances for review by the Engineer. Layout shall confirm all pipe deflections will be possible while keeping the pipe within the Owner’s permanent easement. Layout might include reduction of fitting or addition of fittings as deemed necessary by the pipe manufacturer. Engineer shall review submittals per the Contract Documents and in a timely manner in an effort to allow materials to be ordered.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with utility company standards.

B. Maintain one (1) copy of each document on site.

C. Require submitted evidence that the ductile iron pipe and fitting manufacturer has a minimum of ten years experience in material production of diameters noted on the plans and specifications.
   1. All ductile iron pipe shall be domestically manufactured in the United States.
   2. All pipe material suppliers shall be ISO registered or provide the services of an independent inspection agency.

a. Prior to the start of manufacturing, any manufacturer not meeting the ISO registration requirements shall submit to the Engineer the names of an independent inspection agency for approval.
b. The independent inspection agency shall be responsible for sample monitoring of chemical and mechanical tests, sample visual inspection of quality assurance tests performed on in-process pipe and fittings, and a sample visual and dimensional inspection or finished product for this project.
c. A certified inspection report from the independent inspection agency of all witnessed tests shall be supplied to the Engineer within ten (10) days of completion of pipe manufacturing.
d. Chemical samples shall be taken from each ladle of iron and the manufacturers' chemical control limits shall be maintained for at least the following elements: carbon, sulfur, phosphorus, silicon, magnesium, chromium, manganese, tin, aluminum, cerium, copper, and lead.
e. When chemical values fall outside the manufacturer's control limits, additional mechanical property tests shall be performed to assure minimum mechanical properties are met.

D. Ductile Iron Pipe - Hydrostatic Testing:
1. Manufacturer to provide the hydrostatic testing as defined below:
a. All pipe 4" - 24" shall be tested per AWWA standards to 500 psi.
b. All pipe, 30-inches and larger, shall be subject to a factory hydrostatic test of at least 500 psi for a period of not less than 10 seconds after which time the pressure is to be elevated to a peak pressure that induces a stress in the pipe wall equivalent to 75% of the minimum specified yield of ductile iron (42,000 psi) as calculated by the following formula:

$$\mathbf{p} = \frac{\mathbf{2 f_s t}}{\mathbf{D}}$$

Where:
p = peak hydrostatic pressure
$\mathbf{f_s}$ = stress in pipe wall during hydrostatic test, which shall be 0.75 times the minimum yield strength of the ductile iron in tension, i.e., 42,000 psi.
t = nominal wall thickness, in.
D = outside diameter, in.

Factory Hydrostatic Test Pressures For Ductile Iron Pipe (30 inches and larger)

Pressure Class	**150**		**200**		**250**		**300**		**350**	
Pipe Size / Outside Diameter	**"t" (in)**	**Test Pressure (psi)**	**"t" (in)**	**Test Pressure (psi)**	**"t" (in)**	**Test Pressure (psi)**	**"t" (in)**	**Test Pressure (psi)**	**"t" (in)**	**Test Pressure (psi)**
30" / 32.00	0.34	669	0.38	748	0.42	827	0.45	886	0.49	965
36" / 38.30	0.38	625	0.42	691	0.47	773	0.51	839	0.56	921
42" / 44.50	0.41	580	0.47	665	0.52	736	0.57	807	0.63	892
48" / 50.80	0.46	570	0.52	645	0.58	719	0.64	794	0.70	868

54" / 57.60	0.51	558	0.58	635	0.65	711	0.72	788	0.79	865
60" / 61.60	0.54	552	0.61	624	0.68	695	0.76	777	0.83	849
64" / 65.70	0.56	537	0.64	614	0.72	691	0.80	767	0.87	835

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver and store valves in shipping containers with manufacturer's name and pressure rating labeling in place.

C. Block individual and stockpiled pipe lengths to prevent moving.

D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.

E. Store polyethylene materials out of sunlight.

PART 2 PRODUCTS

2.1 WATER PIPING

A. Ductile Iron Pipe (DIP):
1. Ductile iron pipe shall be in accordance with ANSI A21.50/AWWA C150 and conform to the requirements of A21.51/AWWA C151, latest standards.
2. All ductile iron pipe shall be domestically manufactured in the United States.
3. Push-on and restrained joint pipe shall have a minimum rated working pressure of 150 psi.
   a. All buried pipe shall be pressure class as follows:

Pipe Sizes (inches)	**Pressure Class (psi)**
4 - 12	350
14 - 20	250
24	200
30 - 64	150

4. Pipe wall thickness shall be in accordance to bury depth as shown on drawings.
5. Flange pipe or Victaulic grooved pipe shall be Class 53.

B. Ductile Iron Pipe Joints:
1. Ductile iron pipe and fittings shall be furnished with push-on joints, push-on restrained joints, mechanical joints, flanged joints, and grooved joints as required.
2. Pipe ends (spigot end, bell, and socket) for all pipe shall be gauged with suitable gauges at sufficiently frequent intervals to ensure compliance to the standard dimensions of ANSI/AWWA C151/A1.5, latest edition.
   a. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR).

3. Push-on joints shall conform to ANSI A21.11/AWWA C111 as manufactured by American Ductile Iron Pipe Company - Fastite, or, U.S. Pipe - Tyton, or equal as approved by the Engineer.
    a. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR).
4. Flange joints shall conform to ANSI A21.15/AWWA C115.
    a. Bolts and nuts shall conform to ANSI A21.11/AWWA C111.
5. Restrained joints shall be one of the following:
    a. American Fast-Grip, Flex-Ring, Field Flex-Ring, Lok-Ring.
    b. U.S. Pipe Field Lok, TR Flex, or HP Lok.
    c. EBBA Iron Megalug.
    d. Or Engineer approved equal.
6. Subaqueous ductile iron pipe joints shall be American Flex-Lok (ball and socket), or equal.
    a. Flex-Lok pipe shall be Class 56 minimum, with 15 degrees deflection.
    b. The ductile iron spherical socket shall be threaded onto the ductile iron pipe barrel with threads conforming to ANSI B2.1 adapted to standard ductile iron diameters.
    c. The ball end shall be threaded onto or integrally cast with the pipe barrel and machined to fit the adjoining pipe socket to provide constant compression of the gasket through the entire range of deflection of the assembled joint.
    d. Underwater lubricant is required with all ball and socket pipe.
7. Ductile iron pipe mechanical joints:
    a. AWWA C111.

C. Ductile Iron Fittings:
1. Mechanical Fittings / Restrained Fittings shall conform to ANSI A21.53/AWWA C153 (compact) or A21.10/AWWA C110 (standard).
2. Flanged Fittings shall conform to ANSI A21.10/AWWA C110.
    a. The AWWA C110 fitting flanges shall have facing and drilling which match AWWA C115 threaded-on flanges which also match ANSI B16.1 Class 125 flanges except where Class 250 are specifically noted.
3. All fittings to be rated for 250 psi (minimum).

D. Linings and Coatings:
1. Linings: Ductile iron pipe, specials, and fittings shall be lined with cement mortar lining in accordance with AWWA C104.
2. Coatings:
    a. Ductile iron pipe and fittings for buried service shall receive a 1 mil asphaltic coating in accordance per AWWA C151/ANSI A21.51 and AWWA C110/A21.10.
    b. All exposed piping shall be primed with Wasser FerroClad or Tnemec 37H-77, or Tnemec 140-1211, or equal.
    c. All exposed piping shall be coated with Tnemec Coatings system for water piping as recommended by the manufacturer’s representative. Tnemec is named and included in this section to establish a standard of quality. Equal product manufacturers may be submitted per section 01 60 00 – Product Requirements for “Or Equal” products for approval by

the Engineer. Contractor shall coordinate with the Owner for final color coating.

2.2 TAPPING SLEEVES AND VALVES

A. Manufacturers:
1. American Flow Control.
2. Clow Valve Company.
3. Mueller Company.
4. Engineer approved equal.

B. Tapping Sleeves:
1. Ductile iron or cast-iron dual compression type.
2. Outlet Flange Dimensions and Drilling: MSS SP-60.

C. Tapping Valves:
1. AWWA C500, double disc with non-rising stem. Inlet flanges shall conform to ASME/ANSI B16.1, Class 125 and MSS SP-60. Mechanical joint outlets shall conform to AWWA C111.

2.3 DOUBLE-DISC GATE VALVES

A. Manufacturers:
1. American Flow Control.
2. Clow Valve Company.
3. Mueller Company.
4. Engineer approved equal.

B. Furnish materials in accordance with utility company or governing agency requirements.

C. Double-Disc Gate Valves: AWWA C500, NSF 61; iron body, bronze trim.
1. Gate: Double disc parallel seat gate.
2. Stem: Non-rising stem.
3. Seals: O-ring stem seals.
4. Operating Nut: Square; open counterclockwise unless otherwise indicated.
5. Ends: Flanged, mechanical joint or bell end connections.
6. Coating: AWWA C550; interior and exterior.
7. Provide valves 16-inch diameter and larger with bypass valves and gear operators.
8. Sizes 12-inch Diameter and Smaller: 200 psig.
9. Sizes 14-inch Diameter and Larger: 150 psig.

2.4 RESILIENT WEDGE GATE VALVES

A. Manufacturers:
1. American Flow Control.
2. Clow Valve Company.
3. Mueller Company.
4. Engineer approved equal.

B. Furnish materials in accordance with utility company or governing agency requirements.

C. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron.
1. Resilient seats.
2. Stem: Non-rising bronze stem.
3. Operating Nut: Square; open counterclockwise unless otherwise indicated.
4. Ends: Flanged, mechanical joint or bell end connections.
5. Coating: AWWA C550; interior/exterior.
6. Sizes 12-inch Diameter and Smaller: 200 psig.
7. Sizes 16-inch Diameter and Larger: 150 psig.

2.5 BUTTERFLY VALVES

A. Manufacturers:
1. DeZurik.
2. Mueller.
3. Pratt.
4. Engineer approved equal.

B. Size 2-inch to 24-inch: AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, ten infinite position lever handle.

C. Provide Class 250.

D. Valves open left.

E. Furnish materials in accordance with utility company or governing agency requirements.

F. 24-inch and 42-inch Butterfly Valves should be direct buried valves oriented in the horizontal direction due to their height.

G. All Butterfly Valves should confirm to the City of Columbia’s Water Distribution Technical Specifications.

2.6 VALVE BOXES

A. Valves 12-inch Diameter and Smaller: Cast iron, two-piece, screw type.

B. Valves Larger Than 12-inch Diameter: Cast iron, three-piece, screw type; round base.

C. Cast iron lid marked "WATER".

2.7 FIRE HYDRANTS

A. Manufacturers:
1. American - Darling B-84-B-5.
2. Clow Valve Company - Medallion Series.
3. Mueller - Centurion.
4. M&H Style 929 Reliant (epoxy shoe only).

B. Furnish materials in accordance with utility company or governing agency requirements.
   1. Blue reflective markers per the City of Columbia requirements shall be included.

C. Dry-Barrel Break-Away Type: AWWA C502; cast-iron body, compression type valve.
1. Bury depth: As indicated on the drawings.
2. Inlet hub connection: 6 inches.
3. Additional connections: One (1) standard pumper nozzle and two (2) nozzles for 2-1/2 inch diameter hose.
4. Valve opening: 5-1/4 inch diameter.
5. Ends: Mechanical joint or bell end.
6. Bolts and nuts: Corrosion resistant.
7. Coating: AWWA C550; interior.
8. Direction of opening: Clockwise.
9. Guaranteed for 250 psi working pressure.

D. One Pumper, Two Hose Nozzles.
1. Obtain thread type and size from local fire department.
2. Attach nozzle caps by separate chains.
3. Refer to Fire Hydrant Assembly Detail illustrated in the Construction Plans for additional information.
4. Refer to the City of Columbia's Water Distribution Specifications for additional details.

E. Finish: Primer and two coats of enamel, color in accordance with utility company, fire department, or NFPA 281 requirements.

2.8 AIR VALVES

A. General - Air Valves shall include the following types:
1. Air Release Valves.
2. Air/Vacuum Valves.
3. Combination Air Valves.

B. Air Release Valves:
1. General:
a. This specification is intended to cover the design, manufacture, and testing of 1/2" (13 mm) through 3" (150 mm) air release valves suitable for clean or raw water service with pressures up to 740 psig (5100 kPa).
b. Air release valves shall be automatic float operated valves designed to release accumulated air from a piping system while the system is in operation and under pressure. The capacity and pressure rating of the valve is dependent on the diameter of the precision orifice in the cover. A large inlet connection is required for proper air and water exchange.
2. Standards, Approvals and Verification:
a. Valves shall be manufactured and tested in accordance with American Water Works Association (AWWA) Standard C512.
b. Valves used in potable water service shall be certified to ANSI/NSF 61 Drinking Water System Components - Health Effects.
c. Manufacturer shall have a quality management system that is certified to ISO 9001:2000 by an accredited, certifying body.
3. Connections:

a. Valves 3" (76 mm) and smaller body shall be threaded with NPT inlets and outlets. The body inlet connection shall be hexagonal for a wrench connection. Larger valves shall have ANSI Class 125 flanged inlets.
b. The valve shall have two additional NPT connections for the addition of gauges, testing, and draining.

4. Design:
   a. The cover shall be bolted to the valve body and sealed with a flat gasket. Resilient seats shall be replaceable and provide drop tight shut off to the full valve pressure rating.
   b. Floats shall be unconditionally guaranteed against failure including pressure surges. Mechanical linkage shall provide sufficient mechanical advantage so that the valve will open under full operating pressure. Simple Lever Designs shall consist of a single pivot arm and a resilient orifice button. Compound Lever Designs shall consist of two levers and an adjustable threaded resilient orifice button.
5. Materials:
   a. The valve body and cover shall be constructed of ASTM A126 Class B cast iron for working pressures up to 300 psig. Higher pressure rated valves shall be constructed of ASTM A536 Grade 65-45-12 ductile iron.
   b. The orifice, float and linkage mechanism shall be constructed of Type 316 stainless steel. Non-metallic floats or linkage mechanisms are not acceptable. The orifice button shall be Viton for simple lever valves and Buna-N for compound lever designs.
6. Options:
   a. An optional vacuum check on the outlet shall be provided when specified to prevent air from re-entering the system during negative pressure conditions.
   b. Optional body materials include ASTM A216 Grade WCB cast steel, ASTM A351 Grade CF8M stainless steel, and ASTM B584 Alloy C83600 cast bronze.
   c. An optional screened hood on the outlet shall be provided when specified.
   d. An optional fully-ported brass ball valve shall be provided when specified to isolate the air release valve from the piping system.
   e. Valve interiors and exteriors shall be coated with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWA C550 when specified.
7. Cross Connection and Security Protection:
   a. All air valves (release, vacuum, etc.) installed in vaults or flood prone locations shall include an inflow preventer to prevent the introduction of contaminated water through the air valve outlet. The inflow preventer shall allow the admittance and exhausting of air while preventing contaminated water from entering during normal operating conditions. The inflow preventer shall be flow tested by an independent third party to certify performance. The third party shall be an approved testing lab of the American Society of Sanitary Engineers.
8. Manufacture:

a. The manufacturer shall demonstrate a minimum of five (5) years experience in the manufacture of air valves. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.
b. The exterior of the valve shall be coated with a universal alkyd primer.

C. Air/Vacuum Valve and Optional Regulated-Exhaust Device:
1. General:
a. This specification is intended to cover the design, manufacture, and testing of 1/2" (13 mm) through 20" (500 mm) air/vacuum valves suitable for pressures up to 740 psig (5100 kPa) clean or raw water service.
b. Air/Vacuum valves shall be fully automatic float operated valves designed to exhaust large quantities of air during the filling of a piping system and close upon liquid entry. The valve shall re-open during draining or if a negative pressure occurs.
2. Standards, Approvals and Verification:
a. Valves shall be manufactured and tested in accordance with American Water Works Association (AWWA) Standard C512.
b. Valves used in potable water service shall be certified to ANSI/NSF 61 Drinking Water System Components - Health Effects.
c. Manufacturer shall have a quality management system that is certified to ISO 9001:2000 by an accredited, certifying body.
3. Connections:
a. Valve sizes 3" (76 mm) and smaller shall have full size NPT inlets and outlets equal to the nominal valve size. The body inlet connection shall be hexagonal for a wrench connection.
b. Valve sizes 4" (100 mm) and larger shall have bolted flange inlets with plain outlets and protective hoods to prevent debris from entering the valve. Flanges shall be in accordance with ANSI B16.1 for Class 125 or Class 250 iron flanges and ANSI B16.5 for Class 150 or Class 300 steel flanges.
c. The valve shall have two additional NPT connections for the addition of Air Release Valves, gauges, testing, and draining.
4. Design:
a. The valve body shall provide a through flow area equal to the nominal valve size. A bolted cover with alloy screws and flat gasket shall be provided to allow for maintenance and repair.
b. Floats shall be unconditionally guaranteed against failure including pressure surges. The float shall have a hexagonal guide shaft supported in the body by circular bushings to prevent binding from debris. The float shall be protected against direct water impact by an internal baffle.
c. The resilient seat shall provide drop tight shut off to the full valve pressure rating. The seat shall be a minimum of 1/2" (12 mm) thick on 2" (50 mm) and larger valves and secured in such a manner as to prevent distortion. Valves with working pressures above 400 psig (2760 kPa) shall have metal seats with synthetic seals.

c. On valve sizes 4" (100 mm) and larger, the cover shall be fitted to the valve body by means of a machined register to maintain concentricity between the top and bottom guide bushings at all times. The float shall be double guided with a guide shaft extending through the float to prevent any contact with the body. A resilient bumper shall be provided to cushion the float during sudden opening conditions.

5. Materials:
   a. The valve body, cover, and baffle shall be constructed of ASTM A126 Class B cast iron for Class 125 and Class 250 valves. Class 300 ductile iron valves shall be constructed of ASTM A536 Grade 65-45-12 ductile iron. Class 300 steel valves shall be constructed of ASTM A216 Grade WCB cast steel.
   b. The float, guide shafts, and bushings shall be constructed of Type 316 Stainless Steel. Non-metallic guides and bushings are not acceptable. Resilient seats shall be Buna-N. Class 300 steel valves shall have a 316 Stainless Steel Seat with Buna-N seal to provide an initial contact to Buna-N with final metal to metal contact to prevent over compression of the resilient seal.
6. Options:
   a. An optional regulated-exhaust device, 2" (50 mm) and larger, shall be provided when specified to suppress pressure surges due to column separation or rapid changes in velocity and pressure in the pipeline.
      1) The regulated exhaust device shall be mounted on the inlet of the air/vacuum valve, allow free air flow in and out of the valve, close upon rapid air exhaust, and control the exit velocity to reduce surges.
      2) The Device shall be a flanged, globe style body with a center guided disc and seat assembly. The disc shall have threaded holes to provide adjustment of the air exhaust rate through the valve. The holes shall provide for a flow area of 5% of the nominal valve size.
      3) The material of the body shall be consistent with the Air/Vacuum Valve. The seat and disc shall be ASTM A351 Grade CF8M stainless steel or bronze.
   b. A flanged or screwed outlet connection shall be provided when specified for vault piping.
   c. A stainless steel screened outlet and hood shall be provided when specified for outdoor installations.
   d. Optional body materials include ASTM A536 Grade 65-45-12 ductile iron, ASTM A351 Grade CF8M stainless steel, and ASTM B584 Alloy C83600 cast bronze.
   e. An optional threaded hood with screen on 1/2" - 4" (13mm - 100mm) valves when specified.
   f. An optional isolation valve shall be furnished under the air/vacuum valve when specified. For sizes with threaded inlets, the isolation valve shall be a fully-ported brass ball valve. For sizes with flanged inlets, the isolation valve shall be an AWWA Class 150B or 250B butterfly valve with quarter-turn gear actuator and handwheel.

g. Valve interiors and exteriors shall be coated with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWA C550 when specified.

7. Cross Connection and Security Protection:
   a. All air valves (release, vacuum, etc.) installed in vaults or flood prone locations shall include an inflow preventer to prevent the introduction of contaminated water through the air valve outlet. The inflow preventer shall allow the admittance and exhausting of air while preventing contaminated water from entering during normal operating conditions. The inflow preventer shall be flow tested by an independent third party to certify performance. The third party shall be an approved testing lab of the American Society of Sanitary Engineers.
8. Manufacture:
   a. The manufacturer shall demonstrate a minimum of five (5) years experience in the manufacture of air valves. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.
   b. The exterior of the valve shall be coated with a universal alkyd primer.
   c. Air/Vacuum valves shall be Series 100S or 110F as manufactured by Val-Matic Valve & Mfg. Corporation, Elmhurst, IL, or approved equal.

D. Combination Air Valve and Optional Components:
1. General:
   a. This specification is intended to cover the design, manufacture, and testing of 1/2" (15 mm) through 20" (500 mm) combination air valves suitable for pressures up to 740 psig (5100 kPa) clean water or raw water service.
   b. Combination air valves shall be automatic float operated valves designed to exhaust large quantities of air during the filling of a piping system and close upon liquid entry. The valve shall open during draining or if a negative pressure occurs. The valve shall also release accumulated air from a piping system while the system is in operation and under pressure. The valve shall perform the functions of both air release and air/vacuum valves and furnished as a single body or dual body type as indicated on the plans.
2. Standards, Approvals and Verification:
   a. Valves shall be manufactured and tested in accordance with American Water Works Association (AWWA) Standard C512.
   b. Valves used in potable water service shall be certified to ANSI/NSF 61 Drinking Water System Components - Health Effects.
   c. Manufacturer shall have a quality management system that is certified to ISO 9001:2000 by an accredited, certifying body.
3. Connections:
   a. Dual body valve sizes 3" (75 mm) and smaller and single body valve sizes 4" (100 mm) and smaller shall have full size NPT inlets and outlets equal to the nominal valve size. The body inlet connection shall be hexagonal for a wrench connection.
   b. Larger sizes shall have bolted flanged inlets and threaded or flanged outlets with protective hoods to prevent debris from entering the valve.

Flanges shall be in accordance with ANSI B16.1 for Class 125 or Class 250 iron flanges and ANSI B16.5 for Class 300 steel flanges.

c. The valve shall have two additional NPT connections for the connection to gauges, testing, and draining.

4. Design:
   a. Both single and dual body valves shall provide a through flow area equal to the nominal size. Floats shall be unconditionally guaranteed against failure including pressure surges. The cover shall be bolted to the body and sealed with a flat gasket. A resilient bumper shall be provided on 4" (100 mm) and larger sizes to cushion the float during sudden opening conditions. The resilient seat shall be replaceable and provide drop tight shut off to the full valve pressure rating.
   b. Dual body combination valves shall consist of an air release valve piped to an air/vacuum valve with a quarter-turn, full-ported bronze ball valve on 4" and larger sizes.
      1) The air release valve shall have a leverage mechanism with sufficient mechanical advantage so that the valve will open under full operating pressure. Simple lever designs shall consist of a single pivot arm and a resilient orifice button. Compound lever designs shall consist of two levers and an adjustable threaded resilient orifice button.
      2) The air/vacuum valve sizes 4" (100 mm) and larger shall have a cover fitted to the valve body by means of a machined register to maintain concentricity between the top and bottom guide bushings at all times. The float shall be double guided with a guide shaft extending through the float to prevent any contact with the body. The float shall be protected against direct water impact by an internal baffle bolted to the cover or integrally cast in the body. The seat shall be a minimum of 1/2" (12 mm) thick on 2" (50 mm) and larger valves and secured in such a manner as to prevent distortion. Valves with working pressures above 400 psig (2760 kPa) shall have metal seat with synthetic seals.
   c. Single body combination valves shall have an expanded outlet to provide full flow area around the guide mechanism. The valve shall have a double guided plug on 2" (50 mm) and larger sizes, and an adjustable threaded orifice button. The plug shall be protected against direct water impact by an internal baffle. On valve sizes 4" (100 mm) and smaller, the plug shall have a precision orifice drilled through the center stem. On valve sizes 6" (150 mm) and larger, air release and air/vacuum mechanisms shall be provided as separate units contained within the same body and meet the same design specifications for the dual body combination valve as indicated above.
5. Materials:
   a. The valve body and cover shall be constructed of ASTM A126 Class B cast iron for Class 125 and Class 250 valves. Class 300 ductile iron valves shall be constructed of ASTM A536 Grade 65-45-12 ductile iron. Dual Body Class 300 steel valves shall be constructed of ASTM A216 Grade WCB cast steel.
   b. The float, guide shafts, and bushings shall be constructed of Type 316 stainless steel. Non-metallic floats, linkage, or bushings are not

acceptable. Resilient seats shall be Buna-N. Class 300 steel Dual Body Valves shall have a 316 stainless steel seat with Buna-N seal to provide an initial contact to Buna-N with a final metal-to-metal contact to prevent over compression of the resilient seal.

6. Options:
   a. An optional regulated-exhaust device, 2" (50 mm) and larger, shall be provided when specified to suppress pressure surges due to column separation or rapid changes in velocity and pressure in the pipeline.
      1) The device shall be mounted on the inlet of the combination air valve, allow free air flow in and out of the valve, close upon rapid air exhaust, and control the exit velocity to reduce surges.
      2) The device shall be a flanged, globe style body with a center guided disc and seat assembly. The disc shall have threaded holes to provide adjustment of the air exhaust rate through the valve. The holes shall provide for a flow area of 5% of the nominal valve size.
      3) The material of the body shall be consistent with the combination air valve. The seat and disc shall be ASTM A351 Grade CF8M stainless steel or bronze.
   b. A flanged or screwed outlet connection shall be provided when specified for vault piping.
   c. A stainless steel screened outlet and hood shall be provided when specified for outdoor installations.
   d. Optional body materials include ASTM A536 Grade 65-45-12 ductile iron, ASTM A351 Grade CF8M stainless steel, and ASTM B584 Alloy C83600 cast bronze.
   e. An optional threaded hood with screen on 1/2" - 4" (13mm - 100mm) valves when specified.
   f. An optional isolation valve shall be furnished under the air/vacuum valve when specified. For sizes with threaded inlets, the isolation valve shall be a fully-ported brass ball valve. For sizes with flanged inlets, the isolation valve shall be an AWWA Class 150B or 250B butterfly valve with quarter-turn gear actuator and handwheel.
   g. Valve interiors and exteriors shall be coated with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWA C550 when specified.
7. Cross Connection and Security Protection:
   a. All air valves installed in vaults or flood prone locations shall include an inflow preventer to prevent the introduction pf contaminated water through the air valve outlet. The inflow preventer shall allow the admittance and exhausting of air while preventing contaminated water from entering during normal operating conditions. The inflow preventer shall be flow tested by an independent third party to certify performance. The third party shall be an approved testing lab of the American Society of Sanitary Engineers.

8. Manufacture:
   a. The manufacturer shall demonstrate a minimum of five (5) years experience in the manufacture of air valves. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.
   b. The exterior of the valve shall be coated with a universal alkyd primer.
   c. Combination air valves shall be Series 201C.2 (Single Body), Series 100S/22 (Dual Body), or Series 201CSS (Surge-Suppression) as manufactured by Val-Matic Valve & Mfg. Corporation, Elmhurst, IL, or approved equal.

E. Furnish materials in accordance with utility company or governing agency requirements.

2.9 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon and Trace Wire Tape: Brightly colored blue continuously printed with "WATER SERVICE" in large letters, minimum 6 inch wide by 4 mils thick, with magnetic detectable conductor manufactured for direct burial service.

B. Tracer Wire Shall be installed on all pipe alignments for future location convenience.

2.10 PRECAST CONCRETE VALVE VAULTS AND METER BOXES

A. Conform to Section 33 05 17 - Precast Concrete Valve Vaults and Meter Boxes.

B. Provide size and type as indicated on Drawings.

2.11 CONCRETE FOR THRUST RESTRAINT, ENCASEMENT AND CRADLES

A. Concrete: Class 4000 Concrete conforming to Division 700 of the SCDOT Standard Specifications.

2.12 BEDDING AND COVER MATERIALS

A. Bedding for Rigid Pipe (DIP, PVC C900, PVC C905, and PCCP): Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SP, SP-SM or SP-SC.

B. Bedding for Flexible Pipe (PVC-IPS): Clean course aggregate Gradation No. 57 conforming to Sections 1005 and 1006 of the South Carolina Department of Transportation Standard Specifications.

C. Backfill around Pipe and Above Pipe: As specified in Section 31 23 17 - Trenching.

2.13 ACCESSORIES

A. Polyethylene encasement:
   1. Encasement shall be in accordance with AWWA C105.
   2. Provide two (2) layers polyethylene encasement of pipe in the vicinity of gas lines and other utilities with stray currents where indicated on the plans.
   3. Minimum nominal thickness of 8 mils +/- 10%.

B. Steel Rods, Bolt, Lugs and Brackets: ASTM A36 or ASTM A307 carbon steel.

PART 3 EXECUTION

3.1 PREPARATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing utility water main size, location, and inverts are as indicated on Drawings.

3.2 EXCAVATION

A. Excavate pipe trench in accordance with Section 31 23 17 - Trenching for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.

B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.

C. Provide sheeting and shoring as required.

D. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches in compacted depth; compact to 95 percent.

3.3 INSTALLATION - PIPE

A. Install ductile iron pipe and fittings in accordance with AWWA C600 and manufactures' instructions.

B. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on Drawings.

C. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.

D. Maintain minimum 10-foot horizontal separation and 18-inch vertical separation of water main from sewer piping or as required by local code.

E. Install pipe to indicated elevation to within tolerance of 1/2 inch.

F. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.

G. Remove scale and dirt on inside and outside before assembly.

H. Flanged Joints: Not to be used in underground installations except within structures.

I. Route pipe in straight line. Relay pipe that is out of alignment or grade.

J. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, install air release valves as directed by Architect/Engineer.

K. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.

L. Prevent foreign material from entering pipe during placement.

M. Install pipe to allow for expansion and contraction without stressing pipe or joints.

N. Close pipe openings with watertight plugs during work stoppages.

O. Install access fittings to permit disinfection of water system performed under Section 33 13 00 - Disinfecting Water Utility Distribution Piping.

P. Install underground marking tape continuously 12 inches above pipe line.

Q. Establish elevations of buried piping with not less than 3 feet of cover. Measure depth of cover from final surface grade to top of pipe barrel.

3.4 INSTALLATION - FIRE HYDRANTS

A. Install fire hydrants; provide support blocking and drainage gravel; do not block drain hole.

B. Set hydrants plumb with pumper nozzle facing roadway; set hydrants with centerline of pumper nozzle 18 inches above finished grade and safety flange not more than 6 inches or less than 2 inches above grade.

C. Paint hydrants in accordance with local color scheme.

D. After hydrostatic testing, flush hydrants and check for proper drainage.

3.5 INSTALLATION - VALVES

A. Install valves in conjunction with pipe installation; set valves plumb.

B. Provide buried valves with valve boxes installed flush with finished grade.

3.6 INSTALLATION - TAPPING SLEEVES AND VALVES

A. Install tapping sleeves and valves in accordance with utility company requirements, as indicated on Drawings, and in accordance with manufacturer's instructions.

B. Have Engineer witness tap.

C. Excavate and expose pipe to be tapped, install tapping sleeve and valve, and have utility company perform tap.

3.7 POLYETHYLENE ENCASEMENT

A. Encase ductile iron piping in polyethylene where indicated on drawings to prevent contact with surrounding backfill material.

B. Install in accordance with AWWA C105.

C. Terminate encasement 3 to 6 inches above ground where pipe is exposed.

3.8 CONCRETE THRUST RESTRAINT

A. Provide valves, tees, bends, caps, plugs, and dead ends with concrete thrust blocks as indicated on drawings.

B. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair.

C. Do not encase fitting joints and flanges.

3.9 SERVICE CONNECTIONS

A. Install service connections in accordance with Section 33 12 13 - Water Service Connections.

3.10 BACKFILLING

A. Backfill and compact around sides and to top of pipe in accordance with Section 31 23 17 – Trenching.

B. Maintain optimum moisture content of material to attain required compaction density.

3.11 DISINFECTION OF POTABLE WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00 - Disinfecting Water Utility Distribution.

3.12 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Compaction Testing: Perform soil compaction tests in accordance with Section 31 23 17 - Trenching.

C. Pressure Tests: Perform pressure test on potable water distribution system in accordance with AWWA C600.

D. Notification: Notify Engineer, utility company, Owner, and testing agency 72 hours in advance of test and have witness test.

E. Test Pressure: Not less than 200 psi for all 24-inch water main installed on this project. Not less than 150 psi for all 42-inc water main installed on this project.

F. Pressure Test Procedure:

1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct concurrent pressure and leakage tests.
2. Provide equipment required to perform leakage and pressure tests.
3. Conduct tests for at least two-hour duration.
4. No pipeline installation will be approved when pressure varies by more than 5 psi at completion of hydrostatic pressure test.
5. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure. At conclusion of tests, remove corporation cocks removed and plug resulting piping openings.
6. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
7. Examine exposed piping, fittings, valves, hydrants, and joints carefully during pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.
8. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

   $L = (SD\sqrt{P}) / 148{,}000$

   L = allowable, in gallons per hour

   S = length of pipe tested, in inches

   D = nominal diameter of pipe, in inches

   P = average test pressure during leakage test, in pounds per square inch (gauge)

9. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

END OF SECTION

SECTION 33 12 13
WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe and fittings for domestic water service connections to buildings.
2. Corporation stop assembly.
3. Curb stop assembly.
4. Water meters and meter setting equipment.
5. Backflow preventers.
6. Underground pipe markers.
7. Bedding and cover materials.

B. Related Sections:
1. Section 31 23 17 - Trenching: Excavating backfilling and compacting for Work of this section.
2. Section 33 05 17 - Precast Concrete Valve Vaults and Meter Boxes
3. Section 33 13 00 - Disinfecting of Water Utility Distribution
4. Basis of Payment: Includes backflow preventer, fittings, and accessories.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

B. American Society of Sanitary Engineering:
1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.

C. ASTM International:
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
5. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
6. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
7. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

D. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

E. American Water Works Association:
   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   2. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
   3. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
   4. AWWA C702 - Cold-Water Meters - Compound Type.
   5. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
   6. AWWA C800 - Underground Service Line Valves and Fittings.
   7. WWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in. for Water Service.
   8. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

1.3 DEFINITIONS

A. Utility Company: City of Columbia, South Carolina.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Provide shop drawings for precast concrete vaults to include detail drawings showing the vault and accessories.

C. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance SCDOT Standard Specifications.

B. Maintain one copy of document on site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.

C. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.

D. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

A. Polyvinyl Chloride (PVC): AWWA C900 and AWWA C905, marked with NSF 61 designation for potable water use shall be used on water services greater than 3-inches.
   1. Pipe Class: DR 18, 150 psi.
   2. Fittings:
      a. PVC, AWWA C900 and AWWA C905.
      b. Ductile Iron, Mechanical Joint, AWWA C110.
   3. Joints:
      a. PVC, ASTM D3139 with ASTM F477 flexible elastomeric seals.
      b. Ductile Iron, Mechanical Joint, AWWA C111.
      c. Boltless Restrained Joints: Boltless, push-on type, joint restraint independent of joint seal. Conform to pipe manufacturers specifications.

B. Polyethylene Pipe: AWWA C901 for 160 psig pressure rating: To be used on residential or small commercial water service connections.
   1. Fittings: AWWA C901 molded or fabricated.
   2. Joints: Compression
   3. PE pipe shall be supplied in rolled sections long enough to complete run from supply piping to water meter and appurtenances.

2.2 CORPORATION STOP ASSEMBLY

A. Furnish materials in accordance with utility company standards.

2.3 CURB STOP ASSEMBLY

A. Furnish materials in accordance with City of Columbia Water Distribution Technical Specifications Section.

2.4 METER SETTING EQUIPMENT

A. Furnish materials in accordance with City of Columbia Water Distribution Technical Specifications Section.

2.5 WATER METERS

A. Furnish materials in accordance with City of Columbia Water Distribution Technical Specifications Section.

2.6 BACKFLOW PREVENTERS

A. Furnish materials in accordance with City of Columbia Water Distribution Technical Specifications Section.

2.7 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon and Trace Wire Tape: Brightly colored blue continuously printed with "WATER SERVICE" in large letters, minimum 6 inches wide by 4 mils thick, with magnetic detectable conductor manufactured for direct burial service.

2.8 PRECAST CONCRETE VAULT

A. Conform to Section 33 05 17 – Precast Concrete Vaults and Meter Boxes.

B. Shape and Size: As indicated on Drawings.

C. Frames and Covers: ASTM A48; Class 30B gray cast iron, machine finished with flat bearing surfaces. Furnish cover marked WATER SERVICE.

2.9 CONCRETE

A. Concrete: Class 4000 Concrete conforming to Division 700 of the SCDOT Standard Specifications.

2.10 BEDDING AND COVER MATERIALS

A. As specified in Section 31 23 17 -Trenching and drawings.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare pipe connections to equipment with flanges or unions.

3.2 INSTALLATION - CORPORATION STOP ASSEMBLY

A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the Engineer.

B. Provide service clamps for mains other than of cast iron or ductile iron mains.

C. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 12 inches apart longitudinally and staggered.

D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2-inch width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.

E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the Engineer.

3.3 EXCAVATION, BEDDING AND BACKFILL

A. Excavate pipe trench in accordance with Section 31 23 17 - Trenching for Work of this Section.

B. Place bedding material at trench bottom, level in one continuous layer not exceeding 6-inch loose thickness; compact to 95 percent in accordance with Section 31 23 17 - Trenching.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact to 95 percent in accordance with Section 31 23 17 - Trenching.

D. Maintain optimum moisture content of fill material to attain required compaction density.

3.4 INSTALLATION - PIPE AND FITTINGS

A. Maintain separation of water main from sewer piping in accordance with local code or a minimum of 10 feet horizontal and 18 inches vertical distance.

B. Group piping with other site piping work whenever practical.

C. Install pipe to indicated elevation to within tolerance of 5/8 inch.

D. Route pipe in straight line.

E. Install pipe to allow for expansion and contraction without stressing pipe or joints.

F. Install access fittings to permit disinfection of water system performed under Section 33 13 00 - Disinfecting Water Utility Distribution.

G. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.

H. Establish elevations of buried piping with not less than three (3) feet of cover.

I. Backfill trench in accordance with Section 31 23 17 - Trenching.

3.5 INSTALLATION - CURB STOP ASSEMBLY

A. Set curb stops on solid bearing of compacted soil.

B. Center and plumb curb box over curb stops. Set box cover flush with finished grade.

3.6 INSTALLATION - BACKFLOW PREVENTERS WATER METERS

A. Install positive displacement meters in accordance with AWWA M6, as indicated on Drawings, and in accordance with manufacture's instructions.

B. Install backflow preventer where indicated on Drawings and in accordance with manufacturer's instructions.

C. Comply with local water company requirements and plumbing codes regarding testing and installation requirements.

3.7 SERVICE CONNECTIONS

A. Install water service in accordance with utility company requirements with backflow preventer and water meter.

3.8 PRECAST CONCRETE VAULT

A. Construct valve vaults of precast concrete.

B. Install in accordance with Section 33 05 17 - Precast Concrete Valve Vaults and Meter Boxes.

C. Seal vault joints watertight with preformed plastic joint sealant compound. Apply asphalt waterproofing to exterior walls.

D. Seal annular space between pipe and wall sleeves as indicated on Drawings.

E. Install vault covers and frames; adjust to finished grade elevation.

3.9 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00 - Disinfecting Water Utility Distribution.

3.10 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Compaction testing for bedding and backfill: Conform to Section 31 23 17 - Trenching.

C. Pressure testing: Perform pressure test on water service connections in accordance with AWWA C600.

D. Notification: Notify Engineer, utility company, and testing agency 72 hours in advance of test and have them witness test.

E. Test Pressure: Not less than 200 psi or 50 psi in excess of maximum static pressure, whichever is greater.

F. Procedure:
1. After completion of pipeline installation, but prior to backfill and final connection to existing system, conduct concurrent pressure and leakage tests in accordance with AWWA C605.
2. Provide equipment required to perform leakage and pressure tests.
3. Conduct tests for at least two-hour duration.
4. No pipeline installation will be approved when pressure varies by more than 5 psi at completion of pressure test.
5. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure. At conclusion of tests, remove corporation cocks and plug resulting piping openings.
6. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
7. Examine exposed piping, fittings, valves, and joints carefully during pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.
8. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

$L = (SD\sqrt{P})/C$
L = allowable, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during leakage test, in pounds per square inch gauge
C = 133,200

9. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

END OF SECTION

SECTION 33 13 00

DISINFECTING WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes disinfection of potable water distribution and transmission system, and testing and reporting results.

B. Related Sections:
1. Section 33 11 00 - Water Utility Distribution Piping: Piping Product and Execution requirements for installation, testing, of water distribution piping.

1.2 REFERENCES

A. American Water Works Association:
1. AWWA B300 - Standard for Hypochlorites.
2. AWWA B301 - Standard for Liquid Chlorine.
3. AWWA B302 - Standard for Ammonium Sulfate.
4. AWWA B303 - Standard for Sodium Chlorite.
5. AWWA C600 - Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
6. AWWA C651 - Standard for Disinfecting Water Mains.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit procedures, proposed chemicals, treatment levels, and flushing plan for review. Due to the size of the water mains, the Contractor will be expected to submit a comprehensive chlorination, dichlorination, and flushing plan for all water main included on this project. Submittal shall include, but not be limited to, the proposed testing locations, proposed chlorination volume / mass, proposed de-chlorination location, proposed de-chlorination chemicals (volumes and mass), and proposed discharge locations. Flushing assemblies have been located on the Construction Plans in strategic locations which the Contractors may find useful.

C. Test Reports: Indicate results comparative to specified requirements. The test reports must include at a minimum the chlorine residual, as well as, the bacteriological testing analysis. Contractor shall note that the samples must be collected by personnel employed and licensed through an SCDHEC certified Laboratory.

D. Certificate: Certify cleanliness of water distribution system meets or exceeds specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Disinfection Report:
1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Name of person collecting samples.
5. Initial and 24 hour disinfectant residuals in treated water in ppm for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual after flushing in ppm for each outlet tested.
8. Report shall be on letterhead of laboratory licensed in the state of South Carolina whom collected and analyzed samples.

C. Bacteriological Report:
1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certify water conforms, or fails to conform, to bacterial standards of authority having jurisdiction.

D. Water Quality Certificate: Certify water conforms to quality standards of authority having jurisdiction, suitable for human consumption.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651; maintain one copy of documents onsite.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify piping system has been cleaned, inspected, and pressure tested.

C. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, and demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. Provide and attach required equipment to perform the Work of this Section.

B. Perform disinfection of water distribution system.

C. Introduce treatment into piping system.

D. Maintain disinfectant in system for 24 hours minimum.

E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.

F. Replace permanent system devices removed for disinfection.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Disinfection, Flushing, and Sampling:

1. Notify Engineer, utility company, Owner, and testing agency 72 hours in advance of test and have witness test.
2. Disinfect pipeline installation in accordance with AWWA C651. Use of liquid chlorine is not permitted.
3. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
4. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
5. After final flushing and before pipeline is connected to existing system or placed in service, employ an approved independent testing laboratory to sample, test, and certify water quality suitable for human consumption.
6. Contractor must include comprehensive flushing plan in submittals associated with this specification section. It is expected that the Contractor will keep the pipe clean during construction and plug or cap the termination of each line at the stop of each day to ensure minimal debris enters the new water main. Large Diameter Pipe should be swept clean of any debris prior to installation. Contractor should closely examine each joint during installation.

END OF SECTION