



City of Columbia, South Carolina

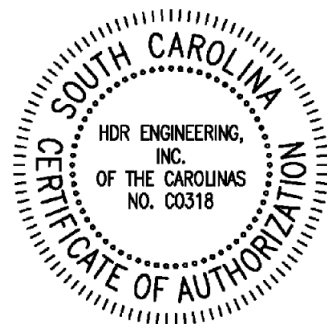
**30-Inch Force Main Relocation Under I-20 at CSX
Railroad**

Carolina Crossroad Phase 3C

**Construction Documents
Project Manual**

90% Submittal - Preliminary

October 2024



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CONTRACT SPECIFICATIONS

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SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.01 LOCATION OF WORK

- A. The work of this Contract is located along I-20 just northeast of the Saluda River and southwest of the Bush River Road interchange.

1.02 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to construct and install the proposed 30-inch wastewater force main in its entirety as shown on the Drawings and as specified herein.
- B. The Work includes, but is not necessarily limited to, the following:
 - 1. 531 LF of 30-inch wastewater force main, including pipe and fittings, to relocate an existing force main under I-20.
 - 2. 2 each of 30-inch plug valves.
 - 3. 410 LF of 48-inch steel casing pipe. 355 LF of which is to be installed by pipe jacking.
 - 4. Connection to existing 30-inch PCCP force main at each end, including bypass piping.
 - 5. Access road and traffic control off I-20 down into the site.

1.03 WORK BY OTHERS

- A. The following work will be performed by others after the completion of the Work of this Contract.
 - 1. Widening of I-20 as part of the Carolina Crossroads program.
- B. Refer to Article 8 of the General Conditions for additional requirements.

1.04 CONTRACTOR'S USE OF PREMISES

- A. Contractor shall limit the use of the premises for his/her Work and for storage to allow for:
 - 1. Work by other contractors and/or SCDOT.
 - 2. Owner operation and maintenance of the existing sewer system.
 - 3. Public use.
- B. Coordinate use of premises with Owner, SCDOT, and other contractors.
- C. Contractor shall assume full responsibility for security of all his/her and his/her subcontractors materials and equipment stored on the site.

- D. If directed by SCDOT, Owner or Engineer, move any stored items which interfere with operations of SCDOT, Owner or other contractors at no additional cost to the Owner.
- E. Contractor shall obtain and pay for use of additional storage or work areas if needed to perform the Work.
- F. Use of premises shall be restricted to all applicable permit requirements and applicable City agreements such as easements.

END OF SECTION

SECTION 01026
APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This section includes the requirements that the Contractor shall follow for submitting applications for payment. Requirements in this section supplement additional requirements contained in Section 00700.
- B. Its noted that the City, at its sole discretion, may authorize the Engineer to act on its behalf for any or all the of the tasks describe herein.

1.02 RELATED WORK

- A. Section 00700 - Conditions of Contract.
- B. Section 01025 - Measurement and Payment.
- C. Section 01370 - Schedule of Values.

1.03 PROCEDURES FOR SUBMITTING APPLCIATIONS FOR PAYMENT

- A. The Contractor shall submit his draft Application for Payment on or before the third working day of each month, or another specific day established at the Pre-Construction Meeting as authorized by the City Construction Coordinator (CC). The City will pay the Contractor the value of the work performed, as approved by the Utility Coordinator (UC) or CC, less retainage, less the aggregate of previous payments, typically within 21 working days of receipt of final approved Application for Payment. Draft Applications for Payment that are submitted later will require additional time for processing for payment.
- B. The City approving authority, usually the CC or UC, will review the draft Application for Payment and provide the Contractor with comments typically within 10 working days of receipt. The Contractor shall then address all comments and be prepared to submit a final Application for Payment on the established date of the Monthly Construction Progress meeting. Final Applications for Payment that are submitted later will require additional time for processing for payment.
- C. Each Application for Payment shall be an itemized Application for Payment that includes the work completed as of the date indicated the application, with supporting documentation showing the extents of the work and/or quantities for which payment is requested. Supporting documentation shall be in a form such as drawings that represent the actual measurements and dimensions so they can be field verified and/or used in subsequent Applications for Payment. Previous quantities paid shall also be shown in the supporting documentation for comparison purposes and for tracking previous quantities paid and the respective locations at which they were paid.

- D. Each Application for Payment shall include a summary showing Adverse Weather Days incurred for the month and the supporting documentation from NOAA station at the Columbia Metropolitan Airport confirming the Adverse Weather experienced, as specified in Section 00700. Failure to submit this summary on a monthly basis forfeits the Contractor's rights to further adverse weather claims.
- E. Applications for Payment will be made using the Owner's standardized Application for Payment form(s). The UC or CC will provide the Contractor an electronic copy of the form(s) prior to the first pay request. The Contractor shall reference the project name, purchase order number, description, and Owner's project number on all pay requests.
- F. All final Applications for Payment must be addressed to the City Construction Management Division and mailed directly to the division's office at P.O. Box 147, Columbia, SC 29217. Four (4) original Application for Payments shall be signed, dated, notarized and submitted for payment. Payments will not be processed from copies. At the City's discretion, electronic submittals may be allowed if authorized at the Pre-Construction Meeting.
- G. If the Construction Management Team requests changes prior to payment or rejects payment in its entirety, the Contractor will be notified of those changes and/or the reasons for rejection and what the Contractor must do before the Application for Payment will be considered.
- H. Submittal of an itemized Application for Payment and supporting documentation by the Contractor shall indicate that the Contractor has inspected those portions of the work included in the application and has determined and certifies that all portions of the work are in compliance with the Contract Documents and that the quantities submitted for payment are true and accurate.
- I. Recommendations for payment will constitute a representation by the City based on supporting data that, to the best of the City's knowledge, information and belief, the work has progressed to the point indicated. However, recommendation for payment does not waive claims for defects, does not constitute acceptance of work not in accordance with the Contract Documents, does not indicate that the work was constructed in accordance with the Contract Documents and does not relieve the Contractor of the responsibility to correct any deficiencies or damaged work that may be found at a later date.
- J. If payment is requested on a basis of materials not yet incorporated into the work but which are delivered, suitably stored, and verified by the CC or UC, the bill of sale, invoice, or other documentation shall be submitted with the Application for Payment warranting to the City that the materials are free and clear of all liens and evidenced that the materials are covered by appropriate property insurance or other arrangements showing protection of materials. Include in the Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation: do not include overhead and profit on stored materials.

3. Provide summary documentation for stored materials. Submit and maintain a Stored Materials Log. The Stored materials Log will indicate the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- K. The City may withhold, in whole or in part, payments previously made to such extent as may be necessary in the City's opinion to protect the City from loss for which the Contractor is responsible, including loss resulting from acts and/or omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons or entities performing portions of the work for, or on behalf of, the Contractor or any of its subcontractors because of, but not limited to, the following:
 1. Defective work not remedied;
 2. Third party claims filed or reasonable evidence indicating probable filing or such claims unless security acceptable to the City is provided by the Contractor;
 3. Failure of the Contractor to make payments properly to subcontractors or for labor, materials and/or equipment;
 4. Reasonable evidence that the work cannot be completed for the unpaid balance of the Contract Sum;
 5. Damage to the City or another Contractor;
 6. Reasonable evidence that the work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
 7. Persistent and repeated failure to carry out the work in accordance with the Contract Documents.
- L. The Contractor agrees that he will indemnify and hold the City harmless from all claims growing out of the lawful demands of subcontractors, laborers, workmen, mechanics, material, men, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the performance of this contract. The Contractor shall, at the City's request, furnish satisfactory evidence that all obligations of nature hereinabove designated have been paid discharged, or waived. If the Contractor fails to do this the City may, after having served written notice on the Contractor, either pay unpaid bills, of which the City has written notice, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all lawful claims. When satisfactory evidence is furnished that all liabilities have been fully discharged, payment to the Contractor shall be resumed in accordance with the terms of this Contract. In no event shall the provisions of this paragraph be construed to impose any obligations upon the City to either the Contractor or his

surety. In paying any unpaid bills of the Contractor, the City shall be deemed the agent of the Contractor, and any payment so made by the City shall be considered as payment made under the Contract to the Contractor, and the City shall not be liable to the Contractor for any such payment made in good faith.

1.04 PROCEDURES FOR SUBMITTING APPLICATIONS FOR FINAL PAYMENT

A. The Contractor shall submit the following to the City prior to the City releasing final payment:

1. A certified copy of Engineer's Substantial Completion Punch List endorsed and dated by Owner/Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance. Owner/Engineer will promptly make such inspection and, when the Work is found acceptable under the Contract Documents and the Contract fully performed, the Owner/Engineer will promptly issue a final Certificate for Payment stating that to the best of the Owner/Engineer's knowledge, information and belief and on the basis of on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable.
2. In the event Contractor requests an inspection for final acceptance and it is determined that the Work is not ready and additional work is required, Contractor shall reimburse the Owner for all additional Engineer fees incurred by Owner as a consequence of such re-inspection, if such re-inspection is necessitated solely by the Contractor's default.
3. An affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the project for which the City or the City's property might be responsible or encumbered (less amounts withheld by the City) have been paid or otherwise satisfied.
4. A certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the City.
5. A written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents. Consent of surety, if any, to final payment. Data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the City.

B. The making of final payment and retainage shall constitute a waiver of Claims by the City except those arising from:

1. Liens, claims, security interests or encumbrances arising out of the Contract and unsettled.
2. Failure of the work to comply with the requirements of the Contract Documents.
3. Terms of all warranties and service plans required by the Contract Document.

C. Upon completion and final acceptance by the City of all work covered under this Contract, the City will pay to the Contractor the amount remaining to be paid under the Contract.

City of Columbia, South Carolina

30" FM Relocation Under I-20
30" FM Relocation Under I-20 roads Phase 3C
at CSX Railroad Carolina Crossroads Phase 3C - October 2024
90% Submittal - October 2024

END OF SECTION

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SECTION 01035
CHANGE ORDER PROCEDURES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDE

- A. Promptly implement change order procedures including providing full written data required to evaluate changes. Maintain detailed records of all work done on a time-and-material basis.
- B. Contractor shall maintain a Change Order Log. The Log shall include a sequential Change Order number, shall indicate both approved change orders (COs) and potential change orders (PCOs), description of the work, CO or PCO amount, and cumulative contract amounts. The Owner/ Engineer shall keep a similar log and the Contractor shall resolve any discrepancies between the Owner/Engineer log and his log at each monthly Construction Progress Meeting.

1.02 RELATED REQUIREMENTS

- A. Section 00500 - Contract.
- B. Section 00700 - Conditions of the Contract.
- C. Section 01026 - Applications for Payment.
- D. Section 01300 – Submittals.
- E. Section 01720 - Project Record Documents.

1.03 DEFINITIONS

- A. Change Order (CO) – if an amendment to the Contract Documents includes a change in the contract price or the contract time, such amendment must be set forth in a CO. The City and Contractor may amend terms and conditions of the Contract Documents that involve:
 - 1. Performance or acceptability of the work;
 - 2. The design (as set forth in the drawings, specifications, or otherwise) with approval of the Engineer, or;
 - 3. Other engineering or technical matters, without the approval of the Engineer.
- B. Work Change Directives (WCD) - a WCD will not change the contract price or the contract time but is evidence that the parties expect that the modification ordered or documented by a WCD will be incorporated in a subsequently issued CO. Contractor must submit any PCO seeking an adjustment of the contract price or the contract times, or both, no later than 30 days after the completion of the work set out in the WCD. Owner must submit any claim seeking an

adjustment of the contract price or the contract times, or both, no later than 60 days after issuance of the WCD.

- C. Field Orders (FO) – The Owner may authorize minor changes in the work or interpretations/clarifications of the Contract Documents if the changes or clarifications do not involve an adjustment in the contract price or the contract time and are compatible with the design concept of the project. Such changes will be binding on the City and also on Contractor. if Contractor believes that a FO justifies an adjustment in the contract price or contract time, or both, then before proceeding with the work at issue, the Contractor shall submit a PCO.
- D. Request for Proposal (RFP) – the Owner/Engineer may initiate changes by submitting a RFP to the Contractor.

1.04 PRELIMINARY PROCEDURES

- A. Owner/Engineer may initiate changes by submitting a RFP to the Contractor. The City may provide the Contractor with a standard RFP request form. The response to the RFP by the Contractor shall include:
 - 1. Detailed description of the change and its associated cost.
 - 2. Products required and location of the change.
 - 3. Supplementary or revised Drawings and Specifications.
 - 4. The projected time span for making the change and a specific statement as to whether overtime work is, or is not, authorized.
 - 5. A specific period of time during which the requested price will be considered valid.
- B. Such request is for information only and is not an instruction to execute the changes, nor to stop work in progress.
- C. Contractor may initiate a PCO by submitting a written notice to Owner, containing:
 - 1. Description of the proposed changes.
 - 2. Statement of the reason for making the changes.
 - 3. Statement of the effect on the contract price and time with supporting documentation.

1.05 WORK CHANGE DIRECTIVE AUTHORIZATION

- A. In lieu of a RFP, Owner/Engineer may issue a WCD for Contractor to proceed with a change for subsequent inclusion in a Change Order. The WCD shall be prepared on a form or format acceptable to the Owner.

- B. Authorization will describe changes in the work, both additions and deletions, with attachments of revised Contract Documents to define details of the change and will designate the method of determining any change in the Contract price and any change in Contract time.
- C. Owner/Engineer will sign and date the WCD Authorization as authorization for the Contractor to proceed with the changes.
- D. Contractor may sign and date the WCD Authorization to indicate agreement with the terms therein.

1.06 DOCUMENTATION OF PROPOSALS AND CLAIMS

- A. Support each quotation for either a lump-sum proposal or unit price which has not previously been established, with sufficient substantiating data to allow Owner/Engineer to evaluate the quotation.
- B. On request, provide additional data to support time and cost computations including:
 - 1. Labor required.
 - 2. Equipment required.
 - 3. Products required.
 - a. Recommended source of purchase and unit cost.
 - b. Quantities required.
 - 4. Taxes, insurance and bonds.
 - 5. Credit for work deleted from Contract, similarly documented.
 - 6. Overhead and profit.
 - 7. Justification for any change in Contract time.
- C. Support each claim for additional costs for work done on a time-and-materials basis with the following documentation:
 - 1. Name of the Owner's authorized agent who ordered the work and date of the order.
 - 2. Dates and times work was performed and by whom.
 - 3. Time record, summary of hours worked and hourly rates paid.
 - 4. Receipts and invoices for:
 - a. Equipment used, listing dates and times of use.
 - b. Products used, listing of quantities.
 - c. Subcontracts.

1.07 PREPARATION OF CHANGE ORDERS

- A. Contractor will prepare and submit a PCO to the Owner/Engineer. PCO shall be prepared on a form or format acceptable to the Owner.
- B. The City Construction Coordinator (CC) or Utility Coordinator (UC) will negotiate the PCO. At the City's sole discretion this task may be delegated to the Engineer.
- C. Owner/Engineer will add and track progress of PCO from receipt through to final determination on a PCO/CO log which will be reconciled monthly with the Contractor's PCO/CO log.
- D. PCO will describe reason for changes, changes in the work, both additions and deductions, with attachments of revised Contract Documents to define details of the change.
- E. PCO will provide an accounting of the adjustment in the Contract price and in the Contract time.
- F. CC will determine if PCO will become CO and prepare City CO form and submit to City for the certification process.
- G. City performs CO certification process which may include approval by the Assistant City Engineer for Design and Construction, City Engineer, Compliance, and Finance Department, and possibly the City manager and City Council.
- H. City receives executed CO and issues hard copy notification to Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01046 CONTROL OF WORK

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section is intended to ensure that the Contractor provides adequate labor, materials, and equipment to complete the construction with minimum disturbance to the public, private land, existing infrastructures, and other private property. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.

1.02 RELATED WORK

- A. Section 01570 - Maintenance and Protection of Traffic
- B. Section 02050 - Demolition Abandonment and Salvage
- C. Section 02270 – Erosion and Sediment Control
- D. Section 02767 - Sanitary Sewer Flow Control

1.03 LABOR AND EQUIPMENT

- A. Furnish all labor and equipment which will be sufficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress which will ensure the completion of the work within the Contract Time. If at any time such labor and equipment appears to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, Owner/Engineer may order the Contractor to increase the efficiency, change the character or increase the labor and equipment and the Contractor shall conform to such order. Failure of the Owner/Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.04 ACCESS TO THE SITE

- A. Representatives of the U.S. Environmental Protection Agency, the South Carolina Department of Health and Environmental Control and any other state and any local agencies having a direct interest in the work shall have access to the work wherever it is in preparation or progress and the contractor shall provide proper facilities and safety precautions as necessary for such access and inspection.

1.05 EMERGENCY RESPONSE

- A. The Contractor shall at all times (including nights, weekends or holidays) have a responsible person available to act in case of emergency repairs whom the Owner may contact. Upon notification of any emergency work necessary, the Contractor's representative shall immediately take steps to make such repairs as may be required.

- B. In case of any emergency which threatens loss or injury of property and/or safety or life, the Contractor will be allowed to act, without previous instructions from the Owner/Engineer, in a diligent manner. He shall notify the Owner/Engineer immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted for review by the Owner.
- C. Where the Contractor has not taken action but has notified the Owner/Engineer of an emergency threatening injury to persons or damage to the work or any adjoining property that is not in any way related or due to the Contractor's work, negligence or performance, he shall act as instructed or authorized by the Owner/Engineer.

1.06 PRIVATE LAND

- A. Do not enter or occupy private land outside of easements, except by written permission of the land owner.

1.07 PIPE AND OTHER UTILITY LOCATIONS

- A. Existing pipelines and utilities are located substantially as indicated on the Drawings. The Owner/Engineer reserves the right to make such modifications in new pipeline locations as may be found desirable to avoid interference with existing structures, pipes or utilities or for other reasons.
- B. Where fittings are noted on the Drawings, such notations are for the Contractor's convenience and does not relieve him from laying and jointing differently or for providing and installing additional items where required.

1.08 OPEN EXCAVATIONS

- A. Adequately safeguard all open excavations by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. Provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Remove bridges provided for access during construction when no longer required.
- B. The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits indicated in the Contract Documents. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Owner/Engineer may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street and/or requiring that the trench shall not remain open overnight.
- C. Take precautions to prevent injury to the public due to open trenches. Provide adequate light at all trenches, excavated material, equipment, or other obstacles which could be dangerous to the public at night.
- D. The Contractor shall keep trenches and excavated areas as well as the site construction areas free from water. The Contractor shall remove all water, including rain water, encountered during trench and sub-structure work by pumps, drains, and other approved methods. Additional dewatering requirements are specified in Section 02140.

1.09 MAINTENANCE OF TRAFFIC

- A. Traffic control, detours and signage shall be provided as shown on the Contract Documents and as specified in Section 01570.
- B. Unless permission to close a street is received in writing from the proper authority, place all excavated material so that vehicular and pedestrian traffic may be maintained at all times. If the construction operations cause traffic hazards, Contractor shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the Owner/Engineer.
- C. Take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist, or police protection provided for traffic while work is in progress. Be fully responsible for damage or injuries whether or not police protection has been provided.

1.10 NOISE CONTROL

- A. All construction work shall be in compliance with the City of Columbia Code of Ordinances, Article III – Noise and all applicable County and local municipality noise ordinances.
- B. Definitions – The following words, terms and phrases, when used in this section, shall have the meanings described below:
 - 1. *Decibel* is a unit of measurement of intensity of sound (the sound pressure level).
 - 2. *Octave band* is a means of dividing the range of sound frequencies into octaves, in order to classify sound according to pitch.
 - 3. *Octave band filter* means an instrument, standardized by the American Standards Association, used in conjunction with a sound level meter to take measurements in specific octave bands.
 - 4. *Sound level meter* means an instrument, standardized by the American Standard Association, used for measurement of the intensity of sound and calibrated in decibels.
- C. Measurement of Sound level
 - 1. For the purpose of measuring the intensity and frequencies of sound, sound level meters and octave band filters shall be employed by the Contractor if requested by the Owner when noise complaints persist. In the enforcement of this section, noise produced by the operation of motor-driven vehicles, stationary units, flying objects or other transportation facilities shall be included in the determination of the maximum decibel levels permitted.
 - 2. Sound of short duration, from forge hammers, punch presses and metal shears, etc. which cannot be measured accurately with the sound level meter, shall be measured with an impact noise filter provided by the Contractor as manufactured by the General Radio Company, or its equivalent, in order to determine the peak value of the impact. For sounds so measured, the sound pressure level set forth in Table 1 may be increased by six decibels.

3. Maximum Permitted Sound Levels – The Contractor shall ensure all his operations at all times are in compliance with the sound pressure levels delineated in Table 1.

TABLE 1. MAXIMUM PERMITTED SOUND PRESSURE LEVEL (IN DECIBELS)

Octave Band (cycles per second)	Sound Pressure Level (Decibels)	
	Residential Areas	Commercial Areas
0 - 75	65	79
75 - 149	60	74
150 - 299	55	66
300 - 599	55	59
600 – 1,199	45	53
1,200 – 2,399	45	47
2,400 – 4,799	40	41
4,800 – and over	40	39

1.11 CARE AND PROTECTION OF PROPERTY

- A. Be responsible for the preservation of all public and private property and use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, restore such property to a condition similar or equal to that existing before the damage was done, or make good the damage in other manner acceptable to the Owner/Engineer.

1.12 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

- A. Assume full responsibility for the protection of all buildings, pavement which is to remain, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, water works, storm drainage, sewer mains, telephone, fiber optics, electric and telephone cables, power lines & power poles, sprinkler systems, private out-buildings such as sheds, and other utilities whether or not they are shown on the Drawings. Carefully support and protect all such structures and utilities from injury of any kind. Immediately repair any damage resulting from the construction operations at no additional cost to the Owner.
- B. Assistance may be given the Contractor in determining the location of existing services. Existing underground utilities shown on the Drawings are based on record drawings provided by the City and field investigations. The City of Columbia and its agents, including the Engineer, do not warrant that they are complete or entirely accurate. The Contractor shall bear full responsibility for obtaining all locations of underground structures and utilities and is responsible for locating and marking existing utilities including (including existing water services, drain lines, sewers, valves, boxes, drainage structures, irrigation lines, electric lines, telecommunication lines) within the Construction limits before any construction activity.
- C. The Contractor shall locate these and other possible unknown utility lines and shall excavate and expose all existing underground lines as part of the excavation work under this contract. Be responsible for planning and coordinating the required work around the existing utilities

- D. Contractor shall coordinate location of the utilities with the owners of record for each utility.
- E. The Contractor shall be solely responsible and liable for any damage (i.e. such as cutting or disturbing, etc.) to any utilities resulting from or incidental to the Contractor's performance of these projects. The Contractor shall be responsible for notifying appropriate companies to protect or move the affected facilities, if any of the specified work is in the area of these affected facilities.
- F. Contractor shall coordinate the removal and relocation of all existing utilities with their respective owner and provide temporary services as needed until new services can be installed, tested and accepted.
- G. The power and phone companies may require that all poles within 5 feet of construction, or as noted on the Drawings, be held in place during construction by their own forces and will bill time and expenses. These costs shall be included in the unit cost of pipe and no additional cost will be considered. The Contractor is advised to familiarize himself with the proposed routing and location of utility poles before the submittal of bid. All of the above costs, including potential repair should any utility be damaged during construction, shall be the responsibility of the Contractor.
- H. The Contractor is responsible for maintaining all existing utilities to the users along the project corridor. The Contractor shall provide the method for maintaining service to the Owner for approval prior to the start of any construction. The payment for maintaining utilities service shall be included in the unit price bid items for the appropriate pipe items. No separate payment will be made.
- I. The flow in all sewers, drains, and watercourses encountered shall be maintained by the Contractor whenever such sewers, watercourses and drains are disturbed or destroyed during the construction of the work. They shall be restored by the Contractor at his expense with the same size pipe, or as directed by the Owner/Engineer. This includes pipes labeled to be restored by the Contractor on the Contract Drawings.
- J. The Contractor will notify all utility companies in writing at least 72 hours (excluding Saturdays, Sundays and Legal holidays) before excavating in any public way. Also contact SC811 Call Before You Dig at telephone number 811 at least 72 hours prior to start of work.
- K. Coordinate the removal and replacement of traffic loops and signals, if required for the performance of the work, at no additional cost to the Owner.

1.13 WATER FOR CONSTRUCTION PURPOSES

- A. In locations where a City of Columbia water supply is available, the Contractor shall be allowed to use water for construction purposes. In order to use water from a fire hydrant, the Contractor shall apply for a temporary hydrant meter. The City of Columbia shall waive all fees for such application, for this project, and waive all usage fees.
- B. If the City does not own the fire hydrants in the vicinity, the Contractor shall be responsible for obtaining the water and paying for any associated costs for usage.
- C. No fire hydrant shall be obstructed in case of fire in the area served by the hydrant.

- D. The express approval of the Owner shall be obtained before water is used. Waste of water shall be sufficient cause for withdrawing the privilege of use.

1.14 MAINTENANCE OF FLOW

- A. Provide for the flow of sewers, storm drains and water courses interrupted during the progress of the work. Discuss the entire procedure of maintaining existing flow with the Owner/Engineer well in advance of the interruption of any flow and provide a written plan and map of the proposed maintenance.
- B. Contractor is required to submit By-Pass pumping requirements including a pump around plan submittal. See also Section 02767 for additional requirements.

1.15 RESTORATION

- A. Where construction is called for through grassed areas, whether in City or private property, the sod shall be neatly cut, removed and carefully stored and kept watered until it is replaced by the Contractor. All grassed areas shall be replaced and Contractor is solely responsible for adequately watering the new sod 3 times a week for the first 3 weeks once sod is replaced. Topsoil underlying grassed areas, and all topsoil disturbed on private property, shall be removed for its full depth and stockpiled separate from the remainder of the material removed from the trench. The topsoil removed shall be replaced by the Contractor after the trenches have been backfilled.
- B. All trees and shrubbery interfering with the work or which may be damaged in pursuance of the work should be carefully removed, heeled and replaced by the Contractor. It is the practice of the City to permit property owners to extend their terraces, lawns, shrubbery and other plantings into the right-of-way. Where any such terraces, lawns, shrubbery or other plantings will be disturbed by the Contractor's equipment or by the trenching or laying of pipe lines, the Contractor will be required to remove, maintain in suitable condition, and replace all topsoil, sod, shrubbery and other things that may interfere with or be damaged by the work. Seeding such areas is unacceptable and shall be considered temporary until sodding can be accomplished.
- C. As work progresses, disturbed areas shall be completely restored at a rate consistent with the rate of utility installation. There shall never be any more than 100 linear feet of unrestored trench from pipe installation, as measured along the trench line. All work in this area must be completed including the reestablishment of permanent services, closing of all excavated pits, restoration of pavement, shoulders, ditches, etc. and restoration of grassed and shrubbery areas prior to continuation of project. This distance shall not be exceeded without prior approval of the Owner/Engineer.
- D. The Contractor shall clean up daily and dispose of all surplus materials and refuse, rubbish, scrap materials, false work, temporary structures, foundations and debris of every nature caused by his operations. The site of the work shall present a neat and orderly.
- E. There will be no direct payment for restoration and cleanup. All costs associated with restoration shall be included in the pipe unit prices as indicated in the Schedule of Values.

1.16 ABANDONMENT OF EXISTING UTILITIES

- A. All contents of each pipe, manhole or vault to be abandoned shall be pumped out to a suitable holding tank, truck or container and all contents disposed of in a manner and at a location acceptable to the Owner/Engineer.
- B. Where specified on the plans, Contractor shall abandon existing utilities in place unless called for removal. Contractor shall plug each 6-inch and larger pipe to be abandoned with a concrete plug and fill existing utilities with flowable fill or other approved material as approved by the Owner/Engineer. Flowable fill shall be pumped in.
- C. The frames and covers of all manholes and vaults shall be removed and the top sections shall be removed to 3 feet below existing grade. All pipe penetrations shall be plugged. The manholes and vaults shall be filled to the top with flowable fill.
- D. Existing water mains to be abandoned shall be abandoned in the sequence described on the Contract Documents. Utilities to be abandoned shall be abandoned in accordance with SCDOT and City of Columbia requirements.

1.17 DUST CONTROL

- A. Maintain all excavations, embankments, stockpiles, access roads, building sites, waste areas, borrow areas and all other work areas within or without the project boundaries free from dust which could cause standards for air pollution to be exceeded and which would cause a hazard or nuisance to others. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.
- B. Dust control shall be generally accomplished by the use of water; however, the use of calcium chloride may be used when necessary to control dust nuisance.
- C. Calcium chloride shall conform to AASHTO M144, Type I except the requirements for "total alkali chlorides" and other impurities shall not apply.
- D. Methods of controlling dust shall meet all air pollutant standards as set forth by Federal and State regulatory agencies and conform to South Carolina DHEC.

1.18 EROSION CONTROL

- A. Erosion control shall also follow the requirements of Section 02270

1.19 PROTECTION OF STREAMS AND SURFACE WATERS

- A. Take precautions to prevent, or reduce to a minimum, damage to any stream or surface water from pollution by debris, sediment or other material, or from the manipulation of equipment and/or materials in or near streams and surface waters. Water that has been used for washing or processing, or that contains oils or sediments, and stormwater that will reduce water quality of receiving waters, shall not be directly returned to streams or other surface waters. Divert such waters through a settling basin, filter or appropriate Best Management Practice before being directed into streams or surface waters.

- B. Do not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water or any storm sewer. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.
- C. Take preventative measures to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action plan approved by the Owner/Engineer. Submit two copies of approved contingency plans to the Owner/Engineer for information purposes only.
- D. Water being flushed from potable water structures or pipelines after disinfection shall be in accordance with Section 02612.

1.20 PROTECTION OF LAND RESOURCES, LAWNS, SHRUBBERY AND TREES

- A. Restore land resources within the project boundaries and outside the limits of permanent work to a condition that, after completion of clean-up, will approximate pre-construction conditions, appear to be natural, and not detract from the appearance of the project in the Owner's opinion. Confine all construction activities to areas shown on the Contract Drawings. All project restoration activities depicted on Contract Drawings shall be implemented.
- B. Trees shall not be disturbed unless specifically indicated for removal in the Contract Documents. Contractor shall take all measures necessary to protect trees and tree root zones during construction. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Contractor is required to notify the Owner/Engineer and the City of Columbia Forestry Department of any damage to trees during construction for a decision on the extent of repair and/or if replacement is necessary. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with tree dressing. Any such trees and shrubbery necessary to be removed shall be replaced and replanted at the contractor's expense. Trees may be removed only after written approval is obtained from the City. Cost of tree protection, replacement, repair, and removal shall be at the contractor's expense.
- C. Pruning of Trees to remain shall have only deadwood pruning and pruning only necessary for clearance of structures should be conducted. Requests for pruning to resolve conflicts with improvements and/or construction equipment shall be made in writing to City of Columbia Forestry Department. City arborists only shall complete needed pruning. No fertilizer should be applied to trees in the project area prior to construction.
- D. Outside of areas requiring earthwork for the construction of the new facilities, do not deface, injure, or destroy trees or shrubs, nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage. Where special emergency use is permitted, first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.
- E. Before beginning operations near them, protect trees that may possibly be defaced, bruised, injured, or otherwise damaged by the construction equipment, dumping or other operations, by installing boards, planks, or poles around trunks to protect against damage. Monuments and markers shall be protected similarly.

- F. Any trees or other landscape features scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to their original condition. The Owner/Engineer will decide the method of restoration to be used and whether damaged trees shall be treated and healed or removed and disposed of. If requested by the Owner/Engineer, a SC certified arborist shall conduct an inspection of damaged trees and submit recommendations for any tree repair to the Contractor. Should the services of a certified arborist be required due to tree damage caused by the Contractor, the cost for the certified arborist shall be the responsibility of the Contractor and not reimbursed by the Owner.
1. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1-in in diameter shall be coated as soon as possible with an approved tree wound dressing unless otherwise directed by the Owner/Engineer. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.
 2. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and are beyond saving in the opinion of the Owner/Engineer, shall be immediately removed and replaced.
- G. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner, and in compliance with applicable federal, state and local regulations.
- H. Where trenches cross private property or public rights-of-way through established lawns, sod shall be cut, removed, stacked and maintained in suitable condition until replacement is approved by the Engineer. Topsoil underlying lawn areas shall be removed and kept separate from general excavated materials until replacement. Once sod is replaced, the Contractor shall be responsible for adequately watering the sod three times a week for three weeks.
- I. Contractor shall comply with any additional requirements identified and agreed to by the Owner as identified on the easement documents included with these Bid Documents.

1.21 PROTECTION OF AIR QUALITY

- A. Burning at the project site for the disposal of refuse and debris will not be permitted.
- B. Provide systems for control of atmospheric pollutants.
1. Prevent toxic concentrations of chemicals.
 2. Prevent harmful dispersal of pollutants into the atmosphere.

1.22 POLLUTION CONTROL DURING CONSTRUCTION

- A. Maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out, or until the material concerned has become stabilized to the extent that pollution is no longer being created.
- B. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.

- C. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.
 - 1. Contaminated soils and liquids shall be stored, transported, and disposed of in accordance with local, State, and federal regulations and this contract.
- D. Care shall be taken to prevent, or reduce to a minimum, damage to any water resource from pollution by debris, sediment or other material, or from the manipulation of equipment and/or materials in or near such waters. Water that has been used for washing or processing, or that contains oils or sediments that will reduce water quality shall be diverted through an oil/water separator or filter before being discharged.
- E. No materials shall be dispersed or stockpiled in any wetland area. No excavated materials or materials to be used in backfilling shall be deposited within 100 feet of any watercourse, wetland area, or drainage facility without prior approval from the Owner/Engineer and regulatory agencies.
- F. The storage of fuel oil and refueling of equipment shall be restricted to designated areas approved by the Owner/Engineer and appropriate regulatory agencies.
- G. The removal and disposal of fuel, lubricants, grease, and other operating fluids from equipment designated for demolition or to be removed shall be done in accordance with current federal, state, and local regulations.
- H. Contractor shall not locate his storage of equipment and materials within 100 feet of wetland boundaries or floodplains.
- I. All debris and excess material will be disposed of outside the boundaries of wetland or floodplain areas in an environmentally sound manner as determined by the federal, state, and local regulations.
- J. Take special measures to prevent harmful substances from entering public waters.
 - 1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.
- K. All Contractor's equipment used during construction shall conform to all current federal, state and local laws and regulations.

1.23 SPARE PARTS

- A. Where spare parts are specified in the technical sections, furnish all spare parts recommended by the manufacturer or system supplier for one year of service. In addition, furnish all spare parts itemized in each Section.
- B. Collect and store all spare parts in an area to be designated by the Owner/Engineer. Furnish an inventory listing of all spare parts, the equipment they are associated with, the name and address of the supplier and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivery cost.

- C. Spare parts shall be packed in cartons, properly labeled with indelible markings with complete descriptive information including manufacturer, part number, part name and equipment for which the part is to be used and shall be properly treated for one year of storage.
- D. All grease, oil and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a one-year supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied.
- E. Any special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation and maintenance of any equipment shall be furnished with the respective equipment. Tools shall be furnished in heavy steel tool boxes complete with lock and duplicate special keys.

1.24 CLEAN UP AND DISPOSAL OF EXCESS MATERIAL

- A. During the course of the work, keep the site of operations as clean and neat as possible. Dispose of all residue resulting from the construction work and, at the conclusion of the work, remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and leave the entire site of the work in a neat and orderly condition.
- B. In order to prevent environmental pollution arising from the construction activities, comply with all applicable Federal, State and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and in other related sections.
- C. Disposal of excess excavated material in wetlands, stream corridors and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by him will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. The Contractor will be required to remove the fill and restore the area impacted at no additional cost to the Owner.

END OF SECTION

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SECTION 01050
PROJECT CONTROLS (SURVEYING)

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide and pay for field engineering services required for project; including but not limited to:
 - 1. Survey work required for project controls and layout.
 - 2. Certified as-built surveys specified herein.
 - 3. Certified as-built survey data to support record drawings as specified in Section 01720.
- B. Retain the services of a registered land surveyor licensed in the state of South Carolina:
 - 1. Identify existing control points and property line corners indicated on the Drawings.
 - 2. Identify existing and new easements and right-of-ways indicated on the Drawings.
 - 3. Verify and record all existing structure locations in the vicinity of, or adjacent to, the proposed Work.
 - 4. Maintain an accurate record of locations of all new buried piping and existing buried piping and other buried existing facilities (conduits, and structures) encountered and/or relocated during construction of the Work.
- C. There shall be no direct payment for this item, the cost of which shall be included in other Bid Items as directed in Section 01025.

1.02 RELATED WORK

- A. Section 01720 - Record Drawings
- B. Section 01740 - Contract Closeout

1.03 SUBMITTALS

- A. Submit, to the Engineer, the name, address and state of registration and license number of proposed registered land surveyor. Show minimum of 5 years of experience on similar sized projects.
- B. On request of the Owner/Engineer, submit documentation to verify accuracy of field engineering work.

1.04 QUALIFICATIONS OF SURVEYOR

- A. Registered land surveyor, licensed in South Carolina. Show minimum of 5 years of experience on similar sized projects.

1.05 SURVEY REFERENCE POINTS

- A. Existing basic horizontal and vertical control points for the project are those designated on Drawings.
- B. Locate and protect control points prior to starting site work and preserve all permanent reference points during construction.
 - 1. Make no changes or relocations without prior written notice to and approval by the Owner/Engineer.
 - 2. Report to the Owner/Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
 - 3. Require the registered surveyor to correctly replace project control points which may be lost or destroyed. Establish replacements based on original survey control.
 - 4. Coordinates on the plans are based on South Carolina State Plane Coordinate System: NAVD 88 Vertical Control and NAD 83 Horizontal Control unless otherwise noted. The data collection methods used for this project shall be survey grade.

1.06 PROJECT SURVEY REQUIREMENTS

- A. For work contained to an individual site or property, establish a minimum of two permanent bench marks on site, referenced to data established by survey control points.
- B. For pipeline projects, establish one permanent bench mark for every mile of new pipe.
 - 1. Record locations, with horizontal and vertical data, on the as-built Drawings.
 - 2. Permanent benchmarks shall be installed and spaced for convenient reference and used at locations along the pipeline route.
 - 3. Benchmarks shall be installed to National Geodetic Survey standards and shall include horizontal and vertical data, as well as the installation date.
- C. Establish lines and levels; locate and lay out:
 - 1. Site improvements
 - a. Stakes for grading, fill and topsoil placement.
 - b. Utility slopes and invert elevations.
 - c. Sidewalks, pavement, fencing, storm drainage facilities, and other finish surface work.
 - 2. Batter boards for structures.
 - 3. Building foundation, column locations and floor levels.
 - 4. Controlling lines and levels required for mechanical and electrical trades.
- D. If lines, levels or layouts are lost or destroyed, or if required by the Owner/Engineer, verify layouts by same methods.

- E. Establish all lines and grades prior to construction of line work for all forcemains, transmission mains, storm drainage piping, gravity sewers and other new utility lines at 100-ft increments, at defined breaks in grade, and at manholes.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 RECORDS

- A. Record Drawings shall be in accordance with Section 01720.
- B. Maintain a complete, accurate log of all control and survey work as it progresses.
- C. Update the project as-built survey as requested by the Owner/Engineer.
- D. Maintain an accurate record of new and existing piping, conduit and structure changes, revisions, relocations, and modifications.

END OF SECTION

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SECTION 01170
SPECIAL PROVISIONS

PART 1 GENERAL

1.01 GENERAL

- A. These special provisions are established for the benefit of the City of Columbia. Any discrepancies or ambiguities within these special provisions shall be interpreted to the best interest of the City of Columbia. Contractor forfeits all claims to misinterpretation of special provisions if no documented inquiry exists with the City of Columbia regarding special provision(s) in question.
- B. There will be no additional cost to the City of Columbia due to any postponement of construction. An extension of the contract time will be considered by the City of Columbia; however, extensions will be approved on a case-by-case basis.
- C. In the event of a dispute between the contractor and the City of Columbia during construction, the contractor shall convey their concerns to the City of Columbia Construction Administrator. If the contractor feels that their requests or concerns have not been appropriately considered, Contractor shall make a request in writing to Assistant City Engineer for Construction for resolution. Failure to comply with this provision could forfeit contractor's ability to be awarded future City of Columbia projects.
- D. All work shall be completed by individuals skilled in the type of work involved. When new work adjoins or connects to existing work, the latter shall be altered as necessary and connected in a substantial and approved workman-like manner. All work shall match as nearly as practical to existing, adjoining and/or adjacent similar work. All existing work which is to remain that is moved, disturbed, or damaged by the contractor's operation shall be replaced and restored properly to "as good or better" condition at no cost to the owner.
- E. Contractor is responsible for providing traffic control in compliance with South Carolina Department of Transportation (SCDOT) specifications, maintaining a proper safe work environment, repair of all private and/or public properties to "as good or better" condition than that which existed prior to construction, providing and maintaining access to all private and public properties impacted by the work, disposing of all applicable waste material, and having a representative on call twenty-four hours per day to handle emergencies that may develop during construction.
- F. The contractor shall provide all equipment, labor, materials, supplies, and resources required to complete the work. Any damaged materials, new or existing, will be replaced by the contractor at their expense. All work shall comply with the plans and specifications included as a part of these contract documents.
- G. The selected Contractor shall notify the Owner, in writing, of any comments and/or concerns regarding the work prior to the issuance of the notice to proceed of mobilization to the job site.

1.02 DOCUMENT MANAGEMENT

- A. The Clean Water 2020 Program has developed a document management system that will be utilized as a part of this project.

- B. The Contractor shall upload project related documents to the Clean Water 2020 SharePoint site, to include outreach plans, bonds and insurance, pay applications, schedules, site management information, meeting agendas/minutes, change orders, RFIs, submittals, work change directives, work summary logs, general correspondence, photos, and other project related information.
- C. The Contractor shall appoint employee(s) that will be responsible for accessing the document management site. These individuals should coordinate with the Clean Water 2020 program for training and access credentials.
- D. An Excel spread sheet titled "Contractor Work Summary" will be given to the Contractor at the pre-construction meeting and the Contractor shall submit this filled in spreadsheet for the cumulative work completed with each pay application.

1.03 INSURANCE

- A. Insurance requirements are specified in the Instructions to Bidders, Part 14, and are amended or supplemented as follows:
 - 1. Builders' Risk Insurance is not required for this project.
 - 2. The Engineer shall be named as an additional insured on the Commercial General Liability, Excess Liability and Comprehensive Automotive Liability policies.
 - 3. Provide a Waiver of Subrogation in favor of the Owner and the Engineer for the Commercial General Liability, Excess Liability, Comprehensive Automotive Liability and Workman's Compensation policies.

1.04 PROJECT COMPLETION TIME

- A. The Contractor shall substantially complete the project within 270 consecutive calendar days and fully complete the project within 300 consecutive calendar days from the date of commencement.
- B. Substantial Completion – The time at which the Work has progressed to the point where, in the opinion of the Owner/Engineer, the Work is sufficiently complete, in accordance with the Contract, so that the Work can be utilized for the purposes for which it is intended. Liquidated damages may be assessed for Contractor's failure to meet the Substantial Completion date.
- C. Final Completion – The time at which the Work has been fully completed to include demolition of existing facilities, completion of punch list items, paving, final sitework and landscaping, paving, and full demobilization and all else required by the Contract. Liquidated damages may be assessed for Contractor's failure to meet the Final Completion date.

1.05 LIQUIDATED DAMAGES

- A. The Contractor recognizes that the Owner will suffer financial loss if the Work is not completed within either or both the time of Substantial Completion and the time of Final Completion. The Contractor also recognizes the delay, expense, and difficulty to both parties involved of proving or contesting the amount of those losses. Instead of requiring proof of those losses, it is agreed that the Contractor shall be liable for and pay the following amounts to the Owner under Owner's damages as liquidated damages and not as a penalty.

Completion Milestone Date	Liquidated Damages (per calendar day)
Date of Substantial Completion	\$1,000.00
Date of Final Completion	\$1,000.00

- B. Liquidated damages will be assessed for the above listed amounts for each and every calendar day the Work remains incomplete beyond the date of Substantial Completion and the date of Final Completion, either date being independent of the other.

1.06 SUPERVISION

- A. The work shall be conducted under the general direction of the Owner and will be inspected by his appointed representatives. The Owner through his representatives will maintain a record of work done and see that the location and limit marks are kept in proper order. The presence of the Owner's representative(s) shall not relieve the Contractor of responsibility for the proper execution of the work.
- B. The Contractor shall furnish at his own expense such labor, organization and materials as may be reasonably necessary in inspecting and supervising the work. Should the Contractor refuse, neglect, or delay compliance with this requirement, the specified facilities may be furnished and maintained by the Owner and the cost thereof deducted from any amounts due, or to become due, the Contractor.
- C. The work shall be entirely under the control of the Owner, and the Owner or his authorized representative(s) shall have access to the same at all times.

1.07 ADVERSE WEATHER CONDITIONS

- A. In the event of temporary suspension of work or during inclement weather, or whenever the Construction Administrator shall direct, the contractor will, and will cause his subcontractors to protect carefully his and their work and materials against damage or injury from the weather. If, in the opinion of the Construction Administrator, any work or materials damaged or injured by reasons of failure of the Contractor or his subcontractors to protect their work, such materials shall be removed and replaced at the expense of the Contractor.
- B. The Owner has reviewed weather data available from the National Oceanic and Atmospheric Administration (NOAA) station at the Columbia Metropolitan Airport and determined a Standard Baseline of average climatic range for the project site.
1. Standard Baseline shall be regarded as the normal and anticipatory number of calendar days for each month during which construction activity shall be expected to be prevented and suspended by cause of precipitation in excess of one-tenth inch (0.10") liquid measure. Suspension of construction activity for the number of days each month as listed is the Standard Baseline is included in the Work and is not eligible for extension of Contract Time.
 2. Standard Baseline (based upon precipitation in excess of one-tenth inch liquid measure) established for this contract as follows:

<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
8	6	7	5	6	7	8	7	5	4	4	6

- C. Adverse Weather is defined as the occurrence of one or more of the following conditions which prevents exterior construction activity or access to the site within twenty-four (24) hours:
1. Precipitation (rain, snow, or ice) in excess of one-tenth inch (0.10") liquid measure.
 2. Temperatures which do not rise above 32 degrees f by 10:00AM.
 3. Sustained wind in excess of twenty-five (25) MPH
 4. Standing snow in excess of one inch (1.00")
 5. Any day the Owner has requested no work to be performed.
- D. A Weather Delay Day may be counted if adverse weather prevents work on the project for fifty percent (50%) or more of the Contractor's scheduled work day, including a weekend day or holiday if Contractor has scheduled construction activity that day.
- E. Adverse Weather may include "dry-out" or "mud" days, as determined by the Construction Administrator such as:
1. If the Contractor's activity is limited to approximately 50% of the Contractor's activity before the Adverse Weather occurrence, then one-half (1/2) a weather delay day will be counted. For example, if the Contractor is diking excavation and embankment areas to dry in situ moisture in the soils or hauling and placing unclassified excavation or borrow material to embankment before an Adverse Weather occurrence, but is able to continue diking excavation and embankment areas or placing unclassified excavation or borrow material, one-half (1/2) a Weather Delay Day will be allowed.
 2. If the Contractor's activity is limited to minor activity when compared to the Contractor's activity before the Adverse Weather occurrence, then one (1) weather delay day will be counted. For example, if the Contractor is diking excavation and embankment areas to dry in situ soils, hauling borrow material to embankment before an Adverse Weather occurrence, but is only able to disk excavation and embankment areas to dry them due to the Adverse Weather occurrence, one (1) Weather Delay Day will be allowed.
- F. If the Contractor is able to only perform diking operations to dry excavation and embankment areas due to in situ moisture in the soil, this is not considered an Adverse Weather occurrence or a Weather Delay Day and is considered to be a part of normal construction activities whether any other work can be performed or not.
- G. All weather data used to determine Adverse Weather for the project site during the course of work shall be data from NOAA station at the Columbia Metropolitan Airport. Therefore, the contractor shall on a monthly basis submit to the Construction Administrator a summary showing Adverse Weather incurred for the month and the supporting documentation from NOAA station at the Columbia Metropolitan Airport confirming the Adverse Weather experienced. Failure to submit on a monthly basis forfeits the Contractor's rights to further adverse weather claims.
- H. In the event of temporary suspension of work or during inclement weather, or whenever the Owner/Engineer shall direct, the Contractor and subcontractors shall provide an enclosure or special protection from weather and will cause his subcontractors to protect carefully his and

their work and materials against damage or injury from the weather without additional cost to the City. If, in the opinion of the Owner/Engineer, any work or materials are damaged or injured by reason of failure of the Contractor or his subcontractors to protect their work, such materials shall be removed and replaced at the expense of the Contractor. Partial payments under the contract will not relieve the Contractor from this responsibility. When materials and work at the site which have been partly paid for are not adequately protected by the Contractor, such materials will be protected by the City at the expense of the Contractor, and no further partial payment will be made thereon.

1.08 PROTECTION OF MATERIAL, WORK AND PROPERTY; AND INJURIES TO PERSONS AND PROPERTY

- A. The Contractor shall at all times take reasonable and proper precautions to protect and safeguard the City's, public and private property, including his own work and all materials of every description both before and after use in the work, from damage or injury or loss in connection with this contract.
- B. The Contractor shall at all times take reasonable and proper precautions to protect and safeguard persons and animals, and must maintain public safety during execution of this contract.
- C. The Contractor shall furnish, erect, install and maintain all necessary temporary works which shall include, but not be limited to, barricades, fences, railings, warning signs, traffic control devices and lights for protection of his work and excavations at night. A sufficient number of lights shall be placed about the work and shall be kept burning from twilight to sunrise. Barricades, warning signs, traffic control devices and other safety devices shall meet the requirements of OSHA, South Carolina Department of Transportation and City of Columbia requirements. No work will commence until the Contractor has secured approval from the agency responsible for the right-of-way in which construction is proposed.
- D. The Contractor shall be held responsible for all injuries to persons and animals and for all damages to the property of the Owner or others caused by or resulting from the negligence of himself, his employees or his agents, during the progress of or in connection with the prosecution of the work, whether within the limits of the work under the contract proper or as extra work.
- E. The Contractor must, as far as practical and consistent with good construction, permit access to private and public property and leave fire hydrants, catch basins, streets, etc., free from encumbrances.
- F. The Contractor must restore, replace or make good at his own expense, unless such was caused directly by errors contained in the Contract, by the City, or its duly authorized representatives, any and all damage, loss, or injury to persons, animals, and/or property caused by any negligence of omission or commission on his part or on the part of his agent, including sidewalks, curbing, sodding, pipes, conduits, sewers, buildings, fences, retaining walls, tanks, power lines, or any other private or public property to a condition of equal or better comparison to the condition of the property when he entered upon the work.
- G. In case of failure on the part of the Contractor to restore such property or make good such damage, the Owner may upon forty-eight (48) hours' notice proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from any money due or which may become due under this contract.

- H. The Contractor shall indemnify and hold harmless the Owner or the Engineer acting in behalf of the Owner from all suits and actions that may be brought against it by reason of any injury, or alleged injury, to the person or property of another resulting from negligence or carelessness in the execution of the work, or on account of any negligent act or omission, or improper methods or means of construction on the part of the Contractor, his representatives, or employees.

1.09 MENTOR-PROTÉGÉ PROGRAM

- A. All Contractors submitting a bid for this project are required to comply with the terms and conditions of the Mentor-Protégé Program (MPP). Additional information including definitions, application process, Mentor/Protégé responsibilities, requirements, and criteria are provided on the City's website.
- B. Mentor (the prime contractor) is required to designate a minimum of 20% of the total contract amount to the Team's Protégé selected for the project. Mentors are required to send in an explanation with their Implementation Plan if they assign less than 20% of the total contract amount.
- C. An MPP Project may consist of the Mentor Protégé Team as well as other named Protégés that will be utilized as subcontractors for the project. The Protégé team member must self-perform a minimum of 50% of their portion of work.

1.10 COLUMBIA DISADVANTAGED BUSINESS ENTERPRISE (CDBE) PROGRAM

- A. All Contractors submitting a bid for this project are required to comply with the terms and conditions of the Columbia Disadvantaged Business Enterprise (CDBE) Program.
- B. The bidder (prime contractor) is strongly encouraged to meet the CDBE goal by designating a minimum of 0% of the total contract amount to CDBE-qualified enterprises or providing documentation of good faith efforts, as defined in the CDBE guidelines, if meeting less than half of the CDBE goal.
- C. All Contractors submitting a bid for this project shall complete the Business Information Records for Subcontractors (CDBE) form contained in the contract documents. Any proposed changes in the list shall be submitted in writing to the Owner prior to the initiation of any action, as indicated on the form.

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 GENERAL

1.01 SCOPE OF WORK AND REQUIREMENTS

- A. The City Construction Coordinator (CC) or Utility Coordinator (UC), unless delegated to the Engineer, shall schedule and administer the Pre-Construction Conference and monthly Construction Progress Meetings throughout progress of the work. The CC or UC, unless delegated to the Engineer, shall prepare minutes of these meetings and distribute. The Contractor shall:
 - 1. Assist with preparation of agenda for all meetings.
 - 2. Make physical arrangements for meetings, except for the Pre-Construction Conference which shall be at a place and time dictated by the CC or UC.
 - 3. Distribute updated color copies (if applicable) of all schedules & Logs (i.e. Submittal Schedule, submittal Log, RFI Log, etc.).
 - 4. Attend all meetings.
- B. Ensure appropriate representatives of Contractor, subcontractors, utility owners, and suppliers attend meetings as necessary to act on behalf of the entity each represents.
- C. Ascertain that work is expedited consistent with Contract comments and construction schedules.
- D. There shall be no direct payment for this item, the cost of which shall be included in other Bid Items as directed in Section 01025.

1.02 RELATED REQUIREMENTS

- A. Section 01310 - Construction Schedules.
- B. Section 01300 - Submittals.
- C. Section 01720 - Record Documents.
- D. Section 01730 - Operating and Maintenance Manuals and Vender Training.
- E. Section 01740 – Contract Close Out.

1.03 PRE-CONSTRUCTION CONFERENCE

- A. Attend a Pre-Construction Conference typically prior to date of Notice to Proceed.
- B. Location: A central site, convenient for all parties, designated by the Owner.
- C. Attendance
 - 1. Owner's Representative.

2. Engineer and his/her professional consultants.
3. Contractor's Superintendent.
4. Major Subcontractors.
5. Major suppliers.
6. Utilities
7. City CC
8. City Utility Coordinator (UC).
9. Others as appropriate.

D. Agenda and Tracking Logs

1. The City CC or UC will distribute the agenda prior to the day of the meeting and the Contractor shall be asked to add items of particular interest or concern to that agenda.
2. The Owner/Engineer shall have prepared a list of required shop drawing submittals, a list of required testing procedures (field tests, shop tests, and performance tests), a list of required warranties, and a list of required material samples and distribute these lists to all parties at or prior to the Pre-Construction Conference. These lists shall be maintained by both the Engineer and Contractor throughout the project duration and reconciled at each Monthly Construction Progress Meeting.

1.04 WEEKLY PLANNED WORK MEETINGS

- A. Schedule and attend regular weekly planned work meetings if requested by the Owner following the first Monthly Construction Progress Meeting. Weekly planned work meetings provide members of the project team the opportunity to monitor the project on a less formal, but more frequent basis. Frequency of these meetings may be modified, including more frequent than weekly, based on the complexity of the project and on projected need as jointly determined by the CC/UC and Contractor.
- B. The participants will discuss the planned week's work for the project and any key issues that may affect the progress of the project. The Contractor shall meet weekly or as needed with the City's CC/UC to discuss the planned week's work for the project and any key issues required to progress the project.
- C. These meetings will be held in the Project field office of the Contractor or other location mutually agreed to, and chaired by the Contractor. The UC will be in attendance and the CC on an as needed basis. The topics for discussion should include specific work elements that are occurring each week.
- D. The Contractor and UC should document minutes of the meetings and disseminate weekly.

1.05 MONTHLY CONSTRUCTION PROGRESS MEETINGS

- A. Schedule and attend regular monthly progress meetings every 30 Calendar days with the first meeting 30 Calendar days after the Pre-Construction Conference.
- B. Location of the meetings: Project field office of Contractor or Engineer or as determined by the Owner.
- C. Attendance
 - 1. City CC and/or UC
 - 2. Engineer and his/her professional consultants as needed.
 - 3. Subcontractors as appropriate to the agenda.
 - 4. Suppliers as appropriate to the agenda.
 - 5. Others as appropriate.
- D. Suggested Agenda
 - 1. Review, approval of minutes of previous meeting.
 - 2. Review of work progress since previous meeting.
 - 3. Field observations, problems and conflicts.
 - 4. Safety issues or other items of concern.
 - 5. Problems which could impede Construction Schedule.
 - 6. Review of off-site fabrication, delivery schedules.
 - 7. Corrective measures and procedures to regain projected schedule.
 - 8. Possible revisions to Construction Schedule.
 - 9. Progress and schedule for succeeding work period.
 - 10. Review submittal schedules;
 - 11. Reconciliation of all submittal, RFI, and testing logs, etc.
 - 12. Maintenance of quality standards.
 - 13. Pending changes and substitutions.
 - 14. Review of Contractors monthly pay requisitions.
 - 15. Other business.

1.06 SPECIALTY COORDINATION MEETINGS

- A. Schedule and attend any special meetings called by the City, Engineer or Contractor to assist in coordination or execution of the Work. Prepare agenda and meeting minutes along with documentation of all decisions reached or direction given.
- B. Invite subcontractors, utility owners, and/or suppliers as may be appropriate for such meetings.

1.07 CLOSE-OUT MEETING

- A. Schedule and attend a Project Close-Out Meeting in accordance with Section 01740. Comply with all requirements of Section 01740 prior to scheduling the meeting.
- B. With approval of the City CC or UC, the Close-Out Meeting may be held in conjunction with the final Monthly Construction Progress Meeting provided all requirements of Section 01740 are complied with in advance.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01300 SUBMITTALS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes the requirements for compiling, processing and transmitting submittals required for execution of the project. Submittals are categorized into two types, Action Submittals and Informational Submittals, as follows:
1. Action Submittals: Written and graphic information submitted by the Contractor that requires the Owner/Engineer's approval. The following are examples of action submittals, which may or may not be required for this project per the Contract Documents:
 - a. Shop Drawings (including working drawings, valve schedules, and product data).
 - b. Samples.
 - c. Operation & Maintenance Manuals.
 - d. Schedule of Values.
 - e. Equipment Delivery Schedule.
 - f. Applications for Payment.
 - g. Site Usage Plan (Contractor's staging and material laydown area).
 - h. Requests for Information (RFI).
 - i. Submittal Logs.
 - j. Construction Site Weekly Reports.
 - k. Record Documents.
 - l. Bypass Pumping.
 - m. Temporary Water Piping.
 2. Informational Submittals: Information submitted by the Contractor that does not require the Owner/Engineer's approval. The following are examples of informational submittals, which may or may not be required for this project per the Contract Documents:
 - a. Shop Drawing Schedule.
 - b. Construction Schedule.
 - c. Statements of Qualifications.
 - d. Health and Safety Plans.
 - e. Fire Safety Program.
 - f. Excavation/Sheet Piling Plans.
 - g. Maintenance of Flow Plan.
 - h. Maintenance of Traffic Plans.
 - i. Moisture and Mold Control Plan.
 - j. Dust and HVAC Control Plan.
 - k. Outage Requests.
 - l. Proposed Testing Procedures and Reports.
 - m. Vendor Training Outlines/Plans.
 - n. Warranties and Bonds.
 - o. A-Built Surveys.
 - p. Contract Close-out Documents.

3. There will be no direct payment for this work, the cost of which shall be included in other bid items.

1.02 RELATED WORK

- A. Section 00700 - General Conditions for the Contract.
- B. Section 01026 - Applications for Payment.
- C. Section 01050 - Project Controls (Surveying).
- D. Section 01310 - Construction Schedules.
- E. Section 01320 - Construction Photos and Video Recording.
- F. Section 01720 - Record Documents.
- G. Section 01730 - Operation and Maintenance Manuals.
- H. Section 01735 - Warranties and Bonds.
- I. Section 01740 - Contract Closeout.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. All submittals shall be clearly identified with the following:
 1. Date of Submission.
 2. Project Number.
 3. Project Name.
 4. Contractor Identification.
 - a. Contractor.
 - b. Supplier.
 - c. Manufacturer.
 - d. Manufacturer or supplier representative.
 - e. Identification of the Product.
 5. Reference to Contract Drawing.
 6. Reference to applicable specification section number, page and paragraph(s).
 7. Reference to applicable standards, such as ASTM or other industry standard numbers.
 8. Contractor's Certification statement.
 9. Identification of deviations from the Contract Documents, if any.
 10. Reference to previous submittal (for resubmittals).

B. Contractor's / Subcontractor Certification and additional Requirements:

1. Submittals shall be clear and legible, and of sufficient size for legibility and clarity of the presented data.
2. Each shop drawing, working drawings, product data, and sample shall have affixed to it the following Certification Statement:

"By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements."

C. Contractor shall maintain a log of all submittals. The submittal log shall be kept accurate and up to date. This log shall be submitted for review prior to the first submittal request for approval and reconciled with a similar log being kept by the Construction Coordinator, Utility Coordinator or Owner/Engineer on a monthly basis at the Construction Progress meetings. Separate logs shall be kept for shop Drawings, RFIs, and Substitutions. These logs should include the following items (as applicable):

1. Description.
2. Submittal Number.
3. Date transmitted to the Owner/Engineer.
4. Date returned to Contractor (from Owner/Engineer).
5. Status of Submittal (Approved/Not Approved/etc.).
6. Date of Resubmittal to Owner/Engineer and Return from Owner/Engineer (if applicable and repeat as necessary).
7. Date material released for fabrication.
8. Projected (or actual) delivery date .

D. Contractor shall utilize the following submittal identification numbering system:

1. The first character shall be a D, S, M or I which represents Shop Drawing (including working drawings and product data), Sample, Manual (Operating & Maintenance) or Informational, respectively.
2. The next five digits shall be the applicable Section Number.
3. The next three digits shall be the sequential number of each separate item or drawing submitted under each Specification Section, in the chronological order submitted, starting at 001.

4. The last character shall be a letter, A to Z, indicating the submission (or resubmission) of the same submittal, i.e., "A" = 1st submission, "B" = 2nd submission, "C" = 3rd submission, etc.
5. A typical submittal number would be as follows:
 - a. D-03300-008-B.
 - b. D = Shop Drawing (03300) = Section for Concrete.
 - c. 008 = the eighth different submittal under this Section.
 - d. B = the second submission (first resubmission) of that particular shop drawing.

1.04 VARIANCES

- A. Notify the Owner/Engineer in writing, at the time of submittal and clearly marked at the beginning, of any deviations in the submittals from the requirements of the Contract Documents.
- B. Notify the Owner/Engineer in writing, at the time of re-submittal (resubmission) and clearly marked at the beginning, of all deviations from previous submissions of that particular shop drawing, except those deviations which are the specific result of prior comments from the Owner/Engineer.
- C. "OR EQUAL" Items:
 1. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description specifically states that no like, equivalent, or "or-equal" item, or no substitution is permitted, other items of material, products or equipment of other Suppliers may be submitted to the City for review.
 2. If in the Owner/Engineer's discretion an item of material, product or equipment proposed by the Contractor is functionally equal to that named and sufficiently similar so that no change in related work will be required, it may be considered by the Owner/Engineer as an "or-equal" item. The review and approval of the proposed item may, in the Owner/Engineer's sole discretion, be approved. For the purposes of this specification, a proposed item of material, product or equipment may be considered functionally equal to an item so named if it is determined that all of the following are met:
 - a. It is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics.
 - b. It will reliably perform its intended function and achieve the results imposed by the design concept of the completed Project as a functioning whole.
 - c. Provide a record of performance and availability of responsive service.
 - d. The Contractor certifies that, if approved and incorporated into the Project, there will be no increase in Contract time or cost, and it will conform substantially to the detailed requirements of the item shown in the Contract Documents.
- D. Substitute Items:

1. If in the Owner/Engineer's discretion, an item of material, product or equipment proposed by the Contractor does not qualify as an "or-equal" item under the above Section, they will consider a proposed substitute item. The Contractor shall submit sufficient information to allow the Owner/Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute thereof. Requests for review of proposed substitute items of material, product or equipment will not be accepted by the Owner/Engineer from anyone other than the Contractor.
2. The Contractor shall request to use substitute materials, products and/or equipment in writing and shall provide the Owner/Engineer certification that the proposed substitute will:
 - a. Perform the functions and achieve the results called for in the plans and the design.
 - b. Be similar in substance to that specified.
 - c. Be suited to the same use in the same conditions as that specified.
3. The Contractor shall:
 - a. State the extent, if any, to which the use of the proposed substitute will prejudice the Contractor's achievement of project completion.
 - b. State whether or not the use of the proposed substitute item in the work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with the City for other work on the Project) to adapt the design to the proposed substitute item.
 - c. State whether or not incorporation or use of the proposed substitute item in connection with the work is subject to payment of any license or other fee.
 - d. Identify all variations and differences of the proposed substitute item from that specified.
 - e. Identify available Engineering, sales, maintenance, repair and replacement services.
 - f. Prepare an itemized estimate of the cost or credits that will result directly or indirectly from the use of the proposed item, including cost of redesign and claims of other Contractors affected by any resulting changes.

1.05 ACTION SUBMITTALS

A. General

1. Shop drawings, working drawings, and product data sheets 11-in x 17-in and smaller shall be bound together in an orderly fashion and bear the below Certification Statement on the cover sheet. The transmittal cover sheet for each identified shop drawing shall fully describe the packaged data and include a listing of all items within the package and include a place for the Owner/Engineer's stamp.
2. The review and approval of shop drawings, working drawings, product data, or samples by the Owner/Engineer shall not relieve the Contractor from the responsibility for the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Owner/Engineer will have no responsibility therefore.
3. Submittals that are acceptable will be reviewed and returned with comments/notes to the contractor in a timely manner after receipt. The need for re-submittals will not be a basis for an extension of contract time for the Contractor.

4. The Contractor shall not receive time extensions or additional cost for expired certifications and/or delays to submittal reviews and approvals.
5. Project work, materials, fabrication, and installation shall conform to approved shop drawings (including working drawings and product data) and applicable samples.
6. No portion of the work requiring a shop drawing (including working drawings and product data) or sample shall be started, nor shall any materials be fabricated or installed before approval of such item. Procurement, fabrication, delivery or installation of products or materials that do not conform to approved shop drawings shall be at the Contractor's risk. Furthermore, such products or materials delivered or installed without approved shop drawings, or in non-conformance with the approved shop drawings will not be eligible for progress payment until such time as the product or material is approved or brought into compliance with approved shop drawings. Neither Owner/Engineer will be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

B. Shop Drawings, Working Drawings, Product Data and Samples.

1. Shop Drawings.
 - a. Shop drawings as defined in the General Conditions, and as specified in individual Sections may include, but are not necessarily limited to, custom prepared data such as fabrication and erection/installation (working) drawings, scheduled information, setting diagrams, actual shop work manufacturing instructions, custom templates, valve schedules, wiring diagrams, coordination drawings, equipment inspection and test reports, and performance curves and certifications, as applicable to the work.
 - b. Prior to the beginning of construction, the Contractor shall submit (4) copies and one electronic version of each submittal and/or shop drawing for the City of Columbia's use; Contractor shall provide additional copies as needed for their records. Submittal and shop drawing review shall be limited to general design requirements only and shall not relieve the Contractor from responsibility for errors and/or omissions or responsibility for resulting consequences due to deviations from the Contract Documents. Changes shall not be made to any submittal after it has been reviewed; a new submittal must be presented for review and approval if changes are requested.
 - c. Contractor shall verify all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and coordinate each item with other related shop drawings and the Contract requirements.
 - d. All details on shop drawings shall clearly show the relation of the various parts to the main members and lines of the structure and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted.
 - e. All shop drawings submitted by subcontractors and vendors shall be reviewed by the Contractor. Contractor shall confirm, materials, dimensions, catalog numbers, technical data and performance criteria; and shall coordinate with other related shop drawings and the Contract requirements. In addition, Contractor shall confirm existing field conditions and dimensions and assure that the submittal is coordinated and

compatible with existing conditions. Submittals directly from subcontractors or vendors will not be accepted by the Owner/Engineer.

- f. The Contractor shall be responsible for the accuracy of the subcontractor's or vendor's submittal; and, for their submission in a timely manner to support the requirements of the Contractor's construction schedule. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractor or vendor to correct, before submission to the Owner/Engineer. All shop Drawings shall be approved by the Contractor.
- g. Delays to construction due to the untimely submission of submittals will constitute inexcusable delays, for which Contractor shall not be eligible for additional cost nor additional contract time. Inexcusable delays consist of any delay within the Contractor's control.
- h. Submittals for equipment specified under Divisions 11, 13, 14, 15 and 16 shall include a listing of installations where identical or similar equipment manufactured by that manufacturer has been installed and in operation for a period of at least five years or as otherwise specified in other specification sections.
- i. The Contractor, when required by the specifications, shall attach current documentation, certifications, the current Approval List published by SCDOT, etc. to appropriate submittals for review and approval by the Owner/Engineer. Submittals are required for materials, plants, etc. that are required to be certified and/or approved by the South Carolina Department of Transportation (SCDOT). Failure of the Contractor to attach the proper documentation to the submittals may result in delays of reviews and approvals.
- j. The Contractor shall be responsible for providing updated certifications/approvals prior to expiration of such. Uncertified and/or unapproved Contractors, materials, plants, etc. shall not participate in or perform work on this project until such time as documentation is provided to the Owner/Engineer showing recertification and/or approval.

2. Working Drawings

- a. Detailed installation drawings (sewers, equipment, piping, electrical conduits and controls, HVAC work, and plumbing, etc.) shall be prepared and submitted for review and approval by the Owner/Engineer prior to installing such work. Installation drawings shall be to-scale and shall be fully dimensioned.
- b. Piping working drawings shall show the laying dimensions of all pipes, fittings, valves, as well as the equipment to which it is being connected. In addition, all pipe supports shall be shown.
- c. Equipment working drawings shall show all equipment dimensions, anchor bolts, support pads, piping connections and electrical connections. In addition, show clearances required around such equipment for maintenance of the equipment.
- d. Electrical working drawings shall show conduits, junction boxes, disconnects, control devices, lighting fixtures, support details, control panels, lighting and power panels,

and Motor Control Centers. Coordinate all locations with the Contract Documents and the Contractor's other working drawings.

3. Product Data

- a. Product data, as specified in individual Specification Sections, include, but are not limited to, the manufacturer's standard prepared data for manufactured products (catalog data), such as the product specifications, installation instructions, availability of colors and patterns, rough-in diagrams and templates, product photographs (or diagrams), wiring diagrams, performance curves, quality control inspection and reports, certifications of compliance (as specified or otherwise required), mill reports, product operating and maintenance instructions, recommended spare parts and product warranties, as applicable.
- b. The product data shall also include the manufacturer's recommendations for the repair of damaged materials, along with a list of all replaceable parts with Suppliers contact information.

4. Samples

- a. Furnish samples required by the Contract Documents for the Owner/Engineer's approval. Samples shall be delivered to the Owner/Engineer as specified or directed. Unless specified otherwise, provide at least two samples of each required item. Materials or equipment for which samples are required shall not be used in the work unless and until approved by the Owner/Engineer.
- b. Samples specified in individual Specification Sections, include, but are not limited to: physical examples of the work (such as sections of manufactured or fabricated work), small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and other specified units of work.
- c. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify and Contract Requirements.
- d. Approved samples not destroyed in testing shall be sent to the Owner/Engineer or stored at the site of the work. Approved samples of the hardware in good condition will be marked for identification and may be used in the work. Materials and equipment incorporated in work shall match the approved samples. Samples which fail testing or are not approved will be returned to the Contractor at his expense, if so requested at time of submission.

C. Operation and Maintenance Manuals and Data (if required)

1. Operation and maintenance data shall be submitted in assembled manuals as specified in Section 01730. Such manuals shall include detailed instructions for Owner personnel on safe operation procedures, controls, start-up, shut-down, emergency procedures, storage, protection, lubrication, testing, trouble-shooting, adjustments, repair procedures, and other maintenance requirements.

D. Equipment Delivery Schedule

1. The Contractor shall also prepare a schedule of anticipated shipping dates for materials and equipment. It is intended that equipment and materials be so scheduled as to arrive at the job site just prior to time for installation to prevent excessive materials on hand for inventory and the necessity for extensive storage facilities at the job site.

E. Payment Applications

1. The City shall provide the Contractor an Application of Payment form at the Pre-Construction Meeting. This form shall be used for all monthly Applications for Payment unless otherwise directed by the City.
2. See also Specification Section 01026.

F. Site Usage Plan

1. Submit a proposed site staging plan, including but not limited to the location of office trailers, storage trailers and material laydown. Such plan shall be a graphic presentation (drawing) of the proposed locations; and, shall include on-site traffic modifications, and temporary utilities, as may be applicable.

G. Requests for Information (RFIs)

1. All RFI's will be submitted on the form mutually agreed upon by the Contractor and Owner/Engineer.

H. Submittal Logs

1. Contractor shall maintain logs of all submittals including shop drawings, RFIs, and substitutions. Additional requirements are as specified above in this Section.

I. Record Documents

1. No later than Substantial Completion, submit a record of all changes during construction not already incorporated into drawings – in accordance with Specification section 01720.

1.06 INFORMATIONAL SUBMITTALS

A. Shop Drawing Schedule

1. Prepare and submit a schedule indicating when shop drawings are required to be submitted to support the as-planned construction schedule. The submittal schedule shall allow sufficient time for preparation and submittal, review and approval, and fabrication and delivery to support the construction schedule.
2. Shop Drawing Schedule is to include any specified materials that has to be ordered very early due to long lead time.

B. Construction Schedule

1. Prepare and submit construction schedules and monthly status reports as specified herein and in Section 01310.

C. Proposed Testing Procedures and Reports

1. Prepare and submit testing procedures it proposes to use to perform testing required by the various technical specifications.
2. Test Records and Reports
 - a. Provide copies of all test records and reports as specified in the various technical specifications.

D. Manufacturer's Guaranty/Warranty/Bonds

1. Contractor to provide a list at the Preconstruction conference of all Warranties deemed to start before Substantial Completion.
2. Assemble a booklet or binder of all warranties and bonds as specified in the various technical specifications and in accordance with the specification on Warranties and Bonds; and provide two originals to the Owner/Engineer.

E. As-Built Surveys

1. Engage the services of a licensed land surveyor in accordance with the Project Controls (Surveying) specification Section 01050. Prior to Final Completion, provide an as-built survey of all the constructed facilities, as specified.

F. Contract Close-Out Documents

1. Submit Contract documentation as indicated in the specification Section 01740.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUBMITTAL SCHEDULE

- A. Provide an initial submittal schedule at the Pre-Construction conference for review by Owner/Engineer. Incorporate comments from Owner/Engineer into a revised submittal schedule.
- B. Maintain the submittal schedule and provide sufficient copies for review by Owner/Engineer. An up-to-date submittal schedule shall be provided at each project progress meeting.

3.02 TRANSMITTALS

- A. Prepare separate transmittal sheets for each submittal. Each transmittal sheet shall include at least the following: the Contractor's name and address, Owner's name, project name, project number, submittal number, description of submittal and number of copies submitted.
- B. Submittals shall be transmitted or delivered directly to the office of the Owner/Engineer, as indicated in the Contact Documents or as otherwise directed by the Owner/Engineer.

- C. Provide copies of transmittals forms or cover letters (without attachments) directly to the Construction Coordinator or Utility Coordinator.

3.03 ACTION SUBMITTALS

A. Contractor's Responsibilities

1. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work of other related Sections, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required). Coordinate with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. Extensions to the Contract Time will not be approved for the Contractor's failure to transmit submittals sufficiently in advance of the Work.
2. The submittals of all shop drawings (including working drawings and product data) shall be sufficiently in advance of construction requirements to allow for possible need of re-submittals, including review time for the Owner/Engineer.
3. No less than 30 calendar days will be required for Owner/Engineer's review time for shop drawings and O&M manuals involving only one Owner/Engineering discipline. No less than 45 calendar days will be required for Owner/Engineer's review time for shop drawings and O&M manuals that require review by more than one Owner/Engineering discipline. Resubmittals will be subject to the same review time.
4. Submittals of operation and maintenance data shall be provided within 30 days of approval of the related shop drawing(s).
5. Before submission to the Owner/Engineer, review shop drawings as follows:
 - a. make corrections and add field measurements, as required.
 - b. use any color for its notations except red (reserved for the Owner/Engineer's notations) and black (to be able to distinguish notations on black and white Documents).
 - c. identify and describe each and every deviation or variation from Contract documents or from previous submissions, except those specifically resulting from a comment from the Owner/Engineer on a previous submission.
 - d. include the required Contractor's Certification statement.
 - e. provide field measurements (as needed).
 - f. coordinate with other submittals.
 - g. indicate relationships to other features of the Work.
 - h. highlight information applicable to the Work and/or delete information not applicable to the Work.
6. Submit the following number of copies:
 - a. Shop drawings (including working drawings and product data) – Submit no fewer than four copies and an electronic version.
 - b. Samples – four copies and an electronic version.
 - c. Site Usage Plan – four copies and an electronic version.
 - d. Schedule of values – four copies and an electronic version.

e. Payment application format – four copies and an electronic version.

7. If Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, provide written notice thereof to the Owner/Engineer immediately; and do not release for manufacture before such notice has been received by the Owner/Engineer.
8. When the shop drawings have been completed to the satisfaction of the Owner/Engineer, carry out the construction in accordance therewith; and make no further changes therein except upon written instructions from the Owner/Engineer.

B. Owner/Engineer's Responsibilities

1. Owner/Engineer will not review shop drawings (including working drawings and product data) that do not include the Contractor's approval stamp and required certification statement. Such submittals will be returned to the Contractor, without action, for correction.
2. Partial shop drawings (including working drawings and product data) will not be reviewed. If, in the opinion of the Owner/Engineer, a submittal is incomplete, that submittal will be returned to the Contractor for completion. Such submittals may be returned with comments from Owner/Engineer indicating the deficiencies requiring correction.
3. If shop drawings (including working drawings and product data) meet the submittal requirements, Owner/Engineer will forward copies to appropriate reviewer(s). Otherwise, noncompliant submittals will be returned to the Contractor without action - with the Owner/Engineer retaining one copy.
4. Submittals which are transmitted in accordance with the specified requirements will be reviewed by the Owner/Engineer within the time specified herein. The time for review will commence upon receipt of submittal by Owner/Engineer.

C. Review of Shop Drawings (Including Working Drawings and Product Data) and Samples.

1. The review of shop drawings, working drawings, data and samples will be for general conformance with the design concept and Contract Documents. They shall not be construed:
 - a. as permitting any departure from the Contract requirements.
 - b. as relieving the Contractor of responsibility for any errors, including details, dimensions, and materials.
 - c. as approving departures from details furnished by the Owner/Engineer, except as otherwise provided herein.
2. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
3. If the shop drawings (including working drawings and product data) or samples as submitted describe variations and indicate a deviation from the Contract requirements that, in the opinion of the Owner/Engineer are in the interest of the Owner and are so minor as

not to involve a change in Contract Price or Contract Time, the Owner/Engineer may return the reviewed drawings without noting an exception.

4. Only the Owner/Engineer will utilize the color "RED" in marking submittals.
5. Shop drawings will be returned to the Contractor with one of the following codes.
 - a. Code 1 – "APPROVED" – This code is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.
 - b. Code 2 - "APPROVED AS NOTED" - This code is assigned when a confirmation of the notations and comments IS NOT required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.
 - c. Code 3 - "APPROVED AS NOTED/CONFIRM" - This combination of codes is assigned when a confirmation of the notations and comments is required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the Owner/Engineer within 15 calendar days of the date of the Owner/Engineer's transmittal requiring the confirmation.
 - d. Code 4 - "APPROVED AS NOTED/RESUBMIT" - This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the entire package. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the Owner/Engineer within 30 calendar days of the date of the Owner/Engineer's transmittal requiring the resubmittal.
 - e. Code 5 – "NOT APPROVED" – This code is assigned when the submittal does not meet the intent of the contract documents. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the requirements of the contract documents.
 - f. Code 6 – "COMMENTS ATTACHED" – This code is assigned where there are comments attached to the returned submittal, which provide additional data to aid the Contractor.
 - g. Code 7 – "RECEIPT ACKNOWLEDGED (Not subject to Owner/Engineer's Review or Approval)" – This code is assigned to acknowledge receipt of a submittal that is not subject to the Owner/Engineer's review and approval, and is being filed for informational purposes only. This code is generally used in acknowledging receipt of means and methods of construction work plans, field conformance test reports, and health and safety plans.
 - h. Codes 1 through 5 designate the status of the reviewed submittal. Code 6 indicates that some or all of the Owner/Engineer's comments are included in an attachment.

6. Repetitive Reviews: Shop drawings, O&M manuals and other submittals will be reviewed no more than twice at the Owner's expense. All subsequent reviews will be performed at the Contractor's expense. Reimburse the Owner for all costs invoiced by Engineer for the third and subsequent reviews.

D. Electronic Transmission

1. Action Submittals may be transmitted by electronic means provided the following conditions are met:
 - a. The above-specified material shall include a transmittal form with specified numbering configuration.
 - b. All other requirements specified above have been met including, but not limited to, coordination by the Contractor, review and approval by the Contractor, and the Contractor's Certification.
 - c. The submittal contains no pages or sheets larger than 11 x 17 inches.
 - d. The electronic files are PDF format (with printing enabled).
 - e. For Submittals that require certification, corporate seal, or professional embossment (i.e., P.E.s, Surveyors, etc.) transmit at least two hard-copy originals to the Owner/Engineer. In addition, provide additional photocopied or scanned copies, as specified above, showing the required certification, corporate seal, or professional seal.

3.04 INFORMATIONAL SUBMITTALS

A. Contractor's Responsibilities

1. Number of copies: Submit four copies, unless otherwise indicated in individual Specification sections.
2. Refer to individual technical Specification Sections for specific submittal requirements.

B. Owner/Engineer's Responsibilities

1. The Owner/Engineer will review informal submittals, schedules, and information and determine if acceptable, however, acceptance will not impose responsibilities on the Owner/Engineer or interfere with or relieve the Contractor from the Contractor's full responsibilities.
2. The Owner/Engineer will review each informational submittal within 14 Calendar days. If the informational submittal complies with the Contract requirements, Owner/Engineer will file for the project record. Owner/Engineer may elect not to respond to Contractor regarding informational submittals meeting the Contract requirements.
3. If an informational submittal does not comply with the Contract requirements, Owner/Engineer will respond accordingly to the Contractor within 14 Calendar days. Thereafter, the Contractor shall perform the required corrective action, including retesting, if needed, until the submittal, in the opinion of the Owner/Engineer, is in conformance with the Contract Documents.

C. Electronic Transmission

1. If hard copy requirements have been waived by the Owner, the following shall apply:
2. Informational submittals may be transmitted by electronic means providing all of the following conditions are met:
 - a. The above-specified material shall include a transmittal form with specified numbering configuration.
 - b. All other requirements specified above have been met including, but not limited to, coordination by the Contractor, review and approval by the Contactor, and the Contractor's Certification.
 - c. The submittal contains no pages or sheets larger than 11 x 17 inches.
 - d. The electronic files are PDF format (with printing enabled).
 - e. For Submittals that require certification, corporate seal, or professional embossment (i.e., P.E.s, Surveyors, etc.) transmit at least two hard-copy originals to the Owner/Engineer. In addition, provide additional photocopied or scanned copies, as specified above, showing the required certification, corporate seal, or professional seal.

END OF SECTION

P.E. CERTIFICATION FORM

The undersigned hereby certifies that he/she is a professional Engineer registered in the State of South Carolina and that he/she has been employed by

_____ to design
(Company Name)

(Insert P.E. Responsibilities)

In accordance with Specification Section _____ for the

_____.
(Name of Project)

The undersigned further certifies that he/she has performed the said design in conformance with all applicable local, state and federal codes, rules and regulations; and, that his/her signature and P.E. stamp have been affixed to all calculations and drawings used in, and resulting from, the design.

The undersigned hereby agrees to make all original design drawings and calculations available to the City of Columbia, South Carolina or Owner's representative within seven days following written request therefor by the Owner.

P.E. Name

Company Name

Signature

Signature

P.E. Registration Number

Title

Address

Address

SECTION 01310 CONSTRUCTION SCHEDULING

PART 1 GENERAL

1.01 PROGRAM DESCRIPTION

- A. A Critical Path Method (CPM) construction schedule shall be used to control the Work and to provide a basis for determining job progress. The construction schedule shall be prepared and maintained by the Contractor. All work shall be done in accordance with the established CPM schedule. The Contractor and all subcontractors shall cooperate fully in developing the construction schedule and in executing the work in accordance with the CPM schedule.
- B. The construction schedule shall consist of a computerized CPM network (diagram of activities) presented in a time-scaled graphic (print-out) with reports, as specified herein.
- C. There shall be no direct payment for this Work, the cost of which shall be included in other Bid Items as directed in Section 01025.

1.02 SUBMITTALS

- A. Contractor shall submit Interim, Preliminary Baseline, Baseline (also known as "as-planned") schedules, revisions, and Monthly Status Reports, all including graphics, reports, and narratives, and an as-built schedule, as specified herein.

PART 2 PRODUCTS

2.01 SOFTWARE

- A. Unless otherwise approved by the Owner/Engineer, the computer-based schedule shall be generated using Microsoft Project 2010 or higher or Oracle-Primavera P6 Professional Project Management Software Release 8.3 or higher.
- B. If the Contractor wants to pursue the use of another scheduling software (other than what is stated above) they need to submit a written request within 5 days of award of contract to the Owner/Engineer justifying their intended scheduling software selection.

2.02 NETWORK REQUIREMENTS

- A. Each schedule submittal shall contain and display the following identifying information:
 - 1. Project Title, Owner's Project Number
 - 2. Contractor's name
 - 3. All Contract milestones, as specified
 - 4. The project calendar(s) (including work week and holidays)
 - 5. Type of submittal (e.g., Interim, Preliminary Baseline, Baseline or Monthly Status Report)

6. Page number and total page count
7. Data date and run (print) date and time
- B. The network of activities shall show the order and inter-dependence of activities; and, show the sequence in which the work is to be accomplished, as planned by the Contractor. The basic concept of a network analysis diagram shall be followed to show how each activity is dependent on preceding activities (predecessors) and following activities (successors).
- C. All activities shall be sufficiently identified and/or described so that the scope of work of each activity is clear. All work tasks shall be broken down into appropriate scopes and durations to facilitate monitoring progress within a given month.
- D. Network activities shall be organized (grouped) by phases (or stages), physical areas, buildings, elevations, or other portions of the project.
- E. Separate network activities shall be provided for subcontractors.
- F. The number of network activities, sufficiency of description, and level of breakdown shall be subject to the Owner/Engineer's review and approval to confirm conformance with the specified requirements.
- G. The format of the schedule network graphic shall be a time-scaled logic diagram - with a list of network activities and the specified data fields presented adjacent to the graphic display.
- H. The following general requirements also apply to the network diagram.
 1. The Critical Path (the sequence of project network activities that add up to the longest overall duration and thereby determines the shortest time possible to complete the project) shall be identified - preferably in 'red'.
 2. Unless otherwise approved by the Owner/Engineer, the Contractor's work schedule shall be based on 'normal work week' as defined in the Contract Documents – (typically 40 hours per week, consisting of five 8-hour days).
 3. The graphics shall indicate the calendar(s) on which activity durations are based (i.e., 5-day workweek or 7 calendar day week). When multiple calendars or work weeks are used, the graphics shall clearly indicate which calendars are used where.
 4. The project calendar shall include exclusions for holidays observed by the Contractor and those indicated in the Contract Documents.
- I. Each network activity shall have the following information (fields) listed alongside the activity on the graphic display.
 1. Activity ID – a manually assigned designation (numeric or alphanumeric). The Contractor should use a logical approach to assigning identification to network activities to facilitate grouping (sorting) of activities.
 2. Activity Description needs to include an Action verb, Element, and Demarcation Points (for example: Excavate 6" CPVC Line from Sta. 14+15 to 16+01)

3. Original Duration – including allowances for adverse weather interruptions – normal for the project location, as defined in the Contract Documents.
4. Percent complete – the Contractor's estimated physical percent complete for each network activity as of the data date for the respective report.
5. Remaining Duration - a calculated value based on Original Duration of each network activity.
6. Early Start Date
7. Early Finish Date
8. Late Start Date
9. Latest Finish Date
10. Total Float

2.03 SUBMITTAL REQUIREMENTS

A. Each schedule submittal shall include the following elements:

1. Graphics – unless otherwise approved by the Owner/Engineer, the network graphics shall consist of 4 copies on 11X17 single sided sheets and an electronic PDF file; including a list of activities and the specified data fields.
2. Narrative
 - a. The Narrative shall consist of a written report by the Contractor providing an overview of the schedule – specific to each submittal.
 - b. The Narrative for the Baseline Schedule shall:
 - 1) explain key activities and assumptions on which the schedule is based;
 - 2) describe the Critical Path;
 - 3) discuss key deliveries that might adversely affect the project schedule; and,
 - c. The Narratives provided with Monthly Status Reports (updates) shall also identify:
 - 1) any changes the Contractor has made to the CPM logic (including any added, modified or deleted activities,
 - 2) any delays that have been encountered, and
 - 3) remedial actions or recovery steps the Contractor will employ to arrest and/or recover from such delays.

PART 3 EXECUTION

3.01 IMPLEMENTATION SCHEDULE

A. Interim Schedule

1. Within 15 days following the receipt of the Notice to Proceed, submit an Interim Schedule indicating the planned operations during the first 60 calendar days after Notice to Proceed. In addition, the Contractor shall indicate its general approach for the balance of the project.
2. While the Preliminary Baseline schedule is being developed, the Contractor shall update the Interim schedule on a monthly basis – indicating actual progress - until the Preliminary Baseline schedule is submitted.

B. Preliminary Baseline Schedule

1. Within 30 days following the receipt of Notice to Proceed, submit a proposed Preliminary Baseline Schedule. The Preliminary Baseline Schedule shall consist of a draft computer-generated CPM-schedule showing the entire Scope of Work. The Preliminary Baseline Schedule shall not include any actual progress earned during development of the schedule (i.e., as of the Notice to Proceed).
2. Within 5 days of submittal of the Preliminary Baseline Schedule, meet with the Owner/Engineer to discuss the review comments.
3. Once the Preliminary Baseline Schedule is submitted, Contractor shall discontinue updating the Interim Schedule. Provide monthly updates of the Preliminary Baseline Schedule until concurrence, acceptance, or approval of the Baseline Schedule.

C. Baseline (as-planned) Schedule

1. With 10 days of the review meeting on the Preliminary Baseline Schedule submittal, the Contractor shall incorporate the Owner/Engineer's comments into the network and submit a Baseline Schedule.

D. Monthly Status Reports

1. Monthly Status Reports shall include updated graphics and a narrative.
2. The Contractor shall provide Monthly Status Reports (schedule updates) commencing approximately 30 days after submission of the Interim Schedule.

E. As-Built Schedule

1. Upon achieving Substantial Completion, the Contractor shall submit an as-built schedule, showing all activities from the Notice to Proceed through Substantial Completion.

3.02 RESPONSIBILITY FOR SCHEDULE COMPLIANCE

- A. Whenever it becomes apparent from the current CPM schedule and CPM Status Report that delays to the critical path have resulted and the contract completion date will not be met, or when so directed by the Owner/Engineer, take some or all of the following actions at no additional cost to the Owner. Submit to the Owner/Engineer for approval, a written statement of the steps intended to take to remove or arrest the delay to the critical path in the approved schedule.
 1. Increase construction manpower in such quantities and crafts,

2. Increase the number of working hours per shift, shifts per day, working days per week,
3. Increase the amount of construction equipment, and/or
4. Reschedule activities to maximize the concurrence of activities and comply with the revised schedule.

END OF SECTION

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SECTION 01320
CONSTRUCTION PHOTOGRAPHS AND VIDEO RECORDING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to provide photographic documentation and video taping of the Project as specified herein.
- B. There shall be no direct payment for this Work, the cost of which shall be included in other Bid Items.
- C. Work includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Construction completion photographs.
 - 4. Preconstruction video recordings.

1.02 RELATED WORK

- 1. Section 01300 - Submittals.
- 2. Section 01720 - Record Documents.

1.03 REFERENCES

- A. Not Used.

1.04 SUBMITTALS

- A. Key Plan: Submit key plan of Project site and/or buildings with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction if applicable.
- B. Digital Photographs: Submit image files within seven days of taking photographs.
 - 1. File Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, City Project Number, and accompanied by key plan file.
 - 2. Submit digital photographs in data disc format as follows:
 - a. Full-size on recordable discs acceptable for USB drives.
 - b. Clearly and indelibly label using self-adhesive labels specifically designed for labeling of discs. Include on the label the project name, project number, and the time period covered by the photographs contained on the disc.

3. If requested by the Owner/Engineer, upload all digital photographs to the Project Management Information System as directed.
 4. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Engineer and/or City Construction Coordinator.
 - d. Name of Contractor.
 - e. Date and time photograph was taken.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier keyed to accompanying key plan.
- C. Video Recordings: Submit video recordings within seven days of recording.
1. Submit video recordings in digital video disc format acceptable to Owner/Engineer.
 - a. Full-size on recordable discs acceptable for USB drives.
 - b. Clearly and indelibly label using self-adhesive labels specifically designed for labeling of discs. Include on the label the project name, project number, and the time period covered by the photographs contained on the disc.
 2. If requested by the Owner/Engineer, upload all digital photographs to the Project Management Information System as directed.
 3. Identification: With each submittal, provide the following information:
 - a. Name of Project.
 - b. Name and contact information for videographer.
 - c. Name of Engineer and/or City Construction Coordinator.
 - d. Name of Contractor.
 - e. Date video recording was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Weather conditions at time of recording.

1.05 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer and/or videographer or Contractor to Owner for unlimited reproduction of photographic documentation.

PART 2 PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

- A. Digital Photographs:
 1. Provide digital photographs produced by a dedicated, fixed- or interchangeable-lens digital camera or other electronic device.

2. Digital Camera: Have a minimum image resolution of 8 megapixels, and produce images in JPEG (.JPG) format with image dimensions of not less than 3200 by 2400 pixels.
3. Include date and time in file name for each image.

B. Digital Video Recordings:

1. Provide video recordings made with a dedicated digital video camera specifically made for video recordings.
2. Digital Video Camera: Have a minimum resolution of 720p (1280 x 720, progressive).
3. Provide video recordings in a common digital video format such as .MP4 or .WMV. The minimum resolution of all video files shall be 720p (1280 x 720, progressive).

PART 3 EXECUTION

3.01 GENERAL

- A. Engage a qualified photographer to take construction photographs.
- B. Take photographs that clearly show the Work. Exhibit correct exposure and focus, accurate color balance, maximum depth of field, minimal optical distortion, and minimal noise. Photographs that, in the Owner/Engineer's opinion, do not meet these quality criteria will not be accepted and shall be re-taken at no additional cost to the Owner.
- C. Discuss key plan and obtain Owner/Engineer preliminary approval at the Pre-Construction Meeting. Maintain key plan with each set of construction photographs that identifies each photographic location.
- D. Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

3.02 PRECONSTRUCTION PHOTOGRAPHS

- A. Before commencement of any excavation, demolition, or start of any construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points. Take additional photographs as specifically as directed by the Owner/Engineer.
- B. Flag excavation areas and construction limits before taking construction photographs.
- C. Take photographs to show existing conditions, including roadways, parking lots, driveways, walkways, etc., adjacent to property before starting the Work.
- D. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
- E. Take photographs as required to record existing settlement or cracking of adjacent structures, pavements, and improvements.

- F. The exact number of photographs will depend on the complexity of the project and the density of the surrounding area. The Contractor shall ensure an adequate number of photographs are taken to properly document the above existing conditions.

3.03 PERIODIC CONSTRUCTION PHOTOGRAPHS

- A. As requested, take progress photographs periodically. Select vantage points to show status of construction and progress since last photographs were taken.

3.04 FINAL COMPLETION CONSTRUCTION PHOTOGRAPHS

- A. Take photographs after date of Substantial Completion for submission as project record documents as required by Section 01720.
- B. The exact number of photographs will depend on the complexity of the project and the density of the surrounding area, but in general should be at the same locations of the Preconstruction photographs. The Contractor shall ensure an adequate number of photographs are taken to properly document the above existing conditions.

3.05 CONSTRUCTION VIDEO RECORDINGS

- A. Engage a qualified videographer to record construction video recordings.
- B. Video Recordings:
 - 1. Produce bright, clear, sharp pictures with accurate colors and free from distortion, excessive shake, or any other form of picture imperfection. The audio track of each video recording shall reproduce precise and concise explanatory notes by the camera operator with proper volume, clarity and freedom from distortion and interference. Video recordings that, in the Engineer's opinion, do not meet these quality criteria will not be accepted and shall be re-recorded at no additional cost to the Owner.
 - 2. Mount camera on tripod before starting recording unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at Project site.
- C. Narration: Describe scenes on video recording by audio narration by microphone while video recording. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
 - 1. Confirm date and time at beginning and end of recording.
 - 2. Begin each video recording with name of Project, City Project Number, Contractor's name, videographer's name, and Project location.
- D. Preconstruction Video Recording: Before commencement of any excavation, demolition, or start of any construction, take video recording of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by the Owner/Engineer. Contractor shall give Owner/Engineer 48 hours' notice prior to

recording video and the Owner/Engineer shall be present for the recording unless specifically waived by the Owner.

1. Flag excavation areas and construction limits before recording construction video recordings.
2. Show existing conditions, including all roadways, parking lots, driveways, walkways, etc., adjacent to Project site before starting the Work.
3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of excavation, demolition, or any construction.
4. Show protection efforts by Contractor.

END OF SECTION

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SECTION 01400
QUALITY CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes general requirements related to the Contractor's responsibility for quality control involving inspections, testing, and certifications. Testing includes both shop tests (those provided by the manufacturer prior to shipment of equipment to the site) and field tests (performance tests of installed equipment and in-situ testing of materials by a state-certified laboratory). Specific requirements are also included in the individual technical sections.
- B. There shall be no direct payment for this Work, the cost of which shall be included in the Miscellaneous Work - Mobilization/Demobilization Bid Item.
- C. This Section includes the following:
 - 1. Inspections.
 - 2. Quality Assurance – Control of Installation.
 - 3. Inspecting and Physical Testing Laboratory Services.
 - 4. Equipment Calibration.
- D. Unless otherwise indicated, only new materials shall be incorporated in the Work. All materials furnished by the Contractor to be incorporated in the Work shall be subject to the inspection and approval of the Owner/Engineer. For all materials requiring approval, no materials shall be processed for, or delivered to the Site without prior approval by the Owner/Engineer.
- E. All materials of construction, supplies and parts, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.
- F. All materials, parts and equipment furnished and incorporated in the work shall be of high grade materials, free from defects and imperfections, and of recent manufacture. Workmanship shall be of the highest grade and in accordance with the best modern standard of practice.
- G. When required, all tests shall be made in the presence of the Owner/Engineer. Where not required, sworn statements or test results shall be furnished by the Contractor within 7 days of completion of tests.

1.02 RELATED WORK

- A. Section 01300 - Submittals.
- B. Specific testing and inspection requirements are also specified in the individual Technical Specifications.

- C. Where standard published specifications of recognized authorities or organizations are specified, the latest revision of such specification at the time the work is executed shall govern, unless otherwise authorized or directed.

1.03 SUBMITTALS

- A. The Contractor is responsible for providing the Owner/Engineer a copy of the proposed Quality Control and Quality Acceptance Program for review and for maintaining such program for the duration of the project within 30 days of Notice to Proceed.
- B. The Contractor shall provide the Owner/Engineer copies of the Contractor-selected South Carolina Department of Transportation Certified material testing laboratories
- C. The Contractor shall provide the Owner/Engineer copies of current organizational chart including names, telephone numbers and current certifications of personnel responsible for the Quality Control Program, testing, inspection, etc. on the project. All tests performed shall be under the supervision of certified personnel or it may result in nonpayment, delay and/or reduction in payment for the material of concern.
- D. Where the specifications call for certified copies of mill or shop tests to establish conformance with the specifications, it shall be the responsibility of the Contractor to assure the delivery of such certifications to the Owner/Engineer.
- E. Transcripts or certified shop test reports including all test results shall be submitted for review to the Owner/Engineer and approved prior to delivery of any equipment to the site. The testing shall have been performed by an approved independent testing facility within the previous six months. Transcripts of test results shall be accompanied by a certificate in the form of a letter from the manufacturer or supplier certifying that the tested material meets the specified requirements and is of the same type, quality, manufacturer, and make as that specified.
- F. The Contractor shall submit signed and certified written reports of each field inspection, test, or similar quality control and quality assurance service performed to the Owner/Engineer within seven (7) working days of the performed service. Written reports and attached forms of each field inspection, test or similar service shall be complete and accurate, shall specify the test locations, shall specify the tests performed, shall include the methods used to perform the test and shall be signed, stamped and dated by the certified person of the state-certified laboratory or testing firm. Reports shall also include:
 - 1. Date of issue.
 - 2. Project title and City project number.
 - 3. Name, address, and telephone number of testing laboratory or firm.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making the inspection or test.
 - 6. Designation of the Work and test method.
 - 7. Identification of product or material and Specification Section.

8. Complete inspection of test data.
9. Test results and an interpretation of test results.
10. Ambient conditions at the time of sample taking and testing.
11. Comments or professional opinion on whether inspected or tested Work complies with requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting.

1.04 INSPECTIONS

- A. The Engineer and the Owner shall have the right to inspect all material and equipment at all stages of collection and processing, and shall be allowed access to the site and to the Contractor's and supplier's facilities to conduct such inspections. Onsite work shall be subject to continuous inspection. Inspection by the Engineer or the Owner shall not release the Contractor from responsibility or liability with respect to material, installation or workmanship. The Engineer or the Owner will supply the Contractor a minimum of 24 hours' notice prior to unscheduled offsite inspections.
- B. No materials or finished articles shall be incorporated in the work until such materials and finished articles have passed any required tests. The Contractor shall promptly segregate and remove rejected material or finished articles from the site of the work. Failure to condemn the material on preliminary inspection shall not be grounds for acceptance if defects are found later.
- C. When local codes or laws require approval and inspection of the work by other agencies or organizations, the Contractor shall obtain such approval and submit one signed original and three copies of the approval to the Owner/Engineer.
- D. The Owner/Engineer shall have the right to mark rejected materials to distinguish them as such.
- E. The Contractor shall furnish the inspector with the necessary facilities and assistance for carrying out his duties. The work and materials shall be supervised by the Owner/Engineer and the inspectors to obtain the finished product in accordance with the Contract Documents. The City shall not assume any liabilities of the Contractor or relieve him of any of his obligations.
- F. The Owner/Engineer shall determine the quality and quantity of all work and materials which are included in this contract. Contractor shall answer all questions relating to lines, levels and dimensions of the work, and interpretations of the plans and specifications.
- G. The Owner/Engineer shall be the final judge of the quality and suitability of the work and materials. Should they fail to meet his approval and/or do not conform to the requirements of the Contract Documents, upon notice from the Owner/Engineer, they shall be removed from the work, forthwith reconstructed, made good, replaced and/or corrected by the Contractor at his own expense. Rejected materials shall immediately be removed from the site. If, in the opinion of the Owner/Engineer, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the

Contract Documents, the compensation to be paid to the Contractor hereunder shall be reduced by such amount that, in the judgment of the Owner/Engineer, shall be equitable.

- H. The testing and approval of materials by the laboratory, or laboratories, shall not relieve the Contractor of his obligations to fulfill his contract and guarantee workmanship and materials. The Contractor may, at his option, and at his own expense, cause such other test to be conducted as he may deem necessary to assure suitability, strength and durability of any material or finished article.

1.05 QUALITY ASSURANCE – CONTROL OF INSTALLATION

- A. The Contractor shall monitor quality control over suppliers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. The Contractor shall comply with manufacturers' instructions, including complying with each step, in-sequence.
- C. The Contractor shall examine the areas and conditions where work is to be performed and notify the Owner/Engineer of conditions detrimental to the proper and timely completion of the Work. The Contractor shall not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Owner/Engineer.
- D. The Contractor shall request clarification from Owner/Engineer should manufacturers' instructions conflict with Contract Documents. The clarification shall be received prior to proceeding.
- E. The Contractor shall 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.
- F. Work shall be performed by persons qualified to produce workmanship of specified quality.
- G. All tests performed shall be under the supervision of certified personnel or it may result in nonpayment, delay and/or reduction in payment for the material of concern.

1.06 INSPECTING AND PHYSICAL TESTING LABORATORY SERVICES

- A. The Contractor shall contract with an independent Subcontractor, upon review and acceptance by the Owner and the Engineer, to perform laboratory testing as required by these Specifications and as required by the Owner.
- B. The independent testing firm(s) shall have performed previous similar work in a satisfactory manner, be an approved subcontractor, and specialize in the types of inspections and tests to be performed. Testing firm(s) shall be authorized by authorities having jurisdiction to operate in the State of South Carolina. The Contractor shall include the costs of this service in his bid.
- C. The Contractor shall provide labor and materials and necessary testing facilities at the site as required by Specifications and the independent laboratories. The Contractor shall cooperate with the Owner and the Engineer and the independent laboratory and shall provide the testing firm with at least 24 hours' notice prior to specified testing.

- D. Inspecting, testing, and source quality control may occur on or off the project site. Offsite inspecting or testing shall be performed as required by the Engineer or the Owner.
- E. The Contractor shall be responsible for scheduling and coordinating inspections, tests, and similar activities with minimum delay to project.
- F. The Contractor shall manage and coordinate all material testing and sequencing of activities to avoid the necessity of removing and replacing construction work to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections, testing, taking samples, and similar activities and shall be responsible for ensuring all tests are performed in accordance with the Contract Documents. The Contractor shall notify the Owner/Engineer a minimum of 24-hours in advance of testing and all testing shall be conducted during typical City working hours, unless approved otherwise in advance.

1.07 EQUIPMENT CALIBRATION

- A. All field test equipment will be kept under control of the Contractor's testing Subcontractor. The testing Subcontractor will be fully trained in the use of equipment, test procedures, and interpretations of results for each piece of test equipment. A copy of calibration certification will be kept by the testing Subcontractor and supplied to the Owner/Engineer.
- B. Calibration of nuclear-density gauges shall conform to the frequencies and methods outlined in ASTM D2922 and D3017. Unstable or erratic gauges shall not be used in density testing and shall be immediately removed from the site.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01490
MOBILIZATION/DEMOBILIZATION

PART 1 GENERAL

1.01 MOBILIZATION

- A. As required by the Contract Documents and for the proper performance and completion of the Work, mobilization shall/may include, but not be limited to, the following principal items:
1. Move onto the site all Contractor's equipment required for the first month's operation.
 2. Install temporary construction power, wiring, and lighting facilities.
 3. Provide and furnish field office trailers for Contractor and Owner/Engineer as required.
 4. Provide on-site sanitary facilities and potable water facilities.
 5. Arrange for and erect Contractor's work and storage yard.
 6. Submit all required insurance certificates and bonds.
 7. Obtain all required permits.
 8. Post all OSHA, SCDHEC, Department of Labor, and all other required notices.
 9. Erect all required Project signs.
 10. Photograph existing conditions, and video record as required, all construction areas within the project area.

B. PAYMENT FOR MOBILIZATION

1. The Contractor's attention is directed to the condition that no payment for mobilization, or any part thereof, will be approved for payment under the Contract until all mobilization items listed above have been satisfactorily completed as specified.

1.02 DEMOBILIZATION

- A. As required by the Contract Documents and for the proper performance and completion of the Work, demobilization shall/may include, but not be limited to, the following principal items:
1. Remove Contractor's and Owner/Engineer's field offices and trailer used for storage, if applicable.
 2. Remove all temporary power and utility lines.
 3. Remove any temporary roadways and parking areas.
 4. Seed all areas disturbed during construction as required per the Contract Documents.
 5. Remove contract signs.

6. Photograph all completed construction areas including final restoration, and video record as required.
 7. Meet with Owner/Engineer on site and have the site approved and acceptable as is.
 8. Complete all items and submit all documents required for Close out as specified in Sections 01720 and 01740.
- B. Demobilization activities must be completed prior to the final application for payment in accordance with Section 01026.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01570
MAINTENANCE AND PROTECTION OF TRAFFIC

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to provide a traffic control plan, implement and maintain all traffic control measures, and construct and remove temporary access roads and ways.
- B. No individual measurement will be made for temporary construction signs, traffic cones, drums, warning lights, arrow boards, message signs, flaggers, or construction barricades. These items and all costs associated with traffic control shall be included in the lump sum Bid Item for Maintenance and Protection of Traffic.

1.02 SUBMITTALS

- A. Submit in accordance with Section 01300:
 - 1. A temporary traffic control plan(s) covering the entire project and extending throughout the life of the project.
 - 2. Layout of all proposed temporary access roads, driveways and parking areas which the Contractor will construct for the project.

PART 2 PRODUCTS (NONE THIS SECTION)

PART 3 EXECUTION

3.01 GENERAL

- A. If traffic control plans are provided in the Contract Document, the Contractor shall implement the traffic control plans in accordance with the latest edition of the SCDOT standard specifications, the Manual on Uniform Traffic Control Devices (MUTCD), and all addenda to date. All proposed changes to traffic control plans shall first be approved by the City of Columbia, SCDOT, and/or Richland County before implementation. The Contractor may implement traffic control only after receiving approval from the Owner/Engineer. The Owner/Engineer will not be responsible for delays to the Contractor due to his failure to abide by this requirement.
- B. If specific traffic control plans are not provided in the Contract Documents, the Contractor shall develop the plans submit them to the Owner/ Engineer for review. Plans shall include the following restrictions:
 - 1. Unless permission to close a street is received in writing from the proper authority, all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the operations cause traffic hazards, the Contractor shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the Owner/Engineer.

2. Detours around construction will be subject to the approval of the Owner/Engineer. Where detours are permitted, the Contractor shall provide all necessary barricades and signs as required to divert the flow of traffic and shall provide flagmen at all times and places necessary. While traffic is detoured the Contractor shall expedite construction operations and periods when traffic is being detoured will be strictly controlled by the Owner.
3. The Contractor shall take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist, or police protection provided for traffic while work is in progress. The Contractor shall be fully responsible for damage or injuries whether or not police protection has been provided.
4. The Contractor shall provide flaggers near all or any areas of this project where construction and/or equipment create a "blind spot" for oncoming or turning traffic.

3.02 CONTROL MEASURES

- A. The Contractor is responsible for furnishing, installing and maintaining all signs, construction barricades, supplemental warning lights, cones, drums, flashing arrow boards, arrow boards with truck-mounted attenuators, changeable message signs, truck-mounted "Prepare to Stop" signs, temporary concrete barriers and pavement markings as required through the duration of the project in accordance with the MUTCD, the SCDOT Standard Specifications for Highway Construction, and the technical specifications. All traffic control devices shall be kept operational when in use and all signs shall be kept legible and plumb day and night during their use.
- B. In the event the Owner/Engineer finds Traffic Controls are not being provided as outlined, then the Contractor will be notified. If the condition is not promptly corrected, then all work shall be suspended until such conditions are corrected.
- C. The Contractor shall provide individuals who are properly trained in traffic control practices. The job duties of these individuals shall be restricted to providing quality assurance of the traffic control installation. The Contractor shall have a person in charge of the traffic control on the job site at all times when construction activities are in progress.
- D. Maintenance of traffic control devices shall be performed in accordance with these Specifications and as deemed necessary by the Owner/Engineer. When maintenance of traffic control devices is required, the Contractor shall give the Owner/Engineer a prior notification before conducting any maintenance activities. Traffic control maintenance performed without proper notification may be rejected by the Owner/Engineer. Also, traffic control maintenance performed without proper notification or which fails to meet required performance levels due to poor workmanship and/or factory defects shall be rejected and corrected at the Contractor's expense.
- E. The Contractor shall notify property owners, by placing door hangers at least three (3) business days in advance of any inconvenience, which will be caused to each owner due to construction. The Contractor's contract name and telephone number shall be included in the notice. The Contractor shall not cut off access to any more driveways than is absolutely necessary, at any given time.

- F. The Contractor shall be responsible for the immediate removal of such traffic hazards as mud, debris, loose stone, and trash as may be washed or spilled on the traveled roadway as a result of the construction work.
- G. Storage of material and equipment will not be permitted within 15 feet of a travel lane unless in an area protected by guardrail or temporary concrete barrier.
- H. All construction exposed to pedestrian traffic including shall comply with all requirements as set forth by the most recent version of the American with Disabilities Act and the MUTCD.

3.03 ACCESS ROADS, DRIVEWAYS AND PARKING AREAS

- A. Contractor shall construct temporary access roads, driveways and parking areas where shown on the Drawings or as shown on the Contractor's approved plans at no additional cost to the Owner. These shall be included in the in the lump sum for Traffic Control Bid Item.
- B. Public streets, roads and drives used by the Contractor for access to and from the site shall be protected from damage in excess of that caused by the normal traffic of vehicles used in connection with construction work. Any such damage done shall be repaired immediately to the satisfaction of the Owner/Engineer, and left in good condition at the end of the construction period.
- C. The Contractor shall restore all existing dirt and/or gravel roads, driveways, and parking areas disturbed during the installation of the work to their preconstruction conditions, or better, unless otherwise indicated. Temporary roads and drives constructed by the Contractor for his use shall be removed and surface restored to original condition unless otherwise directed by the Owner/Engineer. No additional payment will be made for this work.
- D. Where the Work is not accessible from existing roads or streets, the Contractor shall prepare necessary roads and grade or otherwise smooth irregular terrain, along the right-of-way and/or easement, so that equipment may be moved to and operated on and along the site. Any work done under the foregoing requirements will be subject to the Owner/Engineer's approval. Easements and/or permissions to construct such roads must be in the possession of the Contractor.

END OF SECTION

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SECTION 01600
DELIVERY, STORAGE AND HANDLING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies the general requirements for the delivery handling, storage and protection for all items required in the construction of the work. Specific requirements, if any, are specified within individual technical sections.
- B. All materials furnished by the Contractor shall be delivered, handled, and distributed at the site by the Contractor as recommended by the manufacturer. No materials will be furnished by the Owner unless otherwise noted.
- C. There shall be no direct payment for these items, the cost of which shall be included in other bid items.

1.02 TRANSPORTATION AND DELIVERY

- A. Equipment delivery schedule – The Contractor shall prepare a schedule of anticipated shipping dates for materials and equipment. It is intended that equipment and materials be so scheduled as to arrive at the job site just prior to time for installation to prevent excessive materials on hand for inventory and the necessity for extensive storage facilities at the job site. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Owner/Engineer.
- B. Transport and handle items in accordance with manufacturer's instructions.
- C. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.
- D. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting and installing.
- E. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the Contractor's normal construction operation or those of subcontractors and other contractors and will not interfere with the flow of necessary traffic.
- F. Provide necessary equipment and personnel to unload all items delivered to the site.
- G. Promptly inspect shipment to assure that products comply with requirements, quantities are correct and items are undamaged. For items furnished by others (i.e., Owner, other Contractors), perform inspection in the presence of the Owner/Engineer. Notify Owner/Engineer verbally, and in writing, of any problems.
- H. If any item has been damaged, including pipe and fitting linings, coatings, etc., such damage shall be repaired at no additional cost to the Owner as recommended by the manufacturer or replaced with new materials as required by the Owner/Engineer.

1.03 STORAGE AND PROTECTION

- A. Store and protect products in accordance with the manufacturer's instructions, with seals and labels intact and legible. Storage instruction shall be studied by the Contractor and reviewed with the Owner/Engineer. Instruction shall be carefully followed and a written record of this kept by the Contractor. Arrange storage to permit access for inspection.
- B. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- C. Cement and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural, miscellaneous and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking. Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, cracking and spalling to a minimum.
- D. All paint and other coating products shall be stored in areas protected from the weather. Follow all storage requirements set forth by the paint and coating manufacturers.

END OF SECTION

SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SCOPE

- A. The Contractor shall keep and maintain, at the job site or have readily available for review, a copy of submittals and contract documents, marked up to indicate all changes made during the course of a project.
- B. At the completion of the project, the Engineer is required to certify all Record Drawings. The Engineer is responsible for drafting as-built changes to the Contract Drawings and for final submittal of CADD files to the Owner. The Contractor shall maintain Record Drawings throughout the project in a neat and orderly manner to ensure that the Engineer can properly produce the Record Drawings at the end of the project. The Contractor shall comply with all appropriate requirements of the City's Record Drawing Checklist as attached to the end of this section.
- C. Contractor shall keep and maintain and submit to the Owner/Engineer all required as-built drawings and specs, construction photographs, survey control, final survey, warranties/bonds, schedules, shop drawings and other submittals, testing results, and all else specified herein. Items submitted for the record or for approval throughout the duration of the project do not need to be resubmitted at the conclusion of the project.

1.02 RELATED REQUIREMENTS

- A. Section 01050 – Project Control.
- B. Section 01300 – Submittals.
- C. Section 01310 - Construction schedules.
- D. Section 01320 - Construction photographs.
- E. Section 01735 - Warranties and bonds.
- F. Section 01740 - Contract close-out.

1.03 REQUIREMENTS INCLUDED

- A. Contractor shall maintain a record copy of the following documents, marked up to indicate all changes made during the course of a project:
 - 1. Contract Drawings - A full set of plans regularly “red lined”, or other approach as mutually agreed to with the Engineer, with record drawing data. Plans should reflect up to date construction that parallels current Application for Payment quantities.
 - 2. Specifications - A full set of specifications regularly “red lined”, or other approach as mutually agreed to with the Engineer, with record data reflecting any approved deviations.

B. If not previously submitted during construction, the Contractor shall assemble copies of the following documents, as appropriate, for turnover to the Owner/Engineer at the end of the project:

1. All Field Orders, Change Orders, Design Modifications, and RFIs
2. All Field Test records
3. All Permits and permit close-outs (final approvals)
4. Certificate of Occupancy, Permit to Operate, or Certificate of Completion, as applicable
5. All Laboratory test reports (e.g., bacteriological and primary & secondary water quality)
6. Certificates of Compliance for materials and equipment
7. All Record Shop Drawings
8. All Final Submittal logs
9. Final change order and potential change order logs.
10. Construction photographs
11. Final Survey and Control
12. All Samples
13. All required Warranties/ Bonds
14. All required operations and maintenance manuals, spare parts and verification of completion of all required vender training.

C. Record Drawings

1. The Contractor shall annotate (mark-up) the Contract Drawings to indicate all project conditions, locations, configurations, and any other changes or deviations that vary from the original Contract Drawings. This requirement includes, but is not limited to, buried or concealed construction, such as the exact location of horizontal and vertical bends, valves, tees and other fittings installed during the course of construction – whether or not they were indicated on the Contract Drawings. The record information added to the drawings may be supplemented by detailed sketches, if necessary, clearly indicating, the WORK, as constructed.
2. These annotated Contract Drawings constitute the Contractor's Record Drawings and are actual representations of as-built conditions, including all revisions made necessary by change orders, design modifications, requests for information and field orders.
3. The annotated Contract Drawings shall include at least three actual dimensions from permanent markers, accurately locating all underground piping, bends, fittings, valves, structures, or appurtenances.

4. Legibly mark drawings with as-built information including elevations and dimensions of structures and structural elements, all underground utilities (piping and electrical), horizontal and vertical locations of underground piping and fittings and appurtenances, installed pipe material, class, size, joint type, etc.
5. Record drawings shall be accessible to the Owner/Engineer at all times during the construction period.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS AND SAMPLES

- A. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.
- B. Label each document "PROJECT RECORD" in neat large printed letters.
- C. Record information contemporaneously with construction progress and payment applications.

3.02 SUBMITTAL COMPLETION

- A. Upon substantial completion of the Work and prior to final acceptance, the Contractor shall finalize and deliver two complete sets of Record Drawings to the Engineer conforming to the construction records of the Contractor. The set of drawings shall consist of corrected and annotated drawings showing the recorded location(s) of the work.
- B. The information submitted by the Contractor into the Record Drawings and Record Documents will be assumed to be correct, and the Contractor shall be responsible for the accuracy of such information, and shall bear the costs resulting from the correction of incorrect data, or obtaining missing data.
- C. Delivery and Approval of Record Drawings and Record Documents to the Owner will be a prerequisite to Final payment.

END OF SECTION

ALL of the following items must be submitted to begin the Record Drawing Review.

- ✓ Record Drawings
 - ✓ Completed Record Drawings Checklist
 - ✓ Form 2 – Developer’s Certification
 - ✓ Form 3 – Lien Waiver
 - ✓ Materials List (itemized & on Approved Contractor’s letterhead)
 - ✓ Property deed(s) - (Recorded)
 - ✓ Sewer Acceptance Letter (if sewer to be treated by non-City entity)
 - ✓ Mortgage(s) - (for subject properties of the developer that are being developed, mortgage must be recorded)
 - ✓ Off-site easement(s) (if applicable)
 - ✓ Encroachment permit(s) (if applicable)
-
- All post construction submittals outside of City limits should be emailed to Engprojects@columbiasc.gov
 - All post construction submittals inside City limits should be handled by contacting the Development Center at (803) 545-3420

Date	
Project Name	
Project Location	
City File Number	
Engineering Firm	
Engineer's Name	
Engineer's Phone #	
Engineer's Email	

- *Please make a selection for ALL items relevant to your project on this checklist. If any item requires additional notes/explanation, please provide the necessary information in "Notes" at the end of the section.*
- *Water and Sanitary Sewer submittals should be submitted separately with its own cover sheet.*
- *Use all certifications as it is written in its form in the checklist. Deviating from the city's written certifications could cause delays in the Record Drawing Review.*

General/Format – Verify or Indicate if the following are correct (see City's sample):

1.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	City's Record Drawing sample used
2.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Does Record Drawing conform to approved Construction Plans and Approval Letter? Note: City does not determine meter size
3.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Drawings should consist of a cover sheet, plan sheet(s) and profile sheet(s). Notes: 1. This item is N/A for water projects; 2. Showing both plan and profile view on one sheet only acceptable on small projects
4.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	All off-site easements obtained using City prepared documents and approved by the City's Real Estate Division
5.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	No easements for water, sewer, or storm drainage shown in dedicated (existing) public road right-of-way. Note: Does not apply to roadways not yet dedicated and/or privately owned roadways
6.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Use standard symbols for appurtenances/fittings such as meter boxes, fire hydrants, valves, plugs, manholes, junction boxes, etc.
7.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	No copyright statements on record drawings or associated off-site easement exhibits

8.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Is the project location within 5 miles of the nearest city boundary line?
9.	Notes			

Title Block - Indicate if the following are included:

1.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Title Block included on all Plan and Profile Sheets
2.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	"Project Name"; must identify subdivision or project name, phase number if applicable, City, County and State where project is located
3.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	"Prepared For"; must identify legal entity name, mailing address, and contact information for client including email if available
4.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	"Prepared By"; must identify engineering firm, engineer's name, and P.E.'s license number responsible for drawing
5.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	"Last Revised"; must identify date of revisions and provide comments explaining items revised as of that date
6.	Notes			

Cover Sheet - Indicate if the following are included:

1.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Name of the Subdivision or Project and City File number
2.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	State "Record Drawing Date _____, 20__"; Notes: 1. Do not use older label of "As-Built"; 2. Record Drawing date should not predate project approval letter date and should not be the same date as construction plan date
3.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Show "General Notes" for project. See General Notes section of this checklist (cover sheet only)
4.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Name and address of the developer
5.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Name, address, and email of the property owner
6.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Name and address of the water provider
7.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Name and address of the sanitary sewer provider
8.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Name and address of the storm drainage provider

9.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Vicinity map, with North arrow (cover sheet only)
10.	Notes			

General Notes - Indicate if the following are included:

1.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Tax map parcel numbers of subject site in General Notes section of Cover Sheet
2.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Ten State Standards in General Notes section of Cover Sheet – “Ten State Standards maintained between water, sewer, and storm drainage”
3.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Easement language regarding service lines, in General Notes section of Cover Sheet <i>(see “Easement Language,” included in Appendix)</i>
4.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	If sewer provided through septic tank, state “DHEC Septic Tank Approval Letter dated _____, expires five (5) years from date of issue” in General Notes section
5.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Provide mean sea level datum and state in statement form
6.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Identify in statement form to who new roadways will be conveyed (SCDOT, City or County). Only use approved roadway names/do not change roadway names without approval
7.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Other notes deemed appropriate and specific to the project
8.	Notes			

Plan Sheet(s) - Indicate if the following are included:

1.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Identify graphic scale (must use 10, 20, 30, 40, 50, or 60; 100 only if necessary)
2.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Blow-ups/insets for all fire hydrants and/or hydrant valves and elsewhere as deemed appropriate; identify either graphic scale or dimensions
3.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	North Arrow; specify if North Arrow is true or grid
4.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Show and label phase lines
5.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Label tax map number and owner's information for subject property and all adjacent properties. Verify current information at richlandonline.com and www.lex-co.com
6.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Label City File number in lower right quadrant
7.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Show bearings (degrees, minutes, and seconds) and distances for all sanitary sewer mains, storm drainage lines and street boundaries
8.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Label distances for all water mains and service lines (call out). Call outs should indicate size of pipe, material of pipe, and distance of pipe from fitting to fitting. Distances must be provided to nearest one-tenth of a foot (see Appendix for call out example)
9.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Label distances for all sanitary sewer mains, service lines, and storm drainage lines. Stated distance should match distances shown on profile sheet (see Appendix for call out example)
10.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	<p>Location data: All appurtenances/fittings must be identified and "tied to" (i.e. provide the distance to) a nearby stable physical feature such as a true property corner or building corner. Two (2) tie point references are required to be shown on the drawing for the connecting point(s) and ending point(s) of all new lines (both main and service lines). A state plane coordinate table can be used to locate all other appurtenances/fittings such as hydrants, bends, reducers, meter boxes, blow offs, cleanouts, manholes, catch basin, etc. However, this coordinate table must also include the tie point reference distance between said appurtenance/fitting and a stable physical feature.</p> <p>(i.e., connecting point(s) of line is specified as the ultimate beginning where the new main/service line connects to existing City line or ending point(s), the ultimate end where the new main stops at a plug, stub-out, etc. or a service/lead line stops at a meter and/or fire hydrant) – See Appendix for example of state plane coordinate table</p>
11.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Label lot numbers, buildings and, existing/new public and/or private roadways and most current tax map number(s) with ownership

12.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Bends on water drawings must be identified by size (degrees) and noted as vertical, if the bend is a vertical bend
13.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Location of utility lines within easement relative to easement boundaries
14.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Show and label easements for all utilities (power, gas, etc.) on subject properties
15.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Label easements for City utilities as “ ___ ’ Exclusive City of Columbia Water, Sanitary Sewer, Storm Drainage Easement.” Note: See “Easement Language” information in Appendix
16.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Contours (2’ or more accurate) must be labeled and show multiple locations for ease of following. Top nut of hydrant may be substituted for elevation purposes. <u>Final grades required only on all areas City of Columbia will be receiving easement(s)</u>
17.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Provide location and description of monuments (benchmarks)
18.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Label road names and identify ownership of roadway and width of road right-of-way
19.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Water/sewer/storm drainage lines cannot arbitrarily end at phase lines; there must be proper termination of the line (plug, manhole, etc.) A utility line cannot end at a tee
20.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Show sewer profiles including separations for all other utilities meeting Ten State Standards
21.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Identify all rights-of-way, easements, and areas to be dedicated for public use shown along with the purpose of each stated, including but not limited to power line rights of way, gas line rights of way, water, sanitary sewer, and storm drainage easements, public roadways
22.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Label City File Number(s) and project name for existing lines being tied to
23.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Identify meter box(es) and/or sewer clean out for each lot, with references (tie points)
24.	Notes			

Profile Sheet(s) – Indicate if the following are included:

1.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Identify horizontal and graphic scales for each profile
2.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Label station numbers on all manholes, junction boxes, catch basins, etc. Also, show distances of main lines along profile view. Distances and station numbers should correlate
3.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Show size, material, and slope between manholes, and lengths of all sanitary sewer lines on plan view and profiles
4.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Label City File number in lower right quadrant
5.	Notes			

Attachments - Indicate if the following are included:

1.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Off-site easement documentation, if applicable
2.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Must submit Sewer Acceptance Letter upon receipt (if sewer to be treated by non-City entity)
3.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Form 2 – Developer’s Certification (not required for CIP); See City of Columbia Engineering Regulations section 6.5
4.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Form 3 – Lien Waiver Form signed by Contractor (not required for CIP); See City of Columbia Engineering Regulations section 6.6
5.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Itemized Materials List
6.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Provide copy of recorded deed for subject properties of the developer/owner being developed as part of this project (not required on CIP unless pipe installed on City-owned property)
7.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Provide copy of recorded mortgage on subject properties of the developer/owner being developed as part of this project (not required on CIP unless pipe installed on City-owned property)
8.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Copy of encroachment permits for new water, sewer and/or storm drainage lines constructed within dedicated (existing) public roadways and/or rights-of-way. Note: The City applies for encroachment permits upon receipt of encroachment applications.

9.	Notes	
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Certifications, Seals and Signatures - Indicate if the following are included:

1.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Infiltration certification on all sewer drawings: "I hereby certify that the infiltration/exfiltration does not exceed 200 gallons per-day per- inch of pipe diameter per-mile of sewer pipe including manholes for any section of the system."
2.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Engineer's Certification Statement (cover sheet only) – See Appendix for the statement to include on the cover sheet
3.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	SC Professional Engineer Seal, Signature, and Date (on each sheet)
4.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Engineering Firm's Certificate of Authorization Seal (on each sheet)
5.	Notes			

RECORD DRAWING APPENDIX

Engineer's Certification Statement

- The certification below should be used on the cover sheet on all projects. Use the certification as it is written below.

ENGINEER'S CERTIFICATION	
<p>THESE RECORD DRAWINGS ARE A COMPILED REPRESENTATION OF THE CONSTRUCTED PROJECT. I HEREBY CERTIFY THAT TO THE BEST OF MY KNOWLEDGE AND BELIEF, BASED ON OBSERVATIONS DURING CONSTRUCTION, MY ASSESSEMENT OF THE COMPLETED WORK AND REVIEW OF THE "AS-BUILT" SURVEY, THE PROJECT INCLUDING...</p>	
<p>_____ Water Mains _____ Sanitary Sewer System _____ Storm Drainage System _____ Streets</p>	<p>_____ Sewer Force Mains _____ Lift Station/Pump Station _____ Reclaimed Water Mains _____</p>
<p>WAS COMPLETED BY THE CONTRACTOR IN ACCORDANCE WITH THE INTENT OF THE PERMITS, APPROVED PLANS, AND SPECIFICATIONS</p>	
<p>ENGINEER'S SIGNATURE & DATE: _____ Date: _____ NAME: _____ SOUTH CAROLINA LICENSE NO: _____ (AFFIX SEAL HERE)</p>	
<p>INFORMATION PROVIDED BY: GENERAL CONTRACTOR Name: _____ Address: _____ Phone #: _____ S.C. License Number: _____</p>	
<p>SURVEYOR Name: _____ Address: _____ Phone #: _____ S.C. License Number: _____</p>	

Easement Language

Main lines and future extensions – ex: “15’ Exclusive City of Columbia Water Easement” Service Lines should be covered in a note: “There is a 10’ Exclusive City of Columbia water/sewer easement on all service lines from the main line to the meter/cleanout”

Sanitary Sewer Language

This verbiage should be used on record drawings where the sanitary sewer service will be installed by the City of Columbia Forces – ex: “Future Sanitary Sewer Service line to be constructed by City of Columbia Forces”

Storm Drain Certification Language

I hereby certify that the storm drainage system for _____ was installed in accordance with the City of Columbia approval letter dated _____, and meets storm drainage requirements and contained silt on the property concerned to the maximum extent feasible. Provisions for erosion and sediment control and storm drainage were met in accordance with the Columbia Sediment and Erosion Control and Storm Drainage Ordinance.

Note: If the City of Columbia will not be operating and maintaining the drainage system, the statement must be in letter format on the engineer’s letterhead. The statement must be signed and sealed by the Engineer of Record and must provide his P.E. Registration number (reference City Regulations Manual, page 14, items 3 & 4, under “Storm Sewer Design).

Final Submittal

- Record drawings are final (all requested revisions addressed, signed and sealed)
- All required documents for the project must be submitted on legal-size paper, including executed utility deeds, Declaration of Covenant, and Partial Mortgage Release (In instances where there is no mortgage on the property, the Owner must return form to the City identifying the project name and address with the notation, “There is no mortgage on this property.”)
- Final Record Drawing .PDF and .DWG must be submitted electronically through email. You will be notified if a CD ROM or DVD is required

Submittal to DHEC

Final Package to DHEC must include:

1. **Engineer’s Certification Letter:** The Engineer must certify that the project has been built in accordance with the permitted plans and with good engineering practices. The certification is based upon periodic observation of the construction by the project engineer or a representative of his/her office. Infiltration Certification must also be included for all sewer projects.
2. **City’s Ownership, Operation & Maintenance Letter (O&M Letter):** This letter will be provided by the City of Columbia upon receipt of all required documents (deeds, covenants, etc.) approved pressure tests, bacteriological test, and final inspection by the City’s Utility Inspector.

3. **Pressure, Bacteriological and Fire Hydrant Flow Test Results:** Test results will be issued with the City's O&M Letter.
4. **Two (2) Sets of Record Drawings**

Complete package to be submitted by the Engineer to DHEC at:

**Central Midlands District
Environmental Quality Control
P.O. Box 156
State Park, South Carolina 29147**

WATER CALL OUT VERBIAGE

(distance of pipe) LF (size of pipe) (material of pipe) from (fitting) to (fitting)

WATER CALL OUT EXAMPLE

53.89 LF 6" DIP FROM 6" VALVE TO TEE

10.17 LF 6" DIP FROM 90° BEND TO 6" VALVE

5.80 LF 6" DIP FROM REDUCER TO 90° BEND

25.3 LF 6" DIP FROM BEND TO BEND

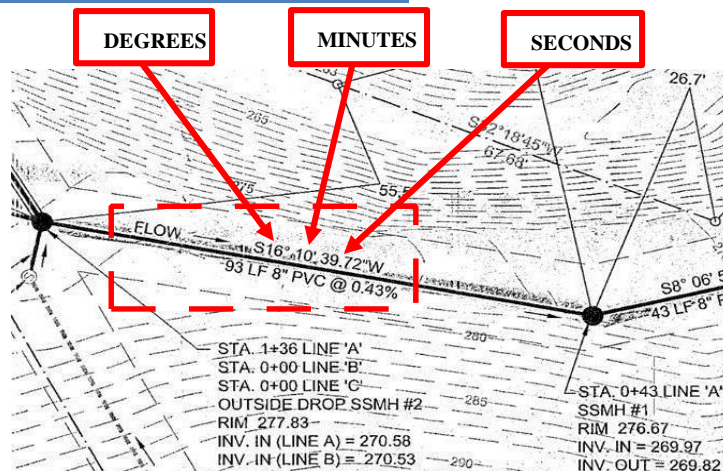
SANITARY SEWER & STORM DRAINAGE CALL OUT

Top portion is indicated by bearing (degrees, minutes, seconds) between station to station Bottom portion is indicated by (distance of pipe) LF (size of pipe) (material of pipe)

Sewer Stations are always manholes or clean-outs

Storm Drainage Stations are junction boxes and catch basins

SANITARY SEWER CALL OUT EXAMPLE



The same example can apply for storm drainage with the addition of junction boxes or catch basins

COORDINATE TABLE

As stated on Page 5 of the Record Drawing Checklist, a coordinate table can be used to display all other appurtenances/fittings such as hydrants, bends, reducers, meter boxes, blow offs, cleanouts, manholes, catch basins, etc. to state plane coordinates. **Two (2) tie point references are required for each appurtenance/fitting on the coordinate table. The two tie points must be from said fitting to a stable physical feature such as true property corner or building corner.** Please see below for coordinate table example.

WATER MAIN LOCATION							
REF	REF PNT	NORTHING	EASTING	PNT	NORTHING	EASTING	DISTANCE
IPF	1	808769.95	1941841.49	2	808730.62	1941813.04	4" VALVE 48.55'
IPF	1	808769.95	1941841.49	3	808703.87	1941807.21	4" DIP WL 74.45'
IPF	1	808769.95	1941841.49	4	808657.41	1941801.54	4" DIP WL 119.43'
IPF	1	808769.95	1941841.49	5	808619.19	1941813.63	4" DIP WL 153.33'
IPF	1	808769.95	1941841.49	6	808580.79	1941805.92	METER 192.48'
IPF	1	808769.95	1941841.49	7	808577.26	1941794.31	4" DIP WL 198.38'
IPF	1	808769.95	1941841.49	8	808571.27	1941780.31	4" DIP WL 207.90'
IPF	1	808769.95	1941841.49	9	808570.33	1941780.31	11.25" BEND 211.11'
IPF	1	808769.95	1941841.49	10	808572.42	1941759.80	90" BEND 213.76'
IPF	1	808769.95	1941841.49	11	808569.21	1941759.04	90" BEND 217.02'
IPF	1	808769.95	1941841.49	12	808569.67	1941757.33	4" VALVE 217.25'
IPF	1	808769.95	1941841.49	13	808570.24	1941755.28	POST HYD 217.53'
IPF	1	808769.95	1941841.49	14	808572.73	1941746.33	METER 218.98'
IPF	1	808769.95	1941841.49	16	808648.01	1941800.89	45" BEND 128.52'
IPF	1	808769.95	1941841.49	17	808630.56	1941814.88	45" BEND 141.91'
IPF	1	808769.95	1941841.49	18	808588.13	1941810.20	45" BEND 184.50'
IPF	1	808769.95	1941841.49	19	808572.33	1941786.96	22.5" BEND 205.01'

Tie Point
Reference #1

WATER MAIN LOCATION							
REF	REF PNT	NORTHING	EASTING	PNT	NORTHING	EASTING	DISTANCE
IPF	15	808568.97	1941748.54	2	808730.62	1941813.04	4" VALVE 172.42'
IPF	15	808568.97	1941748.54	3	808703.87	1941807.21	4" DIP WL 145.36'
IPF	15	808568.97	1941748.54	4	808657.41	1941801.54	4" DIP WL 100.87'
IPF	15	808568.97	1941748.54	5	808619.19	1941813.63	4" DIP WL 78.71'
IPF	15	808568.97	1941748.54	6	808580.79	1941805.92	METER 54.22'
IPF	15	808568.97	1941748.54	7	808577.26	1941794.31	4" DIP WL 42.13'
IPF	15	808568.97	1941748.54	8	808571.27	1941780.31	4" DIP WL 27.41'
IPF	15	808568.97	1941748.54	9	808570.33	1941780.31	11.25" BEND 19.87'
IPF	15	808568.97	1941748.54	10	808572.42	1941759.80	90" BEND 7.62'
IPF	15	808568.97	1941748.54	11	808569.21	1941759.04	90" BEND 6.04'
IPF	15	808568.97	1941748.54	12	808569.67	1941757.33	4" VALVE 4.38'
IPF	15	808568.97	1941748.54	13	808570.24	1941755.28	POST HYD 2.60'
IPF	15	808568.97	1941748.54	14	808572.73	1941746.33	METER 7.65'
IPF	15	808568.97	1941748.54	16	808648.01	1941800.89	45" BEND 92.40'
IPF	15	808568.97	1941748.54	17	808630.56	1941814.88	45" BEND 87.29'
IPF	15	808568.97	1941748.54	18	808588.13	1941810.20	45" BEND 60.32'
IPF	15	808568.97	1941748.54	19	808572.33	1941786.96	22.5" BEND 34.12'

Tie Point
Reference #2

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SECTION 01735 WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1.02 RELATED WORK

- A. Refer to Conditions of Contract for the general requirements relating to warranties and bonds.
- B. Section 01740 – Contract Closeout.
- C. Specific requirements for warranties for the work, products and installations are specified in the individual Technical Sections.

1.03 SUBMITTALS

- A. Submit written warranties to the Owner prior to Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the work, submit written warranties upon request of the Owner.
- B. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within 15 days of completion of that designated portion of the Work.
- C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner for approval prior to final execution.
- D. Refer to individual Sections for specific content requirements, and particular requirements for submittal of special warranties.
- E. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
- F. The Engineer shall provide a list of all required Warranties to the Contractor at the time of the Pre-Construction Conference. The Contractor shall verify that all warranties on that list have been submitted to the Owner prior to Substantial Completion. The Contractor is required to submit all warranties requested in the Contract Documents, whether or not the Engineer has included the warranty on the list.

1.04 WARRANTY REQUIREMENT

- A. **Related Damages and Losses:** When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.
- B. **Reinstatement of Warranty:** When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. If a piece of equipment is replaced, rebuilt, or repaired at a rate equal to or greater than 20 percent of the original installed value, then the warranty shall restart at the full term.
- C. **Replacement Cost:** Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work and/or materials regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.
- D. **Owner's Recourse:** Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
- E. **Rejection of Warranties:** The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conformance with requirements of the Contract Documents.
- F. For a period of at least one year after the date of Substantial Completion of the contract, as specified in Section 00700, the contractor warrants the fitness and soundness of all work done and materials and equipment put in place under the contract. Neither the certificate of Substantial Completion, certificate of final acceptance, payment of the final application for payment, nor any provision in the Contract Documents, not partial or entire occupancy of the premises by the City shall constitute an acceptance of work not done in accordance with the Contract Documents, nor relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.
- G. The Contractor shall remedy any defects in the work and pay for any damage to work resulting therefrom, which shall appear within a period of one year from the date of substantial completion of the work ***unless a longer period is specified, as specified in Section 00700.*** The City will give notice of observed defects with reasonable promptness.”
- H. The one-year warranty described herein shall be in addition to all other warranties required in the Contract Documents. The one-year warranty extended herein shall not limit, alter or prejudice any other right or remedy available to the Owner under the Contract Documents or granted by law. All of the Owner’s rights under this one-year warranty are cumulative, and in addition to, all other rights and remedies under the contract.
- I. The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of Work which is not in accordance with the requirements of the Contract Documents. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner, the Owner may correct it and charge the Contractor all costs related to correcting the Work.

- J. The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work.
- K. The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.
- L. Establishment of the one-year period for correction of Work relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

1.05 MANUFACTURERS CERTIFICATIONS

- A. Where required, the Contractor shall supply evidence, satisfactory to the Owner/Engineer, that the Contractor can obtain manufacturers' certifications as to the Contractor's installation of equipment.

1.06 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01740
CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies administrative, verification and procedural requirements for project closeout, including but not limited to:
 - 1. Project Record Documents in Section 01720.
 - 2. Record Shop Drawings in Section 01300.
 - 3. Warranties, guarantees, and bonds in Section 01735 and applicable Sections in Technical Divisions 10 through 16.
 - 4. Reconciliation of final accounting, final change order, final payment application in Sections 00700, 01026, and 01035.
 - 5. As-built construction schedule in Section 01310.
 - 6. Permit close-outs including Certificate of Occupancy or Certificate of Completion.
- B. There shall be no specific Payment for Contract Closeout, the associated costs shall be included in the Miscellaneous Work – Mobilization/Demobilization Bid Item.

1.02 CLOSEOUT PROCEDURES

- A. Provide all final deliverables and project obligations as defined in the contract documents, prior to submitting the final application for payment.
- B. Verify that the Contractors Shop Drawing log, testing log (field tests, shop tests, and performance tests), warranties list, and material samples list is consistent with that of the Owner/Engineer.
- C. Provide submittals to Owner/Engineer that are required by governing or other authorities having applicable jurisdiction including but not limited to permit close out information, certificates of occupancy, etc.
- D. Submit Certificate of Occupancy to the Owner, if applicable to the project.
- E. Submit Application for Final Payment identifying total adjusted Contract Sum, previous payments and sum remaining due, following submittal and approval of Record Documents and Record Drawings.
- F. Submit Contractor's Final Release and Release of Liens with final payment application.

1.03 FINAL CLEANING

- A. Contractor to complete final cleaning prior to submittal of the final application for payment. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Remove from the project site all temporary construction facilities (those used for both the Contractor and Owner/Engineer) as specified in Section 01500. Remove tools, construction equipment, machinery, and surplus material from Project site.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.
- D. Provide final cleaning by a professional service company if project is located in a building or facility. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturers written instructions. Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces. Complete the following cleaning operations for all buildings or facilities worked on as part of the Project before requesting inspection for certification of Substantial Completion for entire Project or for a portion of the Project:
 - 1. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - 2. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment, vaults, manholes, attics, and similar spaces.
 - 3. Sweep concrete floors broom clean in unoccupied spaces.
 - 4. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - 5. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - 6. Remove labels that are not permanent.
 - 7. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration. Remove any rust from areas. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - 8. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment.

9. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 10. Replace parts that were subject to unusual operating conditions.
 11. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 12. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated without filters during construction.
 13. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 14. Leave Project clean and ready for occupancy.
- E. For pipeline projects, clean Project site, yard, streets, parking areas, easement areas, grounds, landscaped areas, and all other areas disturbed by construction activities. Remove rubbish, waste material, litter, and other foreign substances.
1. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 2. Rake grounds that are neither planted nor paved to a smooth even textured surface.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 02050
DEMOLITION, ABANDONMENT AND SALVAGE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Work specified in this Section includes furnishing all labor, materials, equipment and incidentals required to demolish, abandon, modify, remove, salvage, and dispose of Work shown on the Contract Drawings and as specified herein.
- B. Included, but not limited to, are demolition, modifications, abandonment, and removal of existing materials, equipment or Work necessary to install the new Work as shown on the Contract Drawings and as specified herein and to connect with existing Work in approved manner.
- C. Demolition, modifications and removals which may be specified under other Sections shall conform to requirements of this Section.
- D. All items designated on the Contract Documents to be removed and salvaged shall be turned over the Owner and delivered to a site within the City of Columbia as directed by the Owner. All items indicated for demolition but not indicated for salvage shall be disposed of by the Contractor.
- E. Blasting and the use of explosives will not be permitted for any demolition Work.

1.02 RELATED WORK

- A. Section 01010 - Summary of Work
- B. Section 01300 - Submittals
- C. Section 02100 - Site Preparation
- D. Section 02221 – Trenching Backfill and Compaction

1.03 SUBMITTALS

- A. Submit to the Owner/Engineer, in accordance with Section 01300, proposed methods and operations of demolition of the structures and modifications prior to the start of Work. Include the coordination of shutoff, capping and continuation of utility service as required.
- B. Furnish a detailed sequence of demolition and removal of Work to ensure the uninterrupted progress of the Owner's operations.
- C. Before commencing demolition Work, all modifications necessary to bypass the affected structure or utility shall be completed. Actual Work shall not begin until the Owner/Engineer

has inspected and approved the modifications and authorized commencement of the demolition Work in writing.

- D. The Contractor shall remain responsible for any specialty permits required to complete the demolition work and disposal operations.

1.04 JOB CONDITIONS

A. Protection

1. Execute the demolition and removal Work to prevent damage or injury to structures, occupants thereof and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.
2. Closing or obstructing of roadways, sidewalks and passageways adjacent to the Work by the placement or storage of materials will not be permitted and all operations shall be conducted with a minimum interference to traffic on these ways.
3. Erect and maintain all barriers, lights, sidewalk sheds and other required protective devices as may be required by OSHA and other permitting agencies.

B. Scheduling

1. Carry out operations so as to avoid interference with operations and Work in existing facilities.

C. Notifications

1. At least two weeks prior to commencement of any demolition or removal, confirm with the Owner/Engineer in writing of proposed schedule therefor. Owner/Engineer shall inspect the existing equipment and to identify and mark those Items which are to remain the property of the Owner. No removals shall be started without the permission of the Owner/Engineer.

D. Conditions of Structures

1. The Owner and the Engineer assume no responsibility for the actual condition of the structures to be demolished or modified.
2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations within a structure may occur prior to the start of demolition Work.

E. Repairs to Damage

1. Promptly repair damage caused to adjacent facilities by demolition operation when directed by Owner/Engineer and at no cost to the Owner. Repairs shall be made to a condition at least equal to that which existed prior to construction.

F. Traffic Access

1. Conduct demolition and modification operations and the removal of equipment and debris to ensure minimum interference with roads, streets, walks both onsite and offsite and to ensure minimum interference with occupied or used facilities.
2. Special attention is directed towards maintaining safe and convenient access to the existing facilities by City Operations staff and associated vehicles.
3. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the Owner/Engineer. Furnish alternate routes around closed or obstructed traffic in access ways.

1.05 RULES AND REGULATIONS

- A. The Building Code of the State of South Carolina shall control the demolition, modification or alteration of the existing buildings or structures.

1.06 DISPOSAL OF MATERIAL

- A. Salvageable material and equipment noted on the Contract Drawings shall remain the property of the Owner at their option, otherwise it becomes property of the Contractor and Contractor will be responsible for proper disposal. Dismantle all such items to a size that can be readily handled and deliver them to a designated storage area as directed by the Owner/Engineer. Any such material damaged due to improper handling will not be accepted and the replacement value of the material deducted from the payment to the Contractor.
- B. All other material and Items of equipment shall become the Contractor's property and must be removed from the site and be disposed of properly.
- C. The storage or sale of removed Items while on the site will not be allowed.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 GENERAL

- A. All materials and equipment removed from existing Work, shall become the property of the Contractor, except for those which the Owner has identified and marked for his/her use. All materials and equipment marked by the Owner to remain shall be carefully removed, so as not to be damaged, cleaned, protected and delivered to a place specified by the Owner/Engineer.
- B. Dispose of all demolition materials, equipment, debris and all other Items not marked by the Owner to remain, off the site and in conformance with all existing applicable laws and

regulations. The Owner/Engineer must approve any plans to reuse the material at another location.

C. Pollution Controls

1. All environmental and pollution controls specified elsewhere in the Contract Documents shall be adhered to during demolition.
2. Use water sprinkling, temporary enclosures and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
 - a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding and pollution.
 - b. Clean and protect adjacent structures, facilities, systems, and general Work area of dust, dirt and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the Work.

3.02 STRUCTURAL REMOVALS

- A. Structures designated for demolition or removal shall be removed to a point 3 feet below existing grade (or as shown on the Drawings), or greater if required to provide clearance for new pipelines or other utilities, including allowance for pipe/utility bedding. The portion of the structure that will remain below grade shall be cleaned of rubble and debris including exposed reinforcing steel, backfilled with Common fill material in accordance with specification Section 02230 shall be backfilled and graded to match the existing grade around the structure. All mechanical and electrical equipment and piping shall be removed from those structures prior to backfilling and grading.
- B. Partial removal of structure walls and slabs shall be to the lines shown unless otherwise directed by the Owner/Engineer. Where no limits are shown, the limits shall be 4-in outside the Item to be installed. The removal of masonry beyond these limits shall be at the Contractor's expense and these excess removals shall be reconstructed to the satisfaction of the Owner/Engineer with no additional cost to the Owner.
- C. All concrete, brick, tile, concrete block, roofing materials, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other Items contained in or upon the structure shall be removed and taken from the site, unless otherwise approved by the Owner/Engineer. Demolished Items shall not be used in backfill.
- D. After removal of parts or all of masonry walls, slabs and like Work which tie into new Work or existing Work, the point of junction shall be neatly repaired so as to leave only finished edges and surface exposed.
- E. Contractor shall notify the Owner/Engineer if items of historical significance are found (brick pavers, cobble stones streets, etc.) and obtain direction from the Owner/Engineer on necessary procedures for demolition or salvage.

3.03 ABANDONMENT OF EXISTING PIPING AND MANHOLES

- A. Existing piping and manholes designated for abandonment shall be removed from service, dewatered, and filled with flowable fill as specified in Section 02230. Removal valve boxes on all abandoned utilities.
- B. Where existing piping and manholes are in active service by the Owner, the Contractor shall coordinate with Owner/Engineer to ensure all services have been relocated and/or abandoned prior to decommissioning of pipe and/or manhole. All utilities to be abandoned shall be isolated as indicated in the approved shop drawings prior to filling with flowable fill.
- C. Provide the Owner ten (10) days notification prior to abandonment of existing piping and manholes.
- D. All manholes to be abandoned shall be removed completely to at least 3-feet below finished grade.

3.04 ELECTRICAL REMOVALS

- A. Electrical removals shall consist of the removal of existing transformers, distribution switchboards, control panels, motors, conduits and wires, poles and overhead wiring, panelboards, lighting fixtures and miscellaneous electrical equipment all as shown on the Contract Drawings, specified herein, or required to perform the Work.
- B. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to maintain the integrity of the grounding systems.
- C. Conduits and wires shall be abandoned or removed where shown. All wires in abandoned conduits shall be removed, salvaged and stored at Owners option. Abandoned conduits concealed in floor or ceiling slabs or in walls, shall be cut flush with the slab or wall at the point of entrance. The conduits shall be suitably plugged and the area repaired in a flush, smooth and approved manner. Exposed conduits and their supports shall be disassembled and removed from the site. Repair all areas of Work to prevent rust spots on exposed surfaces.
- D. Where shown or otherwise required, wiring in the underground duct system shall be removed. All such wiring shall be salvaged and stored as specified at owner's option. Verify the function of all wiring before disconnection and removing it. Ducts which are not to be reused shall be plugged where they enter buildings and made watertight.
- E. Where shown, direct-burial cable shall be abandoned. Such cable shall be disconnected at both ends of the run. Where it enters a building or structure the cable shall be cut back to the point of entrance. All opening in buildings for entrance of abandoned direct-burial cable shall be patched and made watertight.
- F. Lighting fixtures and other miscellaneous electrical equipment shall be removed or relocated as shown. Fixtures not relocated shall be removed from the site and delivered to Owner or disposed of properly by the Contractor, at the Owners option. Relocated fixtures shall be carefully removed from their present location and rehung where shown.

- G. Care shall be taken in removing all equipment so as to minimize damage to architectural and structural members. All conduits, electrical switches and/or receptacle boxes shall be plugged to prevent migration of gasses. Any damage incurred shall be repaired.

3.05 CLEAN-UP

- A. Remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the Work, all materials, equipment, waste and debris of every sort shall be removed and premises shall be left, clean, neat and orderly.

END OF SECTION

SECTION 02100
SITE PREPARATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Work specified in this Section includes furnishing all labor, materials and equipment required and performing all site preparation, complete as shown on the Contract Drawings and as specified herein.
- B. Obtain all permits required for site preparation Work prior to proceeding with the Work, including clearing and tree removal.
- C. The areas to be cleared, grubbed and stripped within public rights-of-way and utility easements shall be minimized to the extent possible for the scope of Work and in consideration of the actual means and methods of construction used. No unnecessary site preparation within these areas shall be performed. No tree shall be removed unless specified, shown on the Contract Drawings or with prior permission of the Owner.
- D. Contractor shall contact the appropriate regulatory authority and the Owner to review and approve any trees to be cut prior to starting any cutting.

1.02 RELATED WORK

- A. Section 02050 - Demolition and Modifications
- B. Section 02221 – Trenching Backfill and Compaction
- C. Section 02930 - Loaming, Seeding and Sodding

1.03 SUBMITTALS

- A. Submit to the Owner/Engineer, in accordance with Section 01300, copies of all permits required prior to clearing, grubbing, and stripping Work.
- B. The proposed site for the disposal of material and debris from the site preparation shall be submitted for approval to the Owner/Engineer.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 GENERAL

- A. Mark the area to be cleared at least 5 days prior to commencing work and communicate that marking is complete to the Owner/Engineer.
- B. Ensure all required stormwater controls required by the Contract Documents and permit requirements are installed and operational prior to performing any clearing or grubbing operations.

3.02 CLEARING

- A. Cut and remove all timber, trees, stumps, brush, shrubs, roots, grass, weeds, rubbish and any other objectionable material resting on or protruding through the surface of the ground.
- B. Preserve and protect trees and other vegetation designated on the Contract Drawings or directed by the Owner/Engineer to remain as specified below.

3.03 GRUBBING

- A. Grub and remove all stumps, roots in excess of 1-1/2-in in diameter, matted roots, brush, timber, logs, concrete rubble and other debris encountered to a depth of 18-in below original grade or 18-in beneath the bottom of foundations, whichever is deeper.
- B. Refill all grubbing holes and depressions excavated below the original ground surface with common fill and compact to a density conforming to the surrounding ground surface in accordance with Section 02221 and 02230.

3.04 STRIPPING

- A. Strip topsoil from all areas to be occupied by buildings, structures, and roadways and all areas to be excavated or filled.
- B. Topsoil shall be free from brush, trash, large stones and other extraneous material. Avoid mixing topsoil with subsoil.
- C. Stockpile and protect topsoil until it is used in landscaping, loaming and seeding operations. Dispose of surplus topsoil after all Work is completed.

3.05 DISPOSAL

- A. Cut tree trunks and limbs exceeding 4-in in diameter shall be cut into 4-ft lengths and stockpiled on site in the area designated on the Contract Drawings or approved by the Owner/Engineer.
- B. Dispose of material and debris from site preparation operations by hauling such materials and debris to an approved offsite disposal area. No rubbish or debris of any kind shall be buried on the site.

- C. Burning of cleared and grubbed materials or other fires for any reason will not be permitted.

3.06 PROTECTION

- A. Trees and other vegetation designated on the Contract Drawings or directed by the Owner/Engineer to remain shall be protected from damage by all construction operations by erecting suitable barriers, guards and enclosures, or by other approved means. Conduct clearing operations in a manner to prevent falling trees from damaging trees, vegetation, utilities, and structures designated to remain. Conduct clearing to protect the Work being constructed and to provide for the safety of employees and others.
- B. Maintain protection until all Work in the vicinity of the Work being protected has been completed.
- C. Immediately repair any damage to existing tree crowns, trunks, or root systems. Roots exposed and/or damaged during the Work shall immediately be cut off cleanly inside the exposed or damaged area. Treat cut surfaces with an acceptable tree wound paint and topsoil spread over the exposed root area.
- D. When Work is completed, remove all dead and downed trees. Live trees shall be trimmed of all dead and diseased limbs and branches. All cuts shall be cleanly made at their juncture with the trunk or preceding branch without injury to the trunk or remaining branches. Cuts over 1-inch in diameter shall be treated with an acceptable tree wound paint.
- E. Restrict construction activities to those areas within the limits of construction designated on the Contract Drawings, within public rights-of-way, and within easements provided by the Owner. Adjacent properties and improvements thereon, public or private, which become damaged by construction operations, shall be promptly restored to their original condition, to the full satisfaction of the property Owner.
- F. Construct as necessary based on the type of equipment to be used during the pipelines installations, an access road within the right of way to facilitate the construction activity.

END OF SECTION

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SECTION 02210
ROCK AND BOULDER EXCAVATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Work specified in this Section includes furnishing all labor, materials, equipment and incidentals required to excavate and dispose of rock and boulders as shown on the Contract Drawings and as specified herein such that damage is prevented to adjacent utilities, pipes, structures, property and the Work and such that resulting ground vibrations are maintained below the maximum levels specified in this Section. The Contractor shall furnish acceptable material for backfill in place of the excavated rock to bring the limits of the trench and/or excavation to those required on this project.
- B. If allowed by local authorities and identified on Contract Drawings, blasting may be used to loosen rock and boulders for excavation. If blasting is performed, provide the services of a licensed Professional Engineer or geologist, registered in the State of South Carolina, to prepare blasting plans and supervise blasting operations.
- C. Protect existing structures, utilities, roadways, adjacent property, workers, Engineer, Owner, all abutters and the public from damage or injury from excessive ground vibrations and rock block movements. Should any damage occur to the existing utility or structures caused by rock removal methods (blasting, drilling etc.) shall be repaired at the Contractor's own expense with no additional cost to the Owner.
- D. Furnish, install and put into operation an audible warning system to indicate impending blasting. Familiarize workers, Engineer, Owner, all abutters and the public with the system implemented.
- E. Conduct blast monitoring of every blast round during the conduct of construction using the blast monitoring procedures and equipment specified in this Section.
- F. Conduct pre-blast survey for this Work as specified herein.
- G. Obtain and pay for all permits and licenses required to complete the Work of this Section. Original permits shall be prominently displayed on the Work site prior to initiating blasting operations.

1.02 RELATED WORK

- A. Section 02221 - Trenching, Backfill and Compaction.
- B. Section 02230 - Granular Fill Materials.
- C. Section 02270 - Sedimentation and Erosion Control.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300 and prior to commencing rock and boulder excavation the following:

1. A description of the means and methods of rock and boulder excavation techniques including size and energy of any impact equipment and chemical properties of any chemical agents to be used for chemical splitting.
 2. Name and qualifications of the person(s) responsible for monitoring and reporting rock excavation vibrations.
 3. Submit letters to property owners for pre-blast survey appointments.
 4. Submit three copies of the pre-blast survey, including three sets of photographs and/or video recordings, as specified herein.
 5. Submit blasting plans. Blasting plans shall be prepared by a licensed Professional Engineer or licensed geologist, registered in the State of South Carolina, having a minimum of 5 years of professional experience in blasting operations. The blasting plan shall include precondition surveys and sketches to show blast locations; proximity to, and methods for protection of, existing structures and utilities; vibration monitoring plan; method of transportation, storage and handling, manufacturers data sheet for all explosives, calculations of ground velocities at the nearest structures and nearest utilities, methods for protection of the existing structures and utilities including special perimeter control blasting procedures; and any other pertinent information required. The plan shall also include methods of matting or covering of the blast area to prevent flyrock and excessive airblast overpressure; details of the audible advance signal system to be employed at the job site as a means of informing workers, Engineer, Owner, all abutters and the general public that a blast is about to occur. Field monitoring methods and techniques including seismographs shall also be addressed.
 6. Submit a copy of the licensed Professional Engineer or licensed geologist's certification, on the form specified in Section 01300, stating that blasting plans have been prepared by the professional engineer or geologist,
- B. Review by the Owner/Engineer of material submitted by the Contractor shall not relieve the Contractor of responsibility for the accuracy, adequacy and safety of the rock and boulder excavation, exercising proper supervision and field judgment and producing the results within the limits required by this Section.

1.04 DEFINITIONS

- A. Rock: Any large mass of stone, bedrock, or ledge.
- B. Boulder: Rock fragments exceeding 1 cubic yard in volume.
- C. Rock Excavation: The removal of rock, which, in the opinion of the Owner/Engineer, cannot be removed by conventional mechanical excavation equipment and requires continuous, systematic drilling, blasting, wedging, sledging, cutting, barring, jack hammering, hoe ramming or expansive chemical splitting.
- D. Boulder Excavation: The removal of boulders exceeding 1 cubic yard in volume which can be removed by conventional mechanical excavation equipment.

- E. Rock fragments less than 1 cubic yard which can be removed without resorting to rock excavation shall be considered as "Soil Excavation".
- F. Soil Excavation: The removal of earth, including boulders less than 1 cubic yard in volume, weathered rock and rock fragment that can be removed by conventional mechanical excavation. Soil Excavation shall include all excavation of earth materials that are not considered as rock excavation or boulder excavation.
- G. Loose or disintegrated rock, loose or rotted shale, nested stones, hardpan and the like shall not be considered as rock or boulder.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. When rock is encountered, it shall be uncovered, but not excavated, until measurements are made by the Owner/Engineer.
- B. Rock in pipe trenches shall be excavated to at least 12 inches below the pipe invert. The width shall be as specified in Section 01025. Before the pipe is laid, the pipe bedding shall be installed to the correct subgrade with thoroughly compacted suitable material. Rock excavated greater than 12 inches below the pipe invert shall have the trench width restored to 12-inches below the pipe invert with compacted suitable pipe bedding at no additional cost to the Owner.
- C. Rock at structures shall be excavated to at least 12 inches below the bottom of the structure slab. The width shall be 2 feet beyond the outside wall of the structure. Before the structure is laid, the structure bedding shall be installed to the correct subgrade with thoroughly compacted suitable material. Rock excavated greater than 12 inches below the structure slab shall have the excavation restored to 12-inches below the structure slab with compacted suitable material at no additional cost to the Owner.

3.02 ROCK EXCAVATION

- A. Rock excavation may be performed by drilling, wedging, sledging, cutting, barring, jack hammering, hoe ramming, expansive chemical splitting, or other similar process in a manner, which does not cause damage to the existing structures, new construction or affect the ongoing utility operations.
- B. All rock excavation operations shall comply with the project, state and local noise and dust regulations.
- C. If rock below grade is shattered by rock excavation methods, and if, in the opinion of the Owner/Engineer, the shattered rock is unfit for subgrade (that grade which is below the pipe bedding), the rock shall be removed and the excavation refilled with thoroughly compacted screened gravel or structural fill at no additional cost.
- D. Whenever so directed during the progress of the work, the Contractor shall remove all dirt and loose rock from designated areas and shall clean the surface of the rock. Water in depressions

shall then be removed as required so that the whole surface of the designated area can be inspected to determine whether seams or other defects exist.

- E. The surfaces of rock foundations shall be left sufficiently rough to bond well with the concrete to be built thereon, and if required, shall be cut to rough benches or steps.
- F. Before any masonry or embankment is built on or against the rock, the rock shall be scrupulously freed from all vegetation, dirt, sand, clay, boulders, scale, excessively cracked rock, loose fragments, ice, snow, and other objectionable substances. Picking, barring, wedging, streams of water under sufficient pressure, stiff brushes, hammers, steam jets, and other effective means shall be used to accomplish this cleaning. All free water left on the surface of the rock shall be removed.

3.03 BOULDER EXCAVATION

- A. Boulders and rock fragments up to 1 cubic yard in volume may be reduced in size by rock excavation methods to simplify its removal.

3.04 EXCESS ROCK EXCAVATION

- A. If rock is excavated beyond the limits of payment indicated in Section 01025, the excess excavation, whether resulting from over breakage or other causes, shall be backfilled by and at the expense of the Contractor, as specified below in this Section.
- B. In pipe trenches, excess excavation below the elevation of the bottom of the bedding, cradle, or envelope shall be filled with material of the same type, placed and compacted in the same manner, as specified for the bedding, cradle, or envelope.

3.05 PREPARATION OF ROCK SURFACES

- A. Whenever so directed during the progress of the Work, the Contractor shall remove all dirt and loose rock from designated areas and shall clean the surface of the rock thoroughly, using steam to melt snow and ice, if necessary. Water in depressions shall then be removed as required so that the whole surface of the designated area can be inspected to determine whether seams or other defects exist
- B. Before any masonry or embankment is built on or against the rock, the rock shall be scrupulously freed from all vegetation, dirt, sand, clay, boulders, scale, excessively cracked rock, loose fragments, ice, snow, and other objectionable substances. Picking, barring, wedging, streams of water under sufficient pressure, stiff brushes, hammers, steam jets, and other effective means shall be used to accomplish this cleaning. All free water left on the surface of the rock shall be removed.

3.06 PREPARATION FOR BLASTING

- A. Perform a pre-blast survey for all structures within the influence range of blasting operations, or within 250 ft of the blast area, whichever is greater. The pre-blast survey shall consist of a close visual inspection, fully supported by photographs or video recordings, performed by, or under the supervision of, a licensed Professional Engineer or geologist experienced in such surveys. Contractor is responsible for mailing documentation to schedule an appointment with homeowner. Once appointment is scheduled with property owner, the Contractor is responsible

to give notice in writing, to the property owner and any representative of local authorities required to be present at such survey. Notify in writing the dates on which surveys are planned so that representatives are present during the examination. Provide copies of notices to the Owner/Engineer.

- B. Observations shall be recorded of the existing conditions for residences, buildings and other structures, which might be affected.
- C. The survey shall consist of a description of interior and exterior conditions. Descriptions shall locate cracks, damage or other defects existing and shall include information to make it possible to determine the effect, if any, of the construction operations on the defect. Where significant cracks or damage exists, or for defects too complicated to describe in words, photographs shall be taken and made part of the record.
- D. The records of each property examined shall be signed by the representatives present and, if practicable, by the property owner, whether or not they are present at the examinations.
- E. Upon completion of all earth/rock excavation and blasting work, the Contractor shall make a similar examination of properties and structures where complaints of damage have been received or damage claims have been filed. Give notice to interested parties so that they may be present during the final examinations. Records of the final examination shall be signed and distributed as the original pre-blast survey.
- F. Any damage noted after completion of blasting operations which cannot be determined from the pre-blast survey to be a preexisting condition shall be presumed to have been caused by blasting operations. Such damage shall be repaired promptly and completely to the property owner's satisfaction to restore the condition of the property to that existing prior to blasting.
- G. Maintain pre-blast survey records for a period of not less than 3 years following final completion and acceptance of the Work. In the event of damage claims, a report shall be prepared by the Contractor on the particular structures from those notes and photographs and submitted to the Owner/Engineer.

3.07 VIBRATION MONITORING

- A. Vibration Limit Criteria - The Contractor shall limit rock excavation operations to prevent damage to any adjacent building, structure, utilities, pipes or other features near the site. The Contractor is solely responsible to determine the maximum vibration and air blast tolerable at each facility. However, in no case shall the following be exceeded.
- B. Peak Particle Velocity (PPV) limits at the ground surface at existing residences, structures, utilities, and existing pipelines:

Frequency (Hz)	<u>Maximum Peak Particle Velocity (in. per. sec.)</u>
Over 40	2.0
30 to 40	1.5
20 to 30	1.0
Less than 20	0.5

- C. Scaled Distance (SD), distance/square root of maximum lbs/delay, shall be established based on the initial blasting and the distance to the closest structure and the charge weight that does not

damage any adjacent structure or utility. The established SD shall be used for all blasting associated with this particular portion of the project.

- D. Air blast Overpressure Limit: The Contractor shall conduct all blasting activity in such a manner that the peak air blast overpressure measured at the location of the nearest above ground, occupied structure to air blast does not exceed 0.013 psi.
- E. The Contractor shall monitor peak particle velocities and air blast overpressures using a minimum of two seismographs operated by personnel trained in their use during all rock excavation activities. Seismograph locations shall be mutually agreed upon by the Owner/Engineer and Contractor.
- F. Initial vibration monitoring for blasting operations to establish the SD shall be at the closest existing utility or structure to the blast areas.
- G. Vibration monitoring requires that time of firing be precisely known so that the seismographs can be started before firing. The Contractor shall establish a signal system, which will allow records of vibrations caused by blasting or other rock excavation activities to be made.
- H. Vibration monitoring for non-explosive methods shall be on a continuous basis throughout the operation.
- I. The Owner/Engineer may direct that additional vibration monitoring be performed if conditions warrant such action at no additional cost to the Owner.
- J. Vibration Monitoring Instrumentation – Provide two (minimum) seismographs for full time use on the project during blasting which have been calibrated within the previous six months to a standard, which is traceable to the National Bureau of Standards. Required characteristics of seismographs are listed below:
 - 1. Measure the three mutually perpendicular components of particle velocity in directions vertical, radial and perpendicular to the vibration source.
 - 2. Measure and display the maximum peak particle velocity component and air blast overpressure immediately after each blast.
 - 3. Furnish a permanent record of a velocity/time waveform, on a strip chart or from magnetic tape.

3.08 DISPOSAL OF ROCK AND BOULDERS.

- A. Fragmented rock with dimensions not exceeding 6 inches in any direction may be mixed with common fill and used as common fill in accordance with Section 02230).
- B. Rock and boulders may be crushed and screened for reuse in the work, provided that the resultant materials meet the requirements for gravel, crushed stone, or structural fill as specified in Section 02230).
- C. Excavated material shall be stacked without excessive surcharge on the excavation or obstructing free access to hydrants and all utility valves. Inconvenience to traffic and abutters shall be avoided as much as possible.

- D. Should conditions make it impracticable or unsafe to stack material adjacent to the excavation, the material shall be hauled and stored at a location provided. When required, it shall be re-handled and used in backfilling the trench at no additional cost to the Owner.
- E. Rock and boulder material disposed of by wasting shall be replaced by available surplus suitable soils. Common fill to supply any deficiency of backfill shall be provided at no additional cost.
- F. Unused rock and boulders shall be removed and disposed of off-site in a manner consistent with local rules and regulations at no additional cost to the Owner.

END OF SECTION

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SECTION 02221
TRENCHING BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and perform all trenching for pipelines and appurtenances, including drainage, filling, backfilling, disposal of surplus material and restoration of trench surfaces and easements.
- B. Basic handling of surface water and groundwater by constructing dikes, ditches, and sumps with pumps to prevent water flow into excavations so final grade is made in-the-dry. This work shall be assumed to be an integral part of pipeline construction and will be paid for under the individual pipe bid items.
- C. Excavation shall extend to the width and depth shown on the Drawings or as specified herein and shall provide suitable room for installing pipe, structures and appurtenances.
- D. Furnish and place all sheeting, bracing and supports and remove from the excavation all materials which the Owner/Engineer may deem unsuitable for backfilling. The bottom of the excavation shall be firm, dry and in all respects, acceptable. If conditions warrant, deposit gravel for pipe bedding, or gravel refill for excavation below grade, directly on the bottom of the trench immediately after excavation has reached the proper depth and before the bottom of the trench has become softened or disturbed by any cause whatever. The length of open trench shall be related closely to the rate of pipe laying. All excavation shall be made in open trenches.
- E. All excavation, trenching and related sheeting, bracing, etc., shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926 Subpart P).
- F. Whenever a requirement for percent compaction is referred to herein, it shall mean at least that percent of maximum density as determined by ASTM D1557, Method D.

1.02 RELATED WORK

- A. Section 01046 – Control of Work.
- B. Section 02011 – Test Pits.
- C. Section 02100 – Site Preparation.
- D. Section 02140 – Dewatering and Drainage.
- E. Section 02230 - Granular Fill Materials.
- F. Section 02210 - Rock and Boulder Excavation.
- G. Section 02270 - Erosion and Sedimentation Control.
- H. Section 02575 – Asphalt Pavement, Markings, and Appurtenances.

1.03 JOB CONDITIONS

A. Existing utilities:

1. Approximate location of certain underground lines and structures are shown on the plans for information only, other underground lines or structures may not be shown.
2. Locate these and other possible unknown utility lines using electronic pipe finder, or other approved means.
3. Locate, excavate and expose all existing underground lines in advance of trenching operations.
4. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these utilities in the execution of his work under this Section.
5. The Contractor shall familiarize himself with the existing conditions and be prepared to adequately care for and safeguard himself and the Owner from damage.
6. All Work shall be completed in accordance with the provisions of Section 01046.

B. Notification of intent to excavate:

1. South Carolina Underground Utility Damage Prevention Act (latest edition) requires persons to ascertain the location of underground public utility property prior to excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish prior to commencing such operations. Failure to comply could subject the violator to a civil penalty of up to one thousand dollars (\$1,000) for each violation of the Act.
2. Notification of intent to excavate may be given by calling this toll free number: 1-888-721-7877 or locally at 811.

C. Protecting trees, shrubbery and lawns:

1. Trees and shrubbery in developed areas and along the trench line shall not be disturbed unless absolutely necessary, and subject to the approval of the Owner/Engineer and in accordance with Section 01046. Any such trees and shrubbery necessary to be removed shall be heeled in and replanted.

D. Clearing:

1. Perform all clearing necessary for installation of the complete work in accordance with Section 02100.
2. Clearing shall consist of removing all trees, stumps, roots, brush and debris in the rights-of-way obtained for the Work.

3. All material, including trimmings from above, shall be completely disposed of in a satisfactory manner.

E. Removing and resetting fences:

1. Where existing fences must be removed to permit construction of utilities, remove such fences and reset the fences in their original location and condition or as directed by the Owner/Engineer in accordance with Section 01046 and as the Work progresses.
2. Provide temporary fencing or other safeguards as required.

F. Restoration of disturbed areas:

1. Restore all areas disturbed by construction activities to their existing or better condition. For existing areas with sod type grasses, replace with new sod of same type as existing. Existing sod may be reused where properly removed and stored and as approved by the Owner/Engineer.

1.04 SUBMITTALS

- A. Prior to the start of work, submit the proposed method of backfilling and compaction to the Owner/Engineer for review.
- B. Submit, in accordance with Section 01300, technical product literature for all geotextile products to be used for excavation and backfill.
- C. For any excavations 20 feet deep or deeper, the Contractor shall submit method of bracing/sheeting designed and stamped by a Professional Engineer licensed in the state of South Carolina. Submittal to the Owner/Engineer shall be for information purposes only.

PART 2 PRODUCTS

2.01 EXCAVATED MATERIALS

- A. Perform all excavation of every description and of whatever substances encountered to depths indicated or specified.
- B. Pile material suitable for backfilling in an orderly manner at safe distance from banks or trenches to avoid overloading and to prevent slides or cave-ins.
- C. Remove and dispose unsuitable or excess materials.

2.02 BACKFILL MATERIALS

- A. Provide backfill material in accordance with Section 02230 and the Contract Drawings.
 1. For sanitary sewer mains and storm drainage, select soil material free from organic matter and deleterious substances, containing no rocks or lumps over 2" in greatest dimension for backfill up to 12" above top of utility being covered.

2. For water mains, select sand as defined in Section 02230 for bedding and initial backfill up to 12" above the top of pipe being covered.
 3. Do not permit rocks larger than 2" in greatest dimension in top 6" of backfill.
- B. Should the quantity of suitable on-site material be insufficient to complete the work, provide suitable borrow material in accordance with Section 02230 and as approved by the Owner/Engineer at no additional expense to the Owner.

2.03 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 3; AASHTO M 288.
 2. Survivability: As follows
 - a. Grab Tensile Strength: 120 lbf (534 N); ASTM D 4632/ D 4632M.
 - b. Tear Strength: 50 lbf (223 N); ASTM D 4533/D 4533 M.
 - c. Puncture Strength: 310 lbf 1 N); ASTM D 6241.
 3. Apparent Opening Size: No. 70 (0.212-mm) sieve, maximum; ASTM D 4751.
 4. Permittivity: 0.1 per second, minimum; ASTM D 4751.
 5. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355/D 4355M.
- B. Product: Provide "Mirafi 140N," by TenCate Geosynthetics – Nicolon Corporation, or equal.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION

- A. Trench excavation shall include material of every description and of whatever substance encountered, except rock and boulders. Pavement shall be cut with a saw, wheel or pneumatic chisel along straight lines before excavating.
- B. Strip and stockpile topsoil from grassed areas crossed by trenches. At the Contractor's option, topsoil may be otherwise disposed of and replaced, when required, with approved topsoil of equal quality.
- C. While excavating and backfilling is in progress, traffic shall be maintained, and all utilities and other property protected as specified in other sections of these Contract Documents.

- D. Trenches shall be excavated to the depth indicated on the Drawings and in widths sufficient for laying the pipe, bracing and for pumping and drainage facilities. The bottom of the excavations shall be firm and dry and in all respects acceptable to the Owner/Engineer. Trench width shall be practical minimum.
- E. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. The trench may be excavated by machinery to, or just below the designated subgrade, provided that material remaining in the bottom of the trench is no more than slightly disturbed. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory as a result of inadequate excavation, dewatering or other construction methods shall be removed and replaced by crushed stone fill as required by the Owner/Engineer at the Contractor's expense.
- F. Clay and organic silt soils are particularly susceptible to disturbance due to construction operations. When excavation is to end in such soils, use a smooth-edge bucket to excavate the last 1-ft of depth.
- G. Where pipe is to be laid in gravel bedding, the trench may be excavated by machinery to the normal depth of the pipe provided that the material remaining in the bottom of the trench is no more than slightly disturbed.
- H. Where pipe is to be laid directly on the trench bottom, final excavation at the bottom of the trench shall be performed manually, providing a flat-bottom true to grade upon undisturbed material. Bell holes shall be made as required.
- I. If visible contaminants, odorous waste or any other potentially hazardous material is encountered during the excavation process, the Contractor shall stop work and store the contaminated material in approved containers. Contractor shall notify the City immediately to discuss the appropriate next steps in accordance with all the latest regulations. The Contractor shall make every effort to limit the environmental impact of the contaminants.

3.02 DEWATERING

- A. Control surface water and groundwater such that excavation to final grade is made in-the-dry, the natural undisturbed condition of the subgrade soils are maintained, and softening and/or instability or disturbance due to the presence or seepage of water does not occur. All construction and backfilling shall proceed in-the-dry and flotation of completed portions of work shall be prohibited.
- B. Methods of groundwater control may include but are not limited to perimeter trenches and sump pumping.
- C. At all times during construction, provide and maintain proper equipment and facilities to promptly remove and properly dispose of all water entering excavations. Excavations shall be maintained in-the-dry.
- D. Excavation dewatering shall maintain the subgrade in a natural undisturbed condition and until the fill, structure or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

- E. Pipe, masonry, and concrete shall not be placed in water or be submerged within 24 hours after being installed. Water shall not flow over new masonry or concrete within four days after placement.
- F. In no event shall water rise to cause unbalanced pressure on structures until the concrete or mortar has set at least 24 hours. Prevent flotation of the pipe by promptly placing backfill.
- G. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed condition of the subgrade soils at the proposed bottom of excavation.
- H. If the subgrade of the trench or excavation bottom becomes disturbed due to inadequate dewatering or drainage, excavate below normal grade as directed by the Owner/Engineer and refill with structural fill, screened gravel or other material as approved by the Owner/Engineer at no additional cost.
- I. Water entering the excavation from precipitation or surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to a sump and pumped from the excavation to maintain a bottom free from standing water.
- J. Drainage shall be disposed of in an approved area as specified in Section 01046. Existing or new sanitary sewers shall not be used to dispose of drainage.

3.03 DISPOSAL OF MATERIALS

- A. Excavated material shall be stacked without excessive surcharge on the trench bank or obstructing free access to hydrants and other utilities. Inconvenience to traffic and abutters shall be avoided as much as possible. Excavated material shall be segregated for use in backfilling as specified below.
- B. All excavated material not used for backfilling shall be removed from the site of the work and disposed of, except as directed by the Owner/Engineer. Dispose of such surplus material in approved designated areas.
- C. Should conditions make it impracticable or unsafe to stack material adjacent to the trench, the material shall be hauled and stored at a location approved by the Owner/Engineer. When required, it shall be re-handled and used in backfilling the trench.

3.04 SHEETING AND BRACING

- A. Furnish, put in place and maintain sheeting and bracing required by Federal, State or local safety requirements to support the sides of the excavation and prevent loss of ground which could endanger personnel, damage or delay the work or endanger adjacent structures. If the Owner/Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he/she may order additional supports placed at the expense of the Contractor. Compliance with such order shall not relieve the Contractor from his/her responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.
- B. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or

supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the gravel backfill.

1. When installing rigid pipe (R.C., D.I., etc.), any portion of the box extending below mid diameter shall be raised above this point prior to moving the box ahead to install the next pipe. This is to prevent the separation of installed pipe joints due to movement of the box.
 2. When installing flexible pipe (PVC, etc.), trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below mid-diameter of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, gravel shall be placed to fill any voids created and the gravel and backfill shall be re-compacted to provide uniform side support for the pipe.
- C. The cost for use of sheeting will be included in the bid items for pipe and shall include full compensation for driving, bracing and later removal of sheeting.
- D. All sheeting and bracing shall be carefully removed in such manner as not to endanger the construction of other structures, utilities, or property, whether public or private. All voids left after withdrawal of sheeting shall be immediately refilled with sand and rammed with tools especially adapted to that purpose, or by watering or otherwise as approved by the Owner/Engineer.
- E. No payment will be given for sheeting, bracing, etc, during the progress of the work. No payment will be given for sheeting which has actually been left in the trench for the convenience of the Contractor.
- F. Sheeting driven below mid-diameter of any pipe shall remain in place from the driven elevation to at least 1-ft above the top of the pipe.

3.05 TEST PITS

- A. Excavation of test pits may be required for the purpose of locating underground utilities or structures as an aid in establishing the precise location of new work.
- B. Test pits shall be backfilled as soon as the desired information has been obtained. The backfilled surface shall be maintained in a satisfactory condition for travel until resurfaced as specified.
- C. Test pits shall be excavated in accordance with Section 02011.

3.06 EXCAVATION BELOW GRADE AND REFILL

- A. Whatever the nature of unstable material encountered or the groundwater conditions, trench drainage shall be complete and effective.
- B. If the Contractor excavates below grade through error or for the Contractor's own convenience, or through failure to properly dewater the trench, or disturbs the subgrade before dewatering is sufficiently complete, he may be directed by the Owner/Engineer to excavate below grade as set forth in the following paragraph, in which case the work of excavating below grade and furnishing and placing the refill shall be performed at his own expense.

- C. For sanitary sewer and storm drainage installations, if the material at the level of trench bottom consists of fine sand, sand and silt or soft earth which may work into the gravel pipe bedding, the subgrade material shall be removed to the extent directed and the excavation refilled with a 6-in layer of coarse sand, or a mixture graded from coarse sand to the fine stone, as approved by the Owner/Engineer, to form a filter layer preserving the voids in the gravel bed of the pipe. The composition and gradation of gravel shall be approved by the Owner/Engineer prior to placement. Gravel shall then be placed in 6-in layers thoroughly compacted up to the normal grade of the pipe.
- D. For water main installations, in areas with unsuitable material, excavation shall continue until a depth is reached to provide a suitable foundation for the pipe bedding. In these circumstances, the Engineer shall determine this depth based on field conditions.
- E. Payment for excavation below grade and refill shall be at the unit price bid in the Schedule of Prices for the Over Excavation of Unsuitable Soils and Refill bid Item. Payment shall only be made for removal and replacement of existing unsuitable soils. No payment will be made for removal and replacement of unsuitable soils resulting from improper excavation, improper dewatering or accidental over-excavation by the Contractor.
- F. Geotextile non-woven filter fabric may be substituted for filter layer if approved by the Owner/Engineer.

3.07 BACKFILLING

- A. As soon as practicable after the pipe has been laid and jointed, backfilling shall begin and thereafter be prosecuted expeditiously. Bedding gravel or sand, as specified for the type of pipe installed, shall be placed up to 1-ft over the pipe.
- B. Where the pipes are laid cross-country, the remainder of the trench shall be filled with common fill material meeting AASHTO M145 Group Classification A1-A6 and be compacted in sufficient depths to meet a minimum compaction of 90% standard proctor with an allowable +/- 5% of optimum moisture content. Where a loam or gravel surface exists prior to cross-country excavations, it shall be removed, conserved and replaced to the full original depth as part of the work under the pipe items. In some areas it may be necessary to remove excess material during the clean-up process, so that the ground may be restored to its original level and condition.
- C. Where the pipes are laid within road rights-of-way but outside of 3-feet of the edge of pavement, the remainder of the trench shall meet requirements of AASHTO M145 Group classification A1-A3 and be compacted in 6" layers to a minimum compaction of 95% standard proctor with an allowable +/- 5% of optimum moisture content.
- D. Where the pipes are laid under pavement and within three feet of edge of pavement, the remainder of the trench shall meet requirements of AASHTO M145 Group classification A1 and be compacted in 6" layers to a minimum compaction of 95% standard proctor with an allowable +/- 5% of optimum moisture content. See parts F and G of this section for additional requirements.

- E. Under all pavement and within 3 feet of edge of pavement for SCDOT and County roadways, final backfill material shall be as specified in part E of this section to a depth of 3 feet below sub-base of pavement, then SCDOT excavatable flowable fill up to the subbase of the pavement as shown on the Drawings. The subbase layer for paving shall be as shown on the Drawings and thoroughly compacted in 6-in layers.
1. Approval or inspection prior to placement or following placement may be required by the Owner, SCDOT, or entity having jurisdiction over the work. Contractor to coordinate inspections and be familiar with all placement requirements. Any required rework due to lack of coordination by the Contractor shall be completed at no additional cost to the Owner.
 2. If any material is placed that does not comply with the Contract Documents, that material shall be removed and disposed of and suitable material replaced as backfill all at no additional cost to the Owner.
- F. To prevent longitudinal movement of the pipe, dumping backfill material into the trench and then spreading will not be permitted until selected material or gravel has been placed and compacted to a level 1-ft over the pipe.
- G. Backfill shall be brought up evenly on all sides. Each layer of backfill material shall be thoroughly compacted by rolling, tamping, or vibrating with mechanical compacting equipment or hand tamping. If rolling is employed, it shall be by use of a suitable roller or tractor, being careful to compact the fill throughout the full width of the trench.
- H. Compaction by puddling or water jetting shall not be permitted.
- I. Compaction in confined areas shall be by use of hand or pneumatic ramming with tools weighing at least 20 lbs. The material shall be spread and compacted in layers not exceeding 6-in thick, uncompacted loose measure thickness.
- J. Backfill around structures shall be granular fill material as specified and as shown on the Drawings. All backfill shall be spread and compacted as specified, especially under and over pipes connected to the structures.
- K. Bituminous paving shall not be placed in backfilling unless specifically permitted, in which case it shall be broken up as directed. Frozen material shall not be used under any circumstances.
- L. All road surfaces shall be broomed and hose-cleaned immediately after backfilling. Dust control measures shall be employed at all times.

3.08 RESTORING TRENCH SURFACE

- A. Where the trench occurs adjacent to paved streets, in shoulders, sidewalks, or in cross-country areas, thoroughly compact the backfill and maintain the surface as the work progresses. If settlement takes place, immediately deposit additional fill to restore the level of the ground.
- B. The surface of any driveway or any other area which is disturbed by the trench excavation and which is not a part of the paved road shall be restored to a condition at least equal to that existing before work began.

- C. In sections where the pipeline passes through grassed areas, and at the Contractor's own expense, remove and replace the sod, or loam and seed the surface to the satisfaction of the Engineer.

END OF SECTION

SECTION 02230
GRANULAR FILL MATERIALS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and obtain materials for filling and backfilling, grading and miscellaneous site work, for the uses shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Section 02100 – Site Preparation.
- B. Section 02221 - Trenching, Backfilling and Compaction .
- C. Section 02575 - Asphalt Pavement, Markings, And Appurtenances.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, complete product data and sieve analysis for all materials specified in this Section.
- B. Certification from the supplier of Flowable Fill that mix design is in accordance with SCDOT Standard Specification for Highway Construction, latest edition, SCDOT SC-M-210.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Granluar materials shall be free of all organic material, trash, snow, ice, frozen soil, or other objectionable materials which may be compressible or which cannot be properly compacted.
- B. Materials labelled as (wrapped) on the Drawings require geotextile wrap to control the migration of fines into open voids. In all cases, use a geotextile that prevents the transmission of the smallest soil particles present in both the in-situ soil and the soil used for bedding and structural backfill.
- C. Crushed Stone (commonly known as #57 stone) shall be sound, durable stone, angular in shape, and free of any foreign material, structural defects and chemical decay. Crushed stone shall conform to the following gradation limits:

Sieve Size	Percent Finer By Weight
1 1/2-in	100

1-in	95-100
1/2-in	25-60
No. 4	0-10
No. 8	0-5

- D. Crushed Stone may be substituted with SCDOT 305.2.1 Macadam Base upon the Owner/Engineer's approval. Ensure that aggregate is free from organic matter, sand, lumps or balls of clay and other deleterious material. Macadam Base shall conform to the following gradation limits:

Sieve Size	Percent Finer By Weight
2-in	100
1 1/2-in	95-100
1-in	70-100
1/2 -in	48-75
No. 4	30-60
No. 30	11-30
No. 200*	0-12

*AASHTO T-11 is used to determine the amount passing the No. 200 sieve.

- E. Crusher run shall be sound, durable stone, angular in shape, and free of any foreign material, structural defects and chemical decay. Crusher run shall conform to the following gradation limits:

Sieve Size	Percent Finer By Weight
1-in	100
3/4-in	90
1/2-in	60
1/4-in	25

- F. Common fill shall be free of any foreign material, structural defects and chemical decay. Common fill shall also be free from organic material and muck. Material shall be screened mixed in order to distributed any large pieces of clay. Materials shall have a maximum dry density not less than 100 lbs/ft³ at optimum moisture when tested in accordance with SC-T-29.
- G. Sand shall consist of hard, sharp, angular grains of quartz or other durable rock, free from excessive quantities of clay or other deleterious substances, and containing not more than 10.0% total material passing the No. 200 sieve with a maximum of 6.0% clay. Use sand that is free of clay balls, and if it has any clay contained within it, the clay is uniformly dispersed throughout the material. Excavated, blend, and stockpile the sand so that a uniform product is provided.
- H. Gravel shall be composed of hard durable particles of clean stone, free from an excess of thin or elongated pieces, vegetable matter, or other deleterious substances. Gravel shall conform to the following gradation limits:

Sieve Size	Percent Finer By Weight
2-in	100
1 1/2-in	95-100
1-in	70-100
1/2-in	35 - 65
No. 4	10 - 40

- I. Structural fill shall be sound, durable stone free of any foreign material structural defects and chemical decay. Structural fill shall consist of the following soil types, as defined by AASHTO M 145: Well Graded A-1 soils, Screenings meeting A-1, Macadam Graded aggregate base, Uniformly graded coarse sand A-3 soils (wrapped), Uniformly graded angular stone as large as #5 stone (wrapped).
- J. Flowable Fill shall be Excavatable consisting of a mixture of Portland cement, fly ash, fine aggregate, air entraining admixture, and water. Flowable Fill shall meet the requirements of the latest edition of SCDOT SC-M-210.
1. The Contractor shall utilize flowable fill as identified in the Contract Drawings, the SCDOT Encroachment Permit, or other applicable permits.
 2. The materials and equipment used to produce, transport, and place flowable fill shall be in compliance with the requirements set forth by the SCDOT Standard Specifications for Highway Construction, latest edition. Sampling and testing of flowable fill and materials used to produce it may be required at the discretion of the Owner/Engineer at no additional cost.
 3. The Contractor shall be responsible for providing the Owner/Engineer with certification from the supplier that mix design is in accordance with SCDOT Standard Specification for Highway Construction, latest edition, SCDOT SC-M-210. The Contractor shall use all necessary construction techniques to assure that the finished material will perform as intended. Anticipated unconfined compressive strength for the mixtures shall be as specified in SCDOT SC-M-210.
 4. Flowable fill will harden sufficiently to allow full traffic within 8 to 20 hours, depending upon placement conditions. If necessary to return traffic in less than 8 hours or if there is concern that traffic flow will cause damage to the fill or any structure below, steel plates shall be used to bridge over the hardening flowable fill as directed by the Owner/Engineer.

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 02270
SEDIMENTATION AND EROSION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and perform all installation, maintenance, removal and area cleanup related to erosion and sedimentation control work as shown on the Drawings and as specified herein. The work shall include, but not necessarily be limited to; installation of temporary access ways and staging areas, silt fences, stone filter boxes, stone filter berms, sediment removal and disposal, device maintenance, removal of temporary devices, temporary mulching, excelsior matting installation and final cleanup.
- B. Contractor shall be responsible for all furnishing and installing all erosion and sedimentation control devices required by all applicable permits to the work.

1.02 RELATED WORK

- A. Section 01046 – Control of Work.
- B. Section 02221 - Trenching, Backfill and Compaction.
- C. Section 02230 - Granular fill materials.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, technical product literature for all commercial products to be used for erosion and sedimentation control.
- B. Submit plans showing locations and details of all erosion and sedimentation control devices to be installed.

1.04 QUALITY ASSURANCE

- A. Be responsible for the timely installation and maintenance of all sedimentation control devices necessary to prevent the movement of sediment from the construction site to offsite areas or into a stream system via surface runoff or underground drainage systems. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at the expense of the Contractor. No additional charges to the Owner will be considered.
- B. Sedimentation and erosion control measures shall conform to the requirements outlined in the South Carolina Department of Health and Environmental Control, City of Columbia, and the County guidelines and regulations.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Crushed stone for sediment filtration devices, access ways and staging areas shall be as specified in Section 02230.

B. Berm structural stone shall be rip-rap as follows:

1. Rip-rap shall be sound, durable rock which is roughly rectangular shape and of suitable quality to insure permanence in the condition in which it is to be used. Rounded stones, boulders, sandstone or similar soft stone will not be acceptable. Material shall be free from overburden, spoil, shale and organic material, meet the Owner/Engineer's approval and be well graded within the following limits:

Weight of Stone	Percent Finer by Weight
40 lb	100
12 lb	50
3 lb	0

C. Silt Fence

1. Silt fence shall be a prefabricated commercial product made of a woven, polypropylene, ultraviolet resistant material such as "Envirofence" by Mirafi Inc., Charlotte, NC or equal.

D. 1/4-in woven wire mesh for filter boxes shall be galvanized steel or hardware cloth.

E. Straw mulch shall be utilized on all newly graded areas to protect areas against washouts and erosion. Straw mulch shall be comprised of threshed straw of oats, wheat, barley, or rye that is free from noxious weeds, mold or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

F. Erosion control blanket shall be installed in all seeded drainage swales and ditches as shown on the Drawings or as directed by the Owner/Engineer. Erosion control blanket shall be 100 percent agricultural straw matrix stitch bonded with degradable thread between two photodegradable polypropylene nettings, such as Model S150 Double Net Short-Term Blanket (10 months) by North American Green, Evansville, IN or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Silt Fence Installation

1. Silt fences shall be positioned as indicated on the Drawings and as necessary to prevent off site movement of sediment produced by construction activities as directed by the Owner/Engineer.
2. Dig trench approximately 6-in wide and 6-in deep along proposed fence lines.
3. Drive stakes, 8-ft on center (maximum) at back edge of trenches. Stakes shall be driven 2-ft (minimum) into ground.
4. Hang filter fabric on posts carrying to bottom of trench with about 4-in of fabric laid across bottom of trench. Stretch fabric fairly taut along fence length and maintain secure both ways.

5. Backfill trench with excavated material and tamp.
 6. Install pre-fabricated silt fence according to manufacturer's instructions.
- B. Construct filter boxes as detailed on the Drawings, from 1/4-in woven wire mesh or hardware cloth and wood. Fill with crushed stone and place over drop inlets and manholes to storm drain system as each inlet is completed. This should be done prior to setting casting, if there is a delay between installation of inlet structures or drain manholes and setting of castings. An alternate method is to ring each inlet with a sediment fence.
- C. Stone Filter Berm Installation
1. Place berm structural stone across channel just below lower sandbag wall at work area. Face upstream side of structural berm with crushed stone.
- D. Staging areas and access ways shall be surfaced with a minimum depth of 4-in of crushed stone.

3.02 MAINTENANCE AND INSPECTIONS

A. Inspections

1. Make a visual inspection of all erosion and sedimentation control devices once per week and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of sediment to offsite areas, promptly install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.

B. Device Maintenance

1. Silt Fences
 - a. Remove accumulated sediment once it builds up to 1/2 of the height of the fabric.
 - b. Replace damaged fabric, or patch with a 2-ft minimum overlap.
 - c. Make other repairs as necessary to ensure that the fence is filtering all runoff directed to the fence.
2. Filter Boxes
 - a. Replace crushed stone when it becomes saturated with silt.
3. Stone Filter Berm
 - a. Muck out trapped silt from dewatering operations when it has built up to within 6-in of the top of the berm.
 - b. Replace crushed stone filter when saturated with silt.
4. Add crushed stone to access ways and staging area as necessary to maintain a firm surface free of ruts and mudholes.

3.03 TEMPORARY MULCHING

- A. Apply temporary mulch to areas where rough grading has been completed but final grading is not anticipated to begin within 30 days of the completion of rough grading.
- B. Straw mulch shall be applied at rate of 100 lbs/1000 sq ft with latex acrylic copolymer at a rate and diluted in a ratio per manufacturer's instructions.

3.04 EROSION CONTROL BLANKETS

- A. Erosion control blankets shall be installed in all seeded drainage swales and ditches as shown on the Drawings and as directed by the Owner/Engineer in accordance with manufacturer's instructions. The area to be covered shall be properly prepared, fertilized and seeded with permanent vegetation before the blanket is applied. When the blanket is unrolled, the netting shall be on top and the fibers in contact with the soil over the entire area. The blankets shall be applied in the direction of water flow and stapled. Blankets shall be placed a minimum of three rows (of 4-ft) wide (total approx. 12-ft width) within the drainage swale/ditch and stapled together in accordance with manufacturer's instructions. Side overlaps shall be 4-in minimum. The staples shall be made of wire, .091-in in diameter or greater, "U" shaped with legs 10-in in length and a 1-1/2-in crown. Commercial biodegradable stakes may also be used with prior approval by the Engineer. The staples shall be driven vertically into the ground, spaced approximately two linear feet apart, on each side, and one row in the center alternately spaced between each size. Upper and lower ends of the matting shall be buried to a depth of 4-in in a trench. Erosion stops shall be created every 25-ft by making a fold in the fabric and carrying the fold into a silt trench across the full width of the blanket. The bottom of the fold shall be 4-in below the ground surface. Staple on both sides of fold. Where the matting must be cut or more than one roll length is required in the swale, turn down upper end of downstream roll into a slit trench to a depth of 4-in. Overlap lower end of upstream roll 4-in past edge of downstream roll and staple.
1. To ensure full contact with soil surface, roll matting with a roller weighing 100 lbs/ft of width perpendicular to flow direction after seeding, placing matting and stapling. Thoroughly inspect channel after completion. Correct any areas where matting does not present a smooth surface in full contact with the soil below.

3.05 REMOVAL AND FINAL CLEANUP

- A. Once the site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt and waste materials in proper manner. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated on the Drawings.

END OF SECTION

SECTION 02290 PIPE JACKING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, supplies, and incidentals required and install casing pipe and carrier pipe by jacking at the locations shown on the Drawings and as specified herein.
- B. Work shall be done in strict accordance with the details shown on the Drawings and as specified herein and in accordance with all South Carolina Department of Transportation (SCDOT) requirements and other applicable permit requirements.
- C. The work shall include, but not be limited to, the following: steel casing pipe, excavation within casing, contact grouting of annular space outside of casing, carrier pipe, casing spacers, casing seals, filling annular void between casing and carrier pipe, coatings, location markers, vents and miscellaneous appurtenances as required to complete the installation.
- D. Furnish special insurance, traffic control, flaggers, and any other requirements imposed by all permitting agencies.

1.02 RELATED WORK

- A. Section 02100 - Site Preparation.
- B. Section 02140 - Dewatering and Drainage.
- C. Section 02221 - Trenching Backfill and Compaction.
- D. Section 02270 - Sedimentation and Erosion Control.
- E. Section 02610 – Sewer Testing and Cleaning.
- F. Section 02612 – Cleaning Testing and Disinfection of Water Lines.
- G. Section 02615 - Ductile Iron Pipe for Buried Sewer Service.
- H. Section 02509 – Ductile Iron Pipe for Buried Water Service.
- I. Section 02628 – High Density Polyethylene Pipe.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, complete shop drawings and product data for casing pipe, carrier pipe, fittings and related appurtenances. Submit a lay schedule showing stationing, elevations, pipe classes and class coding.
- B. At least 30 days prior to the scheduled start of any jacking operations, submit in accordance with Section 01300 the proposed methods of jacking. Review will be for information only.

- C. Contractor shall remain responsible for adequacy and safety of construction means, methods, and techniques. Submittals shall consist of design drawings, calculations and related supplemental information describing in detail the design concept for all jacking operations. Submittals shall include, as a minimum, the following:
1. Detailed descriptions of equipment, materials, sequence, and procedures for jacking steel sleeve with shield including provisions for standby and backup equipment.
 2. Revisions to shop drawings, as necessary, to accommodate field conditions and/or compliance as specified herein.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

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-inches and over).
4. ASTM C144 — Standard Specification for Aggregate for Masonry Mortar.
5. ASTM C150 — Standard Specification for Portland Cement.
6. ASTM C207 — Standard Specification for Hydrated Lime for Masonry Purposes.

B. American Water Works Association (AWWA)

1. AWWA C200 — Steel Water Pipe — 6-in (150 mm) and Larger.
2. AWWA C203 — Coal-Tar Protective Coatings and Linings for Steel Water Pipelines — Enamel and Tape — Hot-Applied.
3. AWWA C206 — Field Welding of Steel Water Pipe.

- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. Steel casing pipe shall be the product of a single manufacturer. Pipe shall be tested and inspected at the foundry as required by the standard specifications to which the material is manufactured. Submit in accordance with Section 01300 sworn certificates of such tests, results and satisfactory approvals.
- B. All pipe to be installed under this Contract may be inspected at the site of manufacture for compliance with this Section by an independent laboratory selected by the Owner/Engineer. The manufacturer's cooperation shall be required in these inspections. The cost of any

inspection requested by the Owner of all pipe approved for this Contract shall be borne by the Owner. The cost of inspection of any disapproved pipe shall be borne by the Contractor.

- C. Welders shall be certified in accordance with standards of AWS. Submit current certifications prior to the start of field work.

1.06 SYSTEM DESCRIPTION

- A. The completed installation shall be suitable in all respects for transporting water or sewage without affecting the stability and integrity of the overlying roadways, railroad, structures, etc.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe shall not be dropped. Any damage to the pipe coatings shall be repaired as recommended by the manufacturer and as approved by the Owner/Engineer.
- B. All pipe shall be subjected to careful inspection prior to being installed. If any pipe fails to meet the requirements specified herein, it shall be removed and replaced with satisfactory pipe.

1.08 PROJECT/SITE REQUIREMENTS

- A. Discharge from dewatering operations shall be directed into approved receiving basins in accordance with all applicable regulatory requirements and Section 02140.
- B. Furnish all maintenance of traffic and establish and maintain all safety procedures on adjacent roadways and highways during the jacking operation in accordance with all permitting agency requirements.
- C. Inspect the locations where jacking operations will be conducted and the casing pipe is to be installed, verify the conditions under which the work will be performed, and provide all necessary details, whether shown or specified on the Drawings or not, for the orderly prosecution of the work.
- D. Be prepared to work at night and on weekends, if required, to complete the work. Request and obtain written authorization in accordance with the General Conditions prior to working nights and weekends.
- E. Jacking operations shall not result in measurable settlement, movement, or cracking of roadways or adjacent structures. If any measurable movement or settlement occurs which causes or might cause damage to roadways or structures over, along, or adjacent to the work, jacking operations shall stop immediately except for those activities which will assist in making the work secure and prevent further movement, settlement, or damage. Jacking operations may resume only after all necessary precautions have been taken to prevent further movement, settlement, or damage.
- F. Roadways and structures damaged by jacking operations shall be repaired or replaced as necessary to restore them to their condition prior to beginning jacking operations.

- G. Locate all existing utilities that cross jacking operations and determine elevations prior to submitting lay schedule. Coordinate with appropriate utilities prior to performing jacking operations.

1.09 DEFINITIONS

- A. Casing pipe shall mean the outer sleeve that is installed by the bore and jack method.
- B. Carrier pipe shall mean the pipe inserted within the casing pipe and which acts as the conveyor of liquid.
- C. Launch shaft shall mean the shaft in which the pipe jacking equipment is installed and from which both the casing pipe and carrier pipe are launched.
- D. Exit shaft shall mean the shaft located at the end of the casing pipe remote from the launch shaft at the point where the carrier pipe emerges from the casing pipe.

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

2.02 MATERIALS

A. Steel Casing Pipe

1. Steel casings shall be of leakproof construction and shall conform to the requirements of ASTM A53 (ASTM A139 Grade "B") and shall be protected inside and outside by a black bituminous coating a minimum of 5-mils thick. Steel casing pipe shall have a minimum yield strength of 35,000 psi, shall be equipped with grout holes and shall be designed to withstand H-20 traffic loading.
2. The inside diameter of the casing pipe shall be at least 4-inches greater than the largest outside diameter of the carrier pipe, joints, or couplings. It shall, in all cases, be large enough to allow the carrier pipe to be removed subsequently without disturbing the casing pipe or roadway subgrade.
3. Casing pipes shall have a minimum wall thickness as follows:

<u>Nominal Diameter</u> (inches)	<u>Minimum Nominal</u> <u>Thickness (inches)</u>
Under 14	0.250
16	0.281
18	0.312
24 and 26	0.375

28 and 30	0.406
32	0.438
34 and 36	0.469
Greater than 36	0.50

4. Steel casing thickness shall be increased as necessary by the Contractor to accommodate thrust loads due to jacking to advance the shield and casings.
5. All steel casing pipe shall be furnished in 20-foot lengths and have all joints welded.

B. Carrier Pipe

1. All carrier pipe joints within the casing pipe shall be restrained.
2. All pipe and fittings shall be as shown on the Drawings
3. Ductile iron carrier pipe for sewers shall be as specified in Section 02615.
4. Ductile iron carrier pipe for water service shall be as specified in Section 02509.
5. HDPE carrier pipe shall be as specified in Section 02628.

- C. Casing spacers shall be plastic Model PE as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.**

2.03 MIXES

- A. Cement grout shall consist of a mixture of about one-part cement to six parts sand. The amount of cement may be increased or decreased as necessary and as permitted to provide good flowing characteristics.**

2.04 SURFACE PREPARATION AND SHOP COATINGS

- A. Steel casing pipe shall be protected inside and outside by a black bituminous coating with a minimum thickness of 5-mils.**

PART 3 EXECUTION

3.01 PREPARATION

- A. Notify Owner/Engineer at least seven days in advance of the planned start of work within the permitting agency right-of-way.**
- B. Launch shaft subgrades shall be kept continuously free from ground and surface waters during jacking operations. Additional groundwater controls may be ordered on short notice and shall be implemented as directed. Observed water levels prior to construction are to be below the invert**

elevation of the launch shafts. Groundwater control along and at the face of the jacking casing shall include chemical grout stabilization as required.

3.02 INSTALLATION

- A. Excavate launch shaft and provide excavation supports as required. Excavation support shall extend a sufficient depth below the invert of the steel casing pipe to resist any pressure developed by the soil outside the launch shaft. Excavation support shall extend at least 3-ft, 6-inches above existing grade.
- B. Furnish, install and remove, to the extent required, thrust blocks or such other provisions as may be required in driving the casing pipe or carrier pipe forward.
- C. Maintain proper alignment and elevation of the casing pipe consistently throughout the jacking operation.
- D. Tolerances for installation of the casing pipe shall be as follows:
 - 1. Pressurized pipes:
 - a. Elevation: to grade or a maximum of 6-inches below grade.
 - b. Plan Location: plus or minus 6-inches.
 - 2. Gravity dependent pipes:
 - a. Elevation and grade of carrier pipe to be achieved.
 - b. Plan Location: plus or minus 6-inches.
- E. Jacking operations for the casing pipe shall be continuous and precautions shall be taken to avoid the pipe to "freeze" in place.
- F. Carrier pipe shall be supported within the casing pipe so that pipe bells do not rest directly on the casing. The load of the carrier pipe shall be distributed along the casing by the method of support as shown on the Drawings and as specified herein.
- G. Dewatering through the casing pipe during construction will not be permitted.
- H. Steel casing pipe sections shall have beveled ends with a single v-groove and shall be full penetration butt welded on the outside of the casing in accordance with the applicable portions of AWWA C206 and AWS D7.0 for field welded water pipe joints. All joints of the steel casing shall be butt welded prior to being subjected to the jacking operation. The welded joints shall be wire brushed and painted with bitumastic enamel coating in accordance with AWWA C203.
- I. Jacking shall be performed in a manner to prevent voids from developing outside the jacking sleeve. A jacking shield shall be used to minimize the amount of voids produced during excavating in the forward end of the jacking sleeve. Voids which occur shall be filled with cement grout.
- J. Furnish and install, and later remove to the extent required, thrust blocks or other provisions for backing up the jacks employed in driving the casing pipe forward.

- K. Immediately following the jacking operation, pressure grout the jacked section to fill all voids existing outside of the jacked casing. Grouting shall be from the interior of the casing through the grouting holes.
- L. After the casing pipe has been completely installed, thoroughly clean the interior of the casing pipe and remove all excess material leaving a smooth interior throughout.
- M. The exit shaft shall be excavated up to the casing pipe. Excavation support shall be provided as required. Sufficient room shall be provided to continue installation of carrier pipe, fittings, and all necessary connections to the system.
- N. The carrier pipe shall be installed within the casing using spacers as specified above. Carrier pipe shall be installed from the jacking pit end of the casing. Each joint shall be thoroughly checked prior to being inserted into the casing.
- O. Upon completion of installation of the carrier pipe inside the casing pipe, provide suitable caps or plugs at each end and hydrostatically test the carrier pipe in accordance with Section 02610 (if a sewer pipe) or Section 02612 (if a water pipe). If a water pipe, disinfect carrier pipe in accordance with Section 02612.
- P. Furnish masonry seal or end seal as specified by Engineer after the carrier pipe has been installed and successfully hydrostatically tested. Furnish wood backstop to masonry if required.

3.03 SITE RESTORATION

- A. At the conclusion of all jacking operations, remove excavation support systems for jacking pits. If withdrawal should damage or disturb the roadway subgrade, leave supports in place and cut off 36-inches below finished grade.
- B. All areas disturbed by construction shall be restored to existing or better condition and prepared, seeded, and maintained until accepted by the Engineer, Owner, and permitting agency.

END OF SECTION

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SECTION 02317
UNDERGROUND UTILITY WARNING TAPE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Underground detectable warning tape shall be furnished and installed for all main line (gravity and pressure) sewer, water and drain pipes, regardless of pipe material.
- B. Underground warning tape shall be furnished and installed in other areas as ordered by the Owner/Engineer.

1.02 SUBMITTALS

- A. Submit in accordance with Section 01300.
- B. Submit manufactures literature identifying all materials of construction, conformance with applicable reference standards, dimensions, specified material properties, colors and wording.

PART 2 PRODUCTS

2.01 MATERIALS

- A. The detectable warning tape shall include a solid core that provides detectability utilizing either the inductive or conductive modes using a pipe and cable locator.
- B. The detectable warning tape shall be polyethylene tape manufactured in accordance with the following technical data:

<u>PROPERTIES</u>	<u>TEST METHOD</u>	<u>VALUE</u>
Thickness	ASTM 02103	0.006" (6 mils)
Elongation	ASTM D882-75B	80%
Tensile Strength	ASTM 0882	70 lbs/foot

- C. Tape shall be 6 inches wide.
- D. The warning tape shall be heavy gauge 0.006 inch polyethylene and shall be resistant to acids, alkalis and other soil components. It shall be highly visible in the following colors with the associated phrases stamped in black letters and repeated at a maximum interval of 40 inches.

Type of Utility	Color	Warning Message
Sanitary Sewer	Green	Caution – Sanitary Sewer Buried Below
Storm Drain	Green	Caution – Storm Drain Buried Below
Water	Blue	Caution – Water Line Buried Below

- E. The tape shall be of the type specifically manufactured for marking and locating utilities.
- F. Tape shall be Terra Tape, Sentry Line Detectable warning tape as manufactured by Reef Industries Houston, Texas or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All buried pipe and fittings shall be installed with detectible underground warning tape located approximately 12-inches above but the pipe, but no more than 36 inches below the finished grade surface.
- B. Printed side of the tape shall be installed facing up.

END OF SECTION

SECTION 02610
SEWER TESTING AND CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and test and clean all new sewer pipelines installed under this Contract as specified herein. This section does not apply to water pipelines.

1.02 RELATED WORK

- A. Section 02615 - Ductile Iron Pipe for Buried Sewer Service.
- B. Section 02622 – Polyvinyl Chloride Gravity Sewer Pipe
- C. Section 02605 - Precast Concrete Manholes

1.03 SUBMITTALS

- A. Submit a testing plan including detailed procedures and methods and equipment that will be used for pipeline testing at least 10 days before starting the testing for City of Columbia's (Owner)'s review. All tests shall be conducted in the presence of the Owner. Furnish all necessary equipment and labor for carrying out the specified tests.
- B. Results of all infiltration, exfiltration, low pressure air, and hydrostatic pressure tests shall be submitted to the Owner. All rates of infiltration/exfiltration shall be clearly indicated along with sections of pipelines tested, and durations of the test.
- C. Any pipe not meeting the testing requirements of this section shall be repaired and/or replaced, retested and new test results submitted to the Owner for approval.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Furnish all necessary equipment and labor for cleaning and testing all new sewer pipelines. The procedures and methods shall be approved by the Owner.
- B. Make any taps and furnish all necessary caps, plugs, etc., as required in conjunction with testing pipelines. Furnish a test pump, gauges and any other equipment required in conjunction with carrying out the hydrostatic tests specified herein.

3.02 CLEANING PIPELINES

- A. As pipe laying progresses and at the conclusion of the work thoroughly clean all new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. If, after this cleaning, obstructions remain, they shall be removed by other means by the Contractor as approved by the Owner.

3.03 TESTING GRAVITY SEWER PIPELINES

- A. All sanitary gravity pipelines including ductile iron, PVC, and Centrifugally Cast Fiberglass Reinforced pipe shall be tested for leakage by an infiltration or exfiltration test. Buried piping shall be tested by an infiltration test if the groundwater is more than 2-ft above the crown of the pipe for the full length of the section to be tested. Air testing may be used in lieu of an exfiltration test subject to approval of the Owner.
- B. Exfiltration Test
 - 1. Leakage tests by exfiltration shall be made by creating a head in the pipeline to be tested by filling the line and either a manhole or temporary riser on one end of the line with water. The length of pipe to be tested shall be such that the head over the crown at the upstream end is not less than 2-ft and the head over the downstream crown is not more than 6-ft. The pipe shall be plugged by pneumatic bags or mechanical plugs in such a manner that the air can be released from the pipe while it is being filled with water. Before any measurements are made, the pipe shall be kept full of water long enough to allow absorption and the escape of any trapped air to take place. Following this, a test period of at least one hour shall begin. Provisions shall be made for measuring the amount of water required to maintain the water at a constant level during the test period.
 - 2. If any joint shows an appreciable amount of leakage, the jointing material shall be removed and the joint repaired. If any pipe is defective, it shall be removed and replaced. If the quantity of water required to maintain a constant head in the pipe does not exceed 1.9 gallons per inch of diameter per day per 100-ft of pipe and if all the leakage is not confined to a few joints, workmanship shall be considered satisfactory.
- C. Infiltration Test
 - 1. Pipe shall be tested for infiltration after the backfill has been placed and the ground water allowed to return to normal elevation. The length of line to be tested shall be not less than the length between adjacent manholes and not more than the total length of each size of pipe. The allowable infiltration shall be 1.9 gallons per inch of diameter per day per 100-ft of pipe in each section tested. There shall be no gushing or spurting leaks.
 - 2. If an inspection of the completed pipeline or any part thereof shows pipes or joints which allow noticeable infiltration of water, the defective work or material shall be replaced or repaired as directed.
 - 3. Rates of infiltration shall be determined by means of V-notch weirs, pipe spigots, or by plugs in the end of the pipe installed in an approved manner and at such times and locations as may be directed by the Contractor's Engineer.

D. Low Pressure Air Test

1. Low-pressure air tests shall be made with equipment specifically designed and manufactured for the purpose of testing pipelines using low-pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. All air used shall pass through a single control panel.
2. Install plugs at manholes. Brace plugs securely as required for safety and allow no one in the manholes while pressurizing the line or during the test.
3. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig. The internal air pressure in the sealed line shall not be allowed to exceed 8 psig. At least 2 minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig shall not be less than that shown in Table 1 of ASTM F1417.
4. If the pipe section does not pass the air test, sectionalize the section tested to determine the location of the leak. Once the leak has been located, repair and retest.

3.04 TESTING PRESSURE SEWER PIPELINES

1. All pressure pipelines shall be pressure and leakage tested. Pipelines shall be subjected to a hydrostatic pressure of 150 pounds per square inch or 1.5 times the operating pressure, whichever is greater, as determined by the Owner. This test pressure shall be maintained for at least 2 hours. The test pump and water supply shall be arranged to allow accurate measurement of the water required to maintain the test pressure. Where applicable, hydrant branch gate valves shall remain open during this test.
2. The amount of leakage which will be permitted shall be in accordance with AWWA C600.

3.05 LEAKAGE TESTS FOR SANITARY MANHOLES

- A. Sewer pipelines shall be tested as specified in Section 02610.
- B. Test each sewer manhole for leakage. Owner shall observe each test. Perform exfiltration test as described below:
- C. Assemble manhole in place; fill and point all lifting holes and exterior joints within 6-ft of the ground surface with an approved non-shrinking mortar. Test prior to placing the shelf and invert and before filling and pointing the horizontal joints below 6-ft of depth. Lower ground water table below bottom of the manhole for the duration of the test. Plug all pipes and other openings into the manhole and brace to prevent blow out.
- D. Fill manhole with water to the top of the cone section. If the excavation has not been backfilled and no water is observed moving down the surface of the manhole, the manhole is satisfactorily watertight. If the test, as described above is unsatisfactory as determined by the Owner, or if the manhole excavation has been backfilled, continue the test. A period of time may be permitted to

allow for absorption. Following this period, refill manhole to the top of the cone, if necessary and allow at least 8 hours to pass. At the end of the test period, refill the manhole to the top of the cone again, measuring the volume of water added. Extrapolate the refill amount to a 24-hour leakage rate. The leakage for each manhole shall not exceed one gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the leakage does not exceed three gallons per vertical foot per day, repairs by approved methods may be made as directed by the Owner. If leakage due to a defective section of joint exceeds three gallons per vertical foot per day, the manhole shall be rejected. Uncover the rejected manhole as necessary and disassemble, reconstruct or replace it as directed by the Owner. Retest the manhole and, if satisfactory, fill and paint the interior joints.

- E. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorptions, etc. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete.
- F. An infiltration test may be substituted for an exfiltration test if the ground water table is above the highest joint in the manhole. If there is no leakage into the manhole as determined by the Owner, the manhole will be considered watertight. If the Owner is not satisfied, testing shall be performed as previously described.

3.06 DEFLECTION TESTING

- A. All PVC and Centrifugally Cast Fiberglass Reinforced pipes shall be tested for deflection as follows:
 - 1. Pipe deflection shall be measured not less than 90 days after the backfill has been completed and shall not exceed 5 percent. Deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
 - 2. Deflection shall be measured with a rigid mandrel (Go/No Go) device cylindrical in shape and constructed with a minimum of nine evenly spaced arms or prongs. Drawings of the mandrel with complete dimensions shall be submitted to the Owner for each diameter of pipe to be tested. The mandrel shall be hand pulled through all sewer lines.
 - 3. Any section of sewer not passing the mandrel shall be uncovered at no additional cost to the Owner and the bedding and backfill replaced to prevent excessive deflection. Repaired pipe shall be retested at no additional cost to the Owner. Retested pipe shall not deflect more than 4 percent.

END OF SECTION

SECTION 02615
DUCTILE IRON PIPE FOR BURIED SEWER SERVICE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Work specified in this Section includes the installation of buried ductile iron pipe for gravity and pressure sanitary sewer service as indicated on the Contract Drawings and as herein specified.
- B. The Contractor shall furnish and install sewer piping and service connection piping to the lines and grades and in the locations indicated on the Contract Drawings and/or as ordered by the City of Columbia (Owner).
- C. Piping shall be located substantially as shown on the Drawings. The Owner reserves the right to make such modifications in locations as may be found desirable to avoid interference between pipes or for other reasons. Pipe fitting notation is for the Contractor's convenience and does not relieve him/her from installing and jointing different or additional items where required to achieve a complete piping system.
- D. Where the word "pipe" is used it shall refer to pipe, fittings, or appurtenances unless otherwise noted.

1.02 RELATED WORK

- A. Section 02140 - Dewatering and Drainage
- B. Section 02221 - Trenching, Backfill and Compaction
- C. Section 02230 - Granular Fill Materials
- D. Section 02610 - Sewer Testing and Cleaning
- E. Section 02605 - Precast Concrete Manholes
- F. Section 02317 - Underground Utility Warning Tape

1.03 SUBMITTALS

- A. Submit shop drawings and product data, including piping layouts, design calculations, warranty information, and test reports and the referenced standards.
- B. Submit the name of the pipe and fitting suppliers and a list of materials to be furnished.
- C. Submit certified copies of mill tests confirming the type of materials used in the pipe, and shop testing of pipe to show compliance with the requirements of the applicable standards, along

with a sworn affidavit of compliance that the pipe complies with the referenced standards, shall be submitted.

- D. Submit copies of all shop tests, including hydrostatic tests.
- E. Submit anticipated delivery schedule.
- F. Submit a certified affidavit of compliance from the manufacturer stating that the pipe, fittings, gaskets, linings and exterior coatings for this project have been manufactured and tested in accordance with AWWA and ASTM standards and requirements specified herein.
- G. The Applicator of the interior lining shall submit a certified affidavit of compliance with manufacturer's instructions and requirements specified herein.
- H. Submit handling procedures for all phases from finished fabrication through delivery including storage, transportation, loading, and unloading. This will include storage at the project site and required protection following installation prior to startup.
- I. Submit certified statement that inspection and all specified tests have been performed.

1.04 REFERENCES

- A. The following standards based on the latest edition form a part of this specification as referenced:
 - 1. ASTM A746 Standard Specifications for Ductile Iron Gravity Sewer Pipe
 - 2. AWWA C105 Polyethylene Encasement for Ductile Iron Pipe Systems
 - 3. AWWA C110 Ductile Iron Full Body Fittings, 3 in. through 64 in.
 - 4. AWWA C111 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
 - 5. AWWA C115 Flanged Ductile Iron Pipe with Threaded Flanges
 - 6. AWWA C151 Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids
 - 7. AWWA C150 Thickness Design of Ductile Iron Pipe
 - 8. AWWA C153 Ductile Iron Compact Fittings, 3 in. through 64 in. for Water Service
 - 9. AWWA C600 Installation of Ductile Iron Water Mains and their Appurtenances

1.05 QUALITY ASSURANCE

- A. It is a requirement of these Contract Documents to have all of the ductile iron pipe under this section be designed and supplied by a single supplier rather than have selection and supply of these items by a number of different suppliers.
- B. All pipe and fittings shall be inspected and tested at the foundry as required by the standard specifications by which the material is manufactured.

- C. All pipe and fittings shall be subject to inspection by the Owner after delivery to the job site and may also be subject to inspection at the foundry by a representative of the Owner.
- D. In addition, the Owner reserves the right to have any or all pipe, fittings, and special castings inspected and/or tested by an independent service at either the manufacturer's plant or elsewhere.
- E. All pipe and fittings shall be marked in accordance with all applicable AWWA standards. Legibly and permanently mark all pipe, fittings, specials and appurtenances to be consistent with the laying schedule and marking drawings (if required) with the following information:
 - 1. Manufacturer, date.
 - 2. Size, type, class, or wall thickness.
 - 3. AWWA Standard(s) produced to.

PART 2 PRODUCTS

2.01 PIPE

- A. Provide ductile iron pipe and fitting from American Cast Iron Pipe Co., US Pipe and Foundry, Griffin Pipe Products, McWane Company, or approved equal which must be a member of the Ductile Iron Pipe Research Association (DIPRA).
- B. Ductile iron gravity and pressure pipe shall conform to the current ASTM A746, and AWWA C111 and C151 (ANSI A21.51) standard. All pipe shall be new, and shall have the AWWA or ASTM designation, pressure class and size of pipe stamped on the outside of each joint.
- C. Thickness design shall be per AWWA C150, latest standard, with minimum Pressure Class 350 for piping 12-in and smaller, minimum Pressure Class 250 for piping from 14 to 20-in, minimum Pressure Class 200 for 24-inch piping, and minimum Pressure Class 150 for piping 30 to 64-in.
- D. Pipe to be shipped per AWWA C600 and in accordance with the pipe manufacturer's recommendations and stored in a manner that the pipe is not damaged. The Contractor will replace damaged piping at no additional cost to the Owner.

2.02 JOINTS AND GASKETS

- A. Unless otherwise noted, all ductile iron pipe/fitting joints shall be push-on rubber gasket type or rubber gasket mechanical joint type per AWWA C111 in unrestrained areas.
- B. In restrained areas as indicated on the Drawings, both pipe and fitting joints shall be push on rubber gasket, locking ring type restrained joints per the manufacturer' standard, except where flange joints are shown on the Drawings.
 - 1. Restrained push on joints shall be by one of the following or an approved equal
 - a. Amarillo Fast-Grip gasket, Flex Ring, Field Flex Ring, and LOK Ring by American Cast Iron Pipe

- b. Red Field Lok gasket, TR Flex by US Pipe
 - c. Snap Lok by Griffin Pipe Products
 - d. Superlok by Clow Water Systems Company
 - e. Or Equal
- 2. Restrained joint gaskets shall be colored, non-black. The color shall be consistent throughout the entire cross section of the gasket and not be attained by surface coating; the color shall be inherent within the rubber. Gaskets shall meet applicable requirements of AWWA/ANSI C111/A21.11 and shall be ANSI/NSF Standard 61 certified. Restrained joints shall be rated at a minimum as follows:
 - a. 350 psi for 4"-18" diameter
 - b. 250 psi for 20"-24" diameter
 - c. 150 psi for 30"-64" diameter
- C. Mechanical joint restraint systems that utilize a wedge style gripping system or a gland/ring positive restraint system will be considered acceptable on a case by case basis as approved by the Owner.
 - 1. The optional mechanical joint restraint shall be incorporated in the design of a follower gland. The gland shall be manufactured of ductile iron per ASTM A536. Dimensions of the gland must be such that it can be used with the standard mechanical joint bell and tee-headed bolts, as specified with the pipe.
 - 2. Restraint Mechanism:
 - a. Individually activated gripping surfaces maximizing restraint capability.
 - b. Wedges designed to spread the bearing surfaces on the pipe.
 - c. Torque limiting twist-off nuts. When the nut is sheared off, standard hex nut shall remain.
 - 3. Restraint Device for mechanical joint Ductile Iron Pipe: EBAA Iron Megalug Series 1100 or approved equal.
- D. Threaded ductile iron flanges for ductile iron pipe shall be used only where shown on the Drawings and shall be fabricated per AWWA C115 and sealed during installation with a special high pressure, full face gasket per AWWA C111. At the pipe manufacturer's option, the use of 250 lb. pattern flanges, which are faced and drilled in accordance with ANSI B16.1 may be substituted in order to match valves or other equipment and/or to meet the required working pressure requirements. All flanges shall be rated for the same pressure as the adjacent pipe in all cases. Compatibility of the flanges with 250 lb. class and higher special class AWWA valves will be the responsibility of the Contractor.
 - 1. Flanges shall be pre-drilled and then faced after being screwed onto the pipe, with flanges true to 90 degrees of the pipe axis and shall be flush with the end of the pipe.
 - 2. Gaskets shall be full face rubber, 1/8" thick SBR material. Such as American Toruseal Gasket, or approved equal. Special material ring gaskets such as those by Garlock or approved equal may be required for pressures exceeding 250 for ANSI rated and custom flanges.

3. Flanged joints shall be supplied with bolts and nuts on one end, bolt studs with a nut at each end, or studs with nuts on one end where the flange is tapped. The number and size of bolts shall comply with the same standard as the flange. Bolts and nuts shall, except as otherwise specified or noted in the Specifications or on the Drawings, comply with ASTM A193, grade B7.
 4. Blind flanges shall mate with regular flanges.
- 2.03 FILLER FLANGES AND BEVELED FLANGE FILLERS SHALL BE FURNISHED FACED AND DRILLED COMPLETE WITH EXTRA LENGTH BOLTS.FITTINGS
- A. Fittings for ductile iron pipe shall be of ductile iron, and shall conform to AWWA C153 or AWWA C110.
 - B. Fittings shall have the same pressure rating, as a minimum, of the connecting pipe.
- 2.04 COUPLINGS AND ADAPTERS
- A. Sleeve type couplings shall be mechanical joint solid sleeve type. Dresser Style 38, 138 or equal by Ford Meter Box Co. shall be used only when approved by the Owner.
- 2.05 EXTERIOR COATING
- A. All buried pipe shall be installed with an external bituminous coating in accordance with AWWA C151 and C110 respectively.
 - B. All ductile iron pipe located within 100 LF of an active cathodic protection system, such as that on steel gas lines, shall be protected by installing polyethylene encasement. When used polyethylene encasement shall be V-Bio, or approved equal, and meet all the requirements for ANSI/AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems.
 1. V-Bio polyethylene encasement shall consist of three layers of co-extruded linear low-density polyethylene (LLDPE), have a minimum thickness of 8 mils and meet or exceed the minimum standards established by AWWA C105, current edition. Polyethylene encasement shall meet minimum size requirements per TABLE 3 of section 2.15 of DIPRA's Installation Guide for Ductile Iron Pipe.
 2. The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion. Ductile iron pipe and the polyethylene encasement used to protect it shall be installed in accordance with AWWA C600 and ANSI/AWWA C105/A21.5 and also in accordance with all recommendations and practices of the AWWA M41, Manual of Water Supply Practices.
 3. A 2-inch wide plastic adhesive tape, manufactured by Calpico Vinyl, Polyken, U.P.C. Tape, or approved equal, shall be used for sealing seams, cuts, or tears in polyethylene encasement. Duct tape shall not be allowed.

2.06 INTERIOR LINING

- A. For sanitary sewer, ductile iron pipe and fittings shall be lined with a ceramic-filled amine-cured epoxy, Protecto 401 by Induron, or equal. The lining thickness shall be 40 mils minimum. Application shall be performed by an applicator approved by the coating manufacturer, in accordance with manufacturer's instructions and under controlled conditions at the applicator's shop or the pipe manufacturer's plant.
 - 1. Interior lining shall cover all exposed surfaces of the pipe and fittings. The lining shall extend from the spigot end through the socket to the edge of the gasket sealing the recess for pipe using push-on joints. The lining shall also cover the exterior of the spigot end from the end of the pipe to beyond the gasket sealing area.

PART 3 EXECUTION

3.01 GENERAL

- A. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe, lining or coatings. Pipe and fittings shall not be dropped or skidded against each other. Slings, hooks or pipe tongs shall be used for pipe handling. All pipe and fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to the pipe, lining or coatings shall be repaired per manufacturer's recommendations. Handling and laying of pipe and fittings shall be in accordance with manufacturer's instruction and as specified herein.
- B. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work and when installed or laid, shall conform to the lines and grades required.
- C. Materials, if stored, shall be kept safe from damage and stored in accordance with the manufacturer's requirements. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt, excessive corrosion or foreign matter at all times.
- D. Pipe shall not be stacked higher than the limits recommended by its manufacturer. The bottom tier shall be kept off the ground on timbers, rails, or concrete. Stacking shall conform to manufacturer's recommendations and/or AWWA C600.
- E. Gaskets for push-on joints to be stored shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.
- F. Piping underneath structures shall be encased.

3.02 INSTALLING DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA C600, except as otherwise specified herein. Pipe shall be bedded per details shown on the Drawings. Unless approved at specific locations, blocking will not be permitted. If any defective pipe or fitting is discovered after it has been laid, it shall be removed and replaced with a sound pipe or fitting in a satisfactory manner by the Contractor, at his/her own expense.

1. All pipe and fittings shall be kept clean until they are used in the work and shall be sound and thoroughly cleaned before laying. When laid, the pipe and fittings shall perform to the lines and grades required. When laying is not in progress, open ends of the pipe shall be closed by a watertight plug or other approved means. Sufficient backfill shall be placed to prevent flotation. The deflection at joints shall not exceed that recommended by the manufacturer.
2. All ductile iron pipe laid underground and not in SCDOT right-of-way shall have a minimum of 3 feet of cover for pipes 12-inches and less and 4 feet of cover for pipes greater than 12-inches unless otherwise shown on the Drawings or as specified herein. Pipe shall be laid to the invert elevations shown on the Drawings. All ductile iron pipe laid underground within SCDOT right-of-way shall have a minimum of 4 feet of cover for all diameters or as otherwise required by the SCDOT Utility Accommodations Manual.
3. Fittings, in addition to those shown on the Drawings, shall be provided by the Contractor where required in crossing utilities which may be encountered upon opening the trench. Solid sleeve closures shall be installed at locations approved by the Owner.
4. The pipe interior shall be maintained dry and broom clean throughout the construction period.
5. When field cutting the pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. The end of the cut pipe shall be beveled to conform to the manufacturer's recommendations for the spigot end. Any coating removed from the cut end shall be repaired according to manufacturer's recommendation. Cutting of restrained joint pipe will not be allowed, unless approved at specific joints in conjunction with the use of restrainer glands by EBAA Iron or field adaptable restrained joints. Where field cuts are permitted, the pipe to be cut shall be supplied by the factory as "gauged full length". Should full length gauged pipe be unavailable, the pipe to be cut shall be field gauged at the location of the new spigot using a measuring tape, or other means approved by the manufacturer, to verify that the diameter is within the tolerances permitted in Table 1 of AWWA C151.

B. Jointing Ductile-Iron Pipe

1. Push-on joints shall be made in strict accordance with manufacturer's instructions, AWWA C600 and Appendix B of AWWA C111. If there is conflict, the manufacturer's instructions shall take precedence. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe. The joint surfaces shall be cleaned and lubricated per manufacturers recommendations and the plain end of the pipe shall be aligned with the bell of the pipe to which it is to be joined and pushed home. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is properly seated.
2. Bolts in restrained joints shall be tightened alternately and evenly.
3. Restrained joints shall be installed according to pipe manufacturer's instructions.
4. Flanged joints (not to be used for buried service) shall be assembled in strict accordance with the manufacturer's instructions and Appendix C of AWWA C111. If there is conflict, the manufacturer's instructions shall take precedence. Extreme care shall be taken to ensure

that there is no restraint on opposite ends of pipe or fitting, which would prevent uniform gasket compression, cause unnecessary stress, bending or torsional strains, or distortion of flanges or flanged fittings. Adjoining push on joints shall not be assembled until flanged joints have been tightened. Flange bolts shall be tightened uniformly to compress the gasket uniformly and obtain a seal. Flange bolts shall be left with approximately 1/2-inch projection beyond the face of the nut after tightening. After installation bolts and nuts shall be encapsulated using wax sealing tape per AWWA Standard C217.

5. Mechanical joint solid sleeve couplings shall only be installed for closure or as shown on the Drawings. Couplings shall not be assembled until adjoining joints have been assembled. After installation, bolts and nuts shall be encapsulated using wax sealing tape per AWWA Standard C217, and install protective wrap recommended by the manufacturer or as required herein.
- C. Install V-Bio polyethylene encasement around ductile iron pipe to limits shown on the Drawings and in accordance with pipe manufacturer's recommendations.
1. Polyethylene encasement shall be installed per ANSI/ AWWA C105/A21.5, Method 'A' in accordance with section 2.15 of DIPRA's Installation Guide for Ductile Iron Pipe.
 2. A fabric type or padded sling shall be used when handling polyethylene encased pipe to prevent damage to the polyethylene encasement.
 3. All seams in the polyethylene encasement shall be sealed completely with approved 2-inch wide plastic adhesive tape.
 4. Extreme care shall be taken to ensure that all rips or tears in the polyethylene encasement are properly repaired with additional tape and film as described in ANSI/AWWA C105/A21.5
 5. Extreme care shall be taken when backfilling to avoid damaging the polyethylene encasement

3.03 CONNECTIONS TO STRUCTURES

- A. Wherever a pipe 3-in in diameter or larger passes from a concrete wall to earth horizontally, two flexible joints spaced from 2 to 4-ft apart depending on pipe size shall be installed, within 2-ft of the exterior face of the wall, whether or not shown on the Drawings.
- B. Unless otherwise specified, all pipes passing through a wall will utilize a wall sleeve designed to pass the thrust through the wall via restrained piping.

3.04 TESTING AND CLEANING

- A. All gravity and pressure testing of sewer pipe is included in Section 02610.

3.05 UNDERGROUND UTILITY MARKING

- A. The underground utility warning tape shall be provided and installed in accordance with Section 02317.

END OF SECTION

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SECTION 02616
PLUG VALVES FOR BURIED SEWER MAINS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Work specified in this Section includes furnishing all labor, materials, equipment, supplies, and incidentals required and install all buried Eccentric Plug Valves complete as shown on the Contract Drawings and as specified herein.
- B. The Contractor shall furnish and install all valves at the locations indicated on the Contract Drawings.
- C. Valves shall be located substantially as shown on the Drawings. The Owner/Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with other utilities or for other reasons.
- D. Coordinate Work of this Section with City of Columbia in compliance with other applicable permitting agencies.

1.02 RELATED WORK

- A. Section 01300 - Submittals.
- B. Section 01600 - Delivery Storage and Handling.
- C. Section 01720 - Record Drawings
- D. Section 01730 - Operation and Maintenance Manuals.
- E. Section 02221 - Trenching, Backfill, and Compaction.
- F. Section 02230 - Granular Fill Materials: Aggregate for bedding under valve.
- G. Section 02615 - Ductile Iron Pipe for Buried Sewer Service.
- H. Section 03300 - Cast-in-Place Concrete.

1.03 REFERENCES

- A. The following standards are based on the latest edition and form a part of the specifications as referenced.
 - 1. ANSI/AWWA C110 - Ductile Iron and Gray-Iron Fittings
 - 2. ANSI/AWWA M44 - Distribution Valves: Selection, Installation, Field Testing, and Maintenance
 - 3. ANSI/NSF 61 - Drinking Water System Components – Health Effects

4. ANSI/NSF 372 - Drinking Water System Components – Lead Content
5. AWWA C517 - “Resilient-Seated Cast-Iron Eccentric Plug Valves”
6. AWWA C111 - "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings".
7. AWWA C550 – Protective Interior Coatings for Valves and Hydrants”.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's latest published literature including product illustrations, installation and maintenance instructions, storage and handling procedures, and recommended spare parts lists.
- B. Shop Drawings: Submit description of proposed installation.
- C. Manufacturer's Certificate: Submit manufacturer’s affidavit that specified plug valves conform to stated requirements of AWWA C517, and this Section, and that they have been tested in the United States in accordance with said AWWA Specifications.
- D. Record actual locations of all valves and submit record drawings in accordance with Section 01720 Record Drawings.
- E. Submit all required Operation and Maintenance data for valves in accordance with Section 01730 Record Drawings.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with City of Columbia standards.
- B. The Contractor shall furnish all labor necessary to assist the Owner/Engineer in inspecting valves. All valves shall be inspected upon delivery. Any valve that does not conform to the requirements of this Contract shall be rejected and immediately removed by the Contractor.
- C. Test valves in accordance with AWWA C517.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. All items shall be packaged in such a manner as to provide adequate protection of the products during transportation to the site. Any valves damaged in shipment shall be replaced as directed by the Owner/Engineer.
- C. Valves and accessories shall be loaded and unloaded or otherwise handled in such a manner as to minimize the possibility of damage prior to installation. All materials shall be stored at the construction site in such a way as to prevent damage and to assure they are kept as clean as possible prior to installation.

PART 2 PRODUCTS

2.01 ECCENTRIC PLUG VALVES

- A. Plug Valves shall be manufactured in the United States by DeZurik. Provide worm gear and hand wheel operator on 4-inches and larger. On sizes less than 4-inches ball valves shall be used with quarter turn lever type operator.
- B. Plug Valve shall be 3-in. to 36-in. in diameter, shall be solid one piece, and bodies and covers manufactured from Ductile Iron ASTM A536 Grade 65-45-12.
- C. Ports shall be rectangular and 100% port area. The valve port area shall meet or exceed standard pipe area per ASME/ANSI B36.10M. Bearings shall be sleeve type and made of sintered, oil impregnated permanently lubricated type 316 stainless steel.
- D. The plug shall have a cylindrical resilient seating surface eccentrically offset from the center of the shaft. Plug shall not contact the seat until at least 90% closed.
- E. Seats on shall be 1/8" thick welded overlay of not less than 95% pure nickel. Seat shall be at least 1/2" wide, 1/8" thick through entire width and raised. The raised surface shall be completely covered with nickel to insure that the resilient plug face contacts only the nickel seat.
- F. Adjustable packing shall be multiple V-ring type, with a packing gland follower. Packing gland shall permit inspection, adjustment or complete replacement of packing without disturbing any part of the valve or actuator assembly, except the gland follower. Non-adjustable packing or packing requiring actuator removal to replace the packing, is not acceptable.
- G. Pressure ratings shall be 175 psi (on valve sizes through 12") and 150 psi for 14" and larger. Every valve shall be given a certified hydrostatic shell test and seat test, with test reports being available upon request.
- H. End connections shall meet or exceed the latest revisions of AWWA C517 and other applicable standards. End Connections shall be Mechanical Joint per AWWA C111. Restraint to be provided as indicated on the Contract Drawings.
- I. All buried plug valves shall be provided with worm gear actuators suited for the intended service. Valve actuators shall be fully grease packed and have stops in the open/close position. The actuator shall have a mechanical stop which will withstand an input torque of 300 lbs. against the stop. The actuator shall be able to provide 1.25 times the required operating torque under full rated line pressure combined with a flow velocity of 8 feet per second.
- J. Operating Nut: 2-inch square, centered to ensure even distribution of torque and ductile iron or bronze conforming to ANSI/AWWA C515.
- K. Plug Valve Box and Protector Ring
 - 1. All plug valves shall be equipped with cast iron valve boxes and covers of the adjustable or extension type.

2. All valve boxes to be installed with a valve box protector ring as detailed on the Contract Drawings and have "SEWER" cast in valve box covers.

L. Plug Valve Extension Stem

1. There shall be a maximum 48" depth to valve operator nut. The Contractor must use extension stems, if necessary, to raise operator nut within 48" of the final grade. Extensions must be securely attached to the operating nut so the shaft will not pull off of the operator.
2. Upper end of extension stem shall terminate in square wrench nut no deeper than 4-ft. from finished grade or as shown on Drawings.
3. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.

- M. The interior and exterior of all plug valves shall be coated with a fusion bonded epoxy to resist corrosion, abrasion and chemical attack. The coating shall be applied in accordance with ANSI/NSF 61 providing a surface with no runs, sags, or thin spots. Color shall be black and have a minimum thickness of 4 mils.

PART 3 EXECUTION

3.01 GENERAL

- A. Install all valves in accordance with ANSI/AWWA C517 and manufacturer's recommendations.
- B. Excavate pipe trench in accordance with Section 02221 for Work of this Section.
- C. No pipe or valving shall be installed when the Owner, Engineer, or Contractor has determined that the trench conditions are unsuitable.
- D. Carefully lower valves and fittings into trench in such a manner as to prevent damage to the sewer main materials and protective coatings and linings.
- E. Prevent foreign material from entering valve body while it is installed. During installation, no debris, lifting straps/chains, tools, clothing, or other materials shall be placed in the valve body.
- F. Mechanical Joint Fittings:
 1. Install valves per manufacturer's standards.
 2. There shall be a minimum of 18 inches of pipe between all valves and fittings.
 3. No flanged fittings shall be utilized in a direct bury installation.
- G. Valves shall be designed to be restrained:
- H. Valve vaults shall be installed as directed by the Owner/Engineer.

3.02 HYDROSTATIC TESTING, CLEANING AND DISINFECTION

- A. Cleaning, testing and disinfection of all ductile iron water lines, services, and valves shall be in accordance with Section 02612.

3.03 UNDERGROUND UTILITY MARKING

- A. The underground utility tape shall be provided and installed in accordance with Section 02317.

END OF SECTION

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SECTION 02767
SANITARY SEWER FLOW CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section includes all materials, labor, and equipment required to provide bypass flow control for new sanitary sewer line construction, upgrades or rehabilitation. This section also includes all materials, labor, and equipment required to provide bypass flow control for conducting proper PACP CCTV inspection of sewers.
- B. The Contractor shall be responsible for maintaining wastewater flow in all public and private pipes during construction. All bypass pumping systems shall be manned by the Contractor during non-working hours, seven (7) days per week as necessary. During the installation and/or rehabilitation of sections of the sewer system, it is required that the Contractor maintain sewage flows in the system and from all abutting properties at all times. No sanitary service shall be interrupted by the Contractor except as absolutely necessary and then for only very short periods of time of no more than thirty (30) minutes and then only when coordinated with the affected property owner and the City of Columbia (Owner). During main line cured-in-place pipe lining operations, interruption at the street tie-in will be allowed for up to twenty-four (24) hours, when coordinated, by the Contractor, with the affected property Owner.
- C. The Contractor is required to furnish all power, maintenance, etc. to implement the bypass flow control system necessary to divert the existing flow around the work area for the work's duration. The design, installation, and operation for the temporary bypass pumping system shall be solely the Contractor's responsibility. Bypass pumping is required to adequately control the flow as listed in Paragraph 3.01.
- D. The Contractor shall exhaust all attempts with other methods of flow control (i.e. work in low flow times, plugs, dams, blocking, etc.) prior to recommending bypass pumping. If bypass pumping is determined to be needed, concurrence from the Owner is required before proceeding.
- E. If access to private property is required to perform the work, the contractor must obtain written permission prior to starting any work. Clearing and other costs related to gaining access (including restoration) should be included in contractor's bid pricing. Contractor to assume bid responsibility for coordination of and relocation of sheds if such relocation is required to perform work. The final location of the shed will be determined on a case by case basis in consultation with the Owner and the property owner.
- F. If fence removal is required, fences shall be replaced in kind and a gate should be placed along any easements to allow future access by Owner forces and equipment. Each of these will be determined on a case by case basis directly with the Property Owner.
- G. Contractor shall include site restoration including irrigation line repairs, driveway restoration, shrubbery replacement, etc. when choosing a route for bypass equipment.

- H. Contractor is solely responsible for any damages resulting from his/her operations.
- I. Contractor is required to obtain any and all required permits necessary to implement his proposed bypass pumping operation.
- J. The Contractor shall meet with the City to understand the requirements of the Sanitary Sewer Overflow Response Plan (SORP). Contractor staff shall be trained on the plan's requirements and the Contractor shall be required to implement preventative measures in accordance with the SORP throughout the bypass pumping operations.

1.02 RELATED WORK

- A. Section 02615 - Ductile Iron Pipe for Buried Sewer Service.
- B. Section 02622 - Polyvinyl Chloride Gravity Sewer Pipe.

1.03 SUBMITTALS:

- A. Submit a statement indicating that the Contractor is familiar with the requirements of the SORP and that his staff shall implement applicable requirements throughout the bypass pumping operations.
- B. Submit the following to Owner prior to commencing work for review and approval.
 - 1. Bypass Sewage Pumping Plan. Plan shall contain, at minimum, the following:
 - a. Staging areas for pumps.
 - b. Sewer plugging method and types of plugs.
 - c. Number, size, material, location and method of installation of suction piping.
 - d. Number, size, material, method of installation and location of installation of discharge piping.
 - e. Calculations of bypass pump sizes, capacity, number of each size to be on site and power requirements. Pump sizing shall clearly indicate compliance with requirements of this Specification.
 - f. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted).
 - g. Standby power generator size and location and spill prevention and control measures.
 - h. Downstream discharge plan along with method of protecting discharge manholes or structures from erosion and damage.
 - i. Thrust and restraint block sizes and locations.
 - j. Sections and plans showing suction and discharge pipe location, depth, embedment, select fill and special backfill.
 - k. Method of noise control for each pump and/or generator.
 - l. Any temporary pipe supports and anchoring required.
 - m. Schedule for installation of and maintenance of bypass pumping lines.
 - n. Plan indicating monitoring locations.

- o. All items related to testing, inspection, maintenance, and monitoring as described in these section.
 - p. All other incidental items necessary and/or required to ensure facilities are properly protected including protecting the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in the Contract Documents.
 - q. For sewer rehabilitation by lining methods, generic plans may be developed for typical situations and various sizes to be implemented.
- C. Submit a list of emergency contact phone numbers for staff that are available to respond to emergencies 24-hours per day 7-days-per-week. The phone numbers must be maintained throughout the duration of the bypass operations.
- D. Submit a plan that addresses emergency measures that could be implemented to increase bypass flow if needed during an unforeseen wet-weather condition. The plan shall include addition of pumps, pipes, generators, and appurtenances necessary and the additional flows that could be pumped if such a plan were implemented. Implementation of such a plan would only be required when directed by the Owner.
- E. Submit daily checklists of field quality control as required by Paragraph 3.04.

PART 2 PRODUCTS

2.01 BYPASS EQUIPMENT

- A. All equipment utilized for bypass pumping shall be specifically designed for intended purpose. All piping, pumps, etc. in contact with sanitary sewage shall be manufactured with materials designed for use in a sewage environment.
- B. All pumps used shall be fully automatic self-priming units which do not require foot valves or vacuum pumps in the priming system.
- C. The pumps shall be electric, hydraulic, or diesel powered.
- D. All pumps used shall be constructed to allow dry running for long time periods to accommodate cyclical flows.
- E. Above ground pumps and/or power units shall be located inside a temporary portable berm to contain any fuel or sewage that may spill during the normal course of operation.
- F. Hard discharge piping shall be butt-welded HDPE with a minimum pressure rating of 2.5 times the total dynamic pump head.
- G. Under no circumstances will irrigation type piping or glued PVC pipe be allowed.

- H. Discharge hose may be allowed on rehabilitation projects for short-term setups (less than or equal to 48 hours) on short sections with approval from the Owner. Hoses shall have no leaks, and all couplings shall be quick connecting with gaskets. Quick connect shall be tape wrapped or secured by other means and approved by Owner.
- I. The multiple pump header system shall have check valves, isolation valves and air release valves to facilitate pump removal, service, and/or replacement while the system remains operational.
- J. All above ground pumps and/or power units shall be equipped with sound attenuation measures to reduce noise levels to 75-decibels maximum at a 50-foot distance from the equipment during all operation periods or meet other noise requirements governing the location of construction. The most stringent noise requirements must be met at all time.
- K. Include 100% mechanical redundancy installed online with a float or ultrasonic type system to switch to the standby system automatically if the primary system fails.
- L. The discharge location (the point where the bypass main reenters the gravity sewer system) shall be to existing manholes and constructed with adequate sealant materials to minimize sewer gas and odor release to the maximum extent possible.
- M. The Contractor shall install a minimum 12-inch by 24-inch sign at all bypass pumping locations indicating that the equipment is a temporary wastewater pumping operation, identifying the Contractor as the responsible party, and include an emergency contact phone number.

PART 3 EXECUTION

3.01 FLOW REQUIREMENTS

- A. Provide bypass sewage pumping, as required, around the area of work is being performed. Bypass pumping shall be the full responsibility of the Contractor.
- B. For television inspection, bypass pumping should be utilized if the depth of wastewater flow within the sewer mains to be inspected exceed the following:

6" – 10" pipe:	20% of pipe's diameter
12" – 24" pipe:	25% of pipe's diameter
24" pipe:	30% of pipe's diameter

If Contractor has exhausted all other means for flow control (plugs, nighttime work, etc.), the depth of wastewater flow within the sewer mains to be inspected may be allowed up to 50% of pipe diameter with approval from the Owner.

- C. For complete bypass required for new construction and pipe rehabilitation, the bypass system shall be a sufficient capacity to handle full pipe capacity for the pipeline section being bypassed

times 1.25 and shall provide and maintain sufficient flow at all times to prevent any backwater flooding due to obstructions caused by the construction. Prior to starting work, the Contractor shall submit required information as described in this specification to the Owner for review and approval. No work shall commence until the Owner provides approval.

3.02 GENERAL REQUIREMENTS

- A. If at any time the Contractor is unable to properly bypass pump the sewage, construction will be stopped until the Contractor is able to continue work in an acceptable manner. The Contractor will not receive additional contract time for delays caused by improper equipment, labor, or breakdowns.
- B. Discharge of sewage to the ground, creeks, and/or storm sewers shall be prohibited. Any violation shall be corrected immediately. If the Owner is required to alleviate any prohibited discharges, the Contractor shall be charged two times the Owner's cost of labor, equipment and materials. All costs shall be deducted from the Contract Amount.
- C. Service shall be maintained at all times. Surcharges due to plugging the sewer line for bypass pumping shall be maintained to prevent backups in services and overflows at any point in the system. Contractor is fully responsible for any backups or overflows caused by bypass pumping operations or any associated work.
- D. Bypass pumping systems are required to be operated continuously 24-hours per day.
- E. All suction and discharge piping shall be free of leaks and designed to carry the required pumped sewage. Any leaks shall be repaired immediately. If the piping used is inadequate in size, amount of hose on site, or condition, the Contractor shall be required to replace the hose as directed by the Owner's Representative.
- F. The use of a partial plug may be considered if approved by the Owner.

3.03 PERFORMANCE REQUIREMENTS

- A. It is essential that the system operate uninterrupted throughout the project's duration. Provide, maintain, and operate all bypass facilities such as dams, plugs, pumping equipment (primary and backup units as required), conduits, all necessary power equipment, and all other labor and equipment necessary to intercept the incoming flow before it reaches the point where it would interfere with the work, carry it past the work area, and return it to the existing system downstream of the work.
- B. In the case of emergencies such as failure of the bypass pumping equipment or other aspects of the system, the Contractor shall provide an immediate response within 2 hours of notification, 7 days per week 24 hours per day. The Contractor shall respond with adequate manpower, and work around the clock as necessary to ensure an expeditious repair of the failed system or part.
- C. The temporary pumping system's design, installation, and operation shall be the Contractor's responsibility. The bypass system shall meet all codes and requirements for regulatory agencies having jurisdiction.

- D. Provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the sewer main flows under any circumstances.
- E. No flow diversion around the work area shall be performed in a manner that will cause damage to or surcharging of Owner system. The diversion shall protect public and private property from damage and flooding.

3.04 FIELD QUALITY CONTROL AND MAINTENANCE

- A. Testing: Prior to actual operation, test the complete bypass pumping system for leaks and pressure using clean water. Bypass piping shall be hydrostatically tested following each setup and prior to flow diversion to a minimum pressure 2.5 times the pump(s) total dynamic head. The Owner shall be given a 24-hour notice prior to testing.
- B. Inspection: Inspect the bypass pumping system on a continuous basis to ensure the system is working properly. A daily checklist for the entire system shall be developed and maintained. The checklist shall contain all bypass pumping system components, and shall be specifically developed to address all aspects for the individual project. The daily checklist shall be submitted to the Owner daily. The completed daily checklists shall be maintained, available for review, and on-site for the project's duration.
- C. Maintenance Service: Ensure the temporary bypass pumping system is properly maintained, and a responsible operator shall be readily available at all times when pumps are operating.
- D. Monitoring:
 - 1. During bypass pumping, continuously monitor all bypass pumping system components.
 - 2. A telemetry system or designated personnel to maintain 24-hour onsite monitoring shall be required to alert the Contractor to system malfunctions or high liquid levels in manholes.
- E. Additional Materials:
 - 1. Spare parts for pumps and piping shall be kept on site as required. Adequate hoisting equipment for each pump and accessories shall be maintained on site.
 - 2. Keep an HDPE fusion machine on site and accessible for the duration of bypass pumping operation, or at a minimum, have a machine available within a 2-hour window to facilitate immediate repairs to hard piping.
- F. Preparations and Precautions:
 - 1. Locate any existing utilities in the area selected for the bypass pipelines. Locate the bypass pipelines to minimize any disturbance to existing utilities, and obtain approval for the pipeline locations. Pay all costs associated with relocating utilities and obtaining all approvals.
 - 2. During all bypass pumping operations, protect the Owner site and system (pumping station, conveyance system, etc.) as applicable from damage inflicted by any equipment.

The Contractor is responsible for all physical damage to the system caused by human or mechanical failure.

G. Installation and Removal:

1. When plugging or blocking is no longer needed for work performance, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge flows to prevent surcharging or causing other major disturbances downstream.
2. When working inside manholes, sewers, or force mains, exercise caution and comply with all applicable OSHA requirements.
3. Bypass pipeline installation is prohibited in all wetland areas. The pipeline shall be located, if possible, off streets and sidewalks and on road shoulders. If in easements, the bypass pipeline shall be within the easement area acquired for the project.
4. When the bypass pipeline crosses local streets and private driveways, place the bypass pipelines in trenches and cover with temporary pavement. Obtain any property owner or municipal approvals before placing the temporary pipeline.

3.05 CLEAN-UP

- A. Upon acceptance of the work, the Contractor shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

END OF SECTION

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SECTION 02930
LOAMING, SEEDING AND SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to place loam, finish grade, apply lime and fertilizer, hydraulically apply seed and mulch, and maintain all seeded areas as shown on the Drawings and as specified herein, and to all grassed areas disturbed during the normal progression of the Work.
- B. Furnish all labor, materials, equipment and incidentals required and place loam, finish grade and furnish and install sod to all established lawn areas disturbed during the normal progression of the Work. Any seeding of these areas shall be considered temporary.
- C. Determination of placement of either seed or sod shall be at the sole discretion of the Owner/Engineer.

1.02 RELATED WORK

- A. Section 02100 - Site Preparation.
- B. Section 02221 - Trenching, Backfill and Compaction.
- C. Section 02230 – Granular Fill Materials.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, complete shop drawings, materials and equipment furnished under this Section including seed mixtures and product label information.
- B. Samples of all materials shall be submitted for inspection and acceptance upon Owner/Engineer's request.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Loam shall be fertile, natural soil, typical of the locality, free from large stones, roots, sticks, clay, peat, weeds and sod and obtained from naturally well drained areas. It shall not be excessively acid or alkaline nor contain toxic material harmful to plant growth. Topsoil stockpiled under other Sections of this Division may be used, but the Contractor shall furnish additional loam at his/her own expense if required.
- B. Fertilizer shall be a complete commercial fertilizer 10-08-06 or 10-07-04 grade for grass areas. It shall be delivered to the site in the original unopened containers each showing the manufacturer's guaranteed analysis, properly labeled, and conforming to all applicable State laws. Store fertilizer so that when used it shall be dry and free flowing.
- C. Lime shall be ground limestone containing all the finer particles obtained in the grinding process and ground sufficiently fine so that not less than 80 percent will pass through a No.

8 sieve. The calcium carbonate equivalent must be at least 80 percent. One or both must be greater than 80 so that the multiplication of the percent of calcium carbonate equivalent by the percent of material passing through the No. 8 sieve will be equal to or be more than 0.72. The moisture content at the time of shipment must not exceed 8 percent.

- D. Grass seed shall be from the same or previous year's crop; each variety of seed shall have a percentage of germination not less than 90, a percentage of purity not less than 85 and shall have not more than 1 percent weed content. The classes of Seeding Mixture shall consist of one or more of the classes listed below. Seeding Mixtures from the specified class shall be designated by the Owner/Engineer, based on the season of the year when seeding operations are performed.

LOCATIONS	SEEDS	LBS./ACRE	SEASON TO USE
1 – Sunny	Bermuda, hulled	25	February through April
	Bermuda, unhulled	25	
	Rye grass, Italian	150	
2- Sunny	Bermuda, hulled	25	May through September 15
	Bermuda, unhulled	25	
	Millet, brown top	25	
3 – Sunny	Bermuda, unhulled	60	September 15 through February
	Rye grass, Italian	150	
4 – Shady	Substitute carpet grass for Bermuda in 1, 2 and 3	40	All Season
5 – Steep Slopes	Lespedeza, Sericea (Clay Soils) Add to 1, 2, 3 and 4	25	All Season

- E. The seed shall be furnished and delivered premixed in the proportions specified above. A manufacturer's certificate of compliance to the specified mixes shall be submitted by the manufacturer for each seed type. These certificates shall include the guaranteed percentages of purity, weed content and germination of the seed and also the net weight and date of shipment. No seed may be sown until the certificates have been submitted.
- F. Mulch shall be a specially processed cellulose fiber containing no growth or germination-inhibiting factors. It shall be manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a homogeneous slurry. When sprayed on the ground, the material shall allow absorption and percolation of moisture. Each package of the cellulose fiber shall be marked by the manufacturer to show the air-dry weight content.
- G. Sod shall be as grown by an established sod grower, as approved by the Engineer and shall consist of the following grasses:

<u>Botanical Name</u>	<u>Common Name</u>	<u>Percent</u>
Poa pratensis	Kentucky Bluegrass	90 to 100

Festuca rubra

Jamestown Fescue

0 to 10

1. Sod shall be vigorous, well rooted, healthy turf, free from insect pests, disease, weeds, other grasses, stones, bare spots, burned spots and any other harmful or deleterious matter. Sod shall be machine stripped at a uniform soil thickness of approximately 1-in and not less than 3/4-in. The measurement for thickness shall not include top growth and thatch and shall be determined at the time of cutting in the field.
2. Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2-in on width and plus or minus 5 percent on length. Broken rolls or torn or uneven rolls will not be acceptable.
3. Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.
4. Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.
5. Harvest, deliver and transplant sod within a period of 36 hours unless a suitable preservation method is approved by the Owner/Engineer prior to delivery. Sod not transplanted within this period shall be subject to inspection and approval by the Owner/Engineer prior to its installation.
6. Before stripping, mow sod uniformly at a height of 1-in to 2-1/2-in.

PART 3 EXECUTION

3.01 APPLICATION

- A. Unless otherwise shown on the Drawings, loam shall be placed to a minimum depth of 6-in on all lawn areas and 4-in in areas indicated to be naturalized.
- B. For all areas to be seeded:
 1. Lime shall be applied at the rate of 1.0 tons/acre.
 2. Fertilizer shall be applied at the rate of 400 lbs/acre.
 3. Lawn grass seed shall be applied at the rate of 10 lbs/1,000 sq ft.
 4. Fiber mulch shall be applied at the rate of 20 lbs/1,000 sq ft.
- C. The application of seed, fertilizer and lime shall be incorporated into soil to a depth of at least three (3) inches by discing, harrowing or other approved methods acceptable to the Owner/Engineer.
- D. The application of seed, fertilizer and lime may be performed hydraulically in one operation with hydroseeding and mulching. If lime is applied in this manner, clean all structures and paved areas of unwanted deposits.

3.02 SEEDING INSTALLATION

- A. Schedules for seeding and fertilizing shall be submitted to the Owner/ Engineer for approval prior to the work.
- B. The subgrade of all areas to be loamed and seeded shall be raked and all rubbish, sticks, roots and stones larger than 2-in shall be removed. Subgrade surfaces shall be raked or otherwise loosened immediately prior to being covered with loam. Subgrade shall be inspected and approved by the Owner/Engineer before loam is placed.
- C. Loam shall be placed over approved areas to a depth sufficiently greater than required so that after natural settlement and light rolling, the complete work will conform to the lines, grades and elevations indicated. No loam shall be spread in water or while frozen or muddy.
- D. After loam has been spread, it shall be carefully prepared by scarifying or harrowing and hand raking. All large stiff clods, lumps, brush, roots, stumps, litter and other foreign material shall be removed from the loamed area and disposed of. The areas shall also be free of smaller stones, in excessive quantities, as determined by the Owner/Engineer. The whole surface shall then be rolled with a hand roller weighing not more than 100 lbs/ft of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional loam and the surface shall be regraded and rolled until a smooth and even finished grade is created.
- E. Seeding, mulching and conditioning shall only be performed during those periods within the seasons which are normal for such work as determined by the weather and locally accepted practice, as approved by the Owner/Engineer. Hydroseed only on a calm day.
- F. Seeding shall be done within 10 days following soil preparation. Seed shall be applied hydraulically at the rates and percentages indicated. The spraying equipment and mixture shall be so designed that when the mixture is sprayed over an area, the grass seed and mulch shall be equal in quantity to the specified rates. Prior to the start of work, the Owner/Engineer shall be furnished with a certified statement for approval as to the number of pounds of materials to be used per 100 gallons of water. This statement shall also specify the number of square feet of seeding that can be covered with the quantity of solution in the Hydroseeder.
- G. In order to prevent unnecessary erosion of newly graded slopes and unnecessary siltation of drainage ways, carry out seeding and mulching as soon as satisfactory completion of a unit or portion of the project. A unit of the work will be defined as not more than 20,000 sq ft.
- H. When protection of newly graded areas is necessary at a time that is outside of the normal seeding season, protect those areas by whatever means necessary (such as straw applied with a tar tack) or by other measures as approved by the Owner/Engineer.

3.03 SEEDING IN WOODED AND UNGRADED AREAS

- A. For preparation and seeding in wooded areas under this Contract and where no grading is required, all of the specified materials and procedures shall be utilized except that no disking shall be performed within the drip line of trees to be preserved. The seed bed shall be prepared by the addition of a thin layer of top soil roughly 1-in deep.

3.04 SOD INSTALLATION

- A. At locations specified, or shown on the plans, or designated by the Owner/Engineer, sod shall be installed rather than seeding. The Contractor shall carefully store the furnished sod prior to installation. Upon compaction of the trench in a manner satisfactory to the Owner/Engineer, the sod shall be replaced in a neat, workman like manner, over a minimum of two (2) inches of loam. Any deficiency in sod necessary to restore the surface to a condition comparable to that which existed before construction operations began will be furnished by the Contractor unless other specified

3.05 MAINTENANCE AND PROVISIONAL ACCEPTANCE

- A. Keep all seeded areas watered and in good condition, reseeding if and when necessary until a good, healthy, uniform growth is established over the entire area seeded. Maintain these areas in an approved condition including a minimum of two mowings of the lawn areas until provisional acceptance.
- B. On slopes, provide against washouts by an approved method. Any washout that occurs shall be regraded and reseeded at the Contractor's expense until a good sod is established.
- C. The Owner/Engineer will inspect all work for provisional acceptance at the end of the 8-week grass maintenance period.
- D. A satisfactory stand will be defined as a section of grass of 10,000 sq ft or larger that has:
 - 1. No bare spots larger than 3 sq ft.
 - 2. No more than 10 percent of total area with bare spots larger than 1 sq ft.
 - 3. Not more than 15 percent of total area with bare spots larger than 6-in square.
- E. The inspection by the Owner/Engineer will determine whether maintenance shall continue in any area.
- F. After all necessary corrective work and clean-up has been completed, the Owner/Engineer will certify in writing the provisional acceptance of the lawn areas. Maintenance of lawns or parts of lawns shall cease on receipt of provisional acceptance.

3.06 GUARANTEE PERIOD AND FINAL ACCEPTANCE

- A. All seeded areas shall be guaranteed for not less than 1 full year from the time of provisional acceptance.
- B. At the end of the guarantee period, inspection will be made by the Owner/Engineer. Lawn areas not demonstrating satisfactory stands as outlined above, shall be renovated, reseeded and maintained meeting all requirements as specified herein.
- C. After all necessary corrective work has been completed, the Owner/Engineer shall certify in writing the final acceptance of the lawns.

END OF SECTION

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SECTION 3301
CONCRETE AND REINFORCING STEEL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install all concrete work complete as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and product data for:
1. Placing drawings and bar bending details in conformity with the recommendations of ACI 315.
 2. Technical data on all materials and components.
 3. Material Safety Data Sheets (MSDS) for all concrete admixtures and curing agents.
- B. Test Reports
1. Sieve analysis, mechanical properties and deleterious substance content for fine and coarse aggregates.
 2. Concrete mixes: For each formulation of concrete proposed for use, submit constituent quantities per cubic yard, water cementitious ratio, concrete slump, type and manufacturer of cement. Provide either a. or b., below, for each mix proposed.
 - a. Standard deviation data for concrete mixes based on statistical records.
 - b. Water cementitious ratio curve for concrete mixes based on laboratory tests. Provide average cylinder strength test results at 7 and 28 days for laboratory concrete mix designs. Provide results of 14 day tests if available.
- C. Certifications
1. Certify that admixtures used in the same concrete mix are compatible with each other and the aggregates.
 2. Certify admixtures are made for use in concrete in contact with potable water after 30 days of concrete curing.

1.03 REFERENCE STANDARDS

- A. ASTM International
1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 3. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 4. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 5. ASTM C33 - Standard Specification for Concrete Aggregates.
 6. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 7. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
 8. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete
 9. ASTM C150 - Standard Specification for Portland Cement
 10. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 13. ASTM C311 - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete.
 14. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
 15. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Portland Cement Concrete.
- B. American Concrete Institute (ACI).
1. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 2. ACI 232.2R - Use of Fly Ash in Concrete
 3. ACI 301 - Specification for Structural Concrete.
 4. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 5. ACI 305R - Hot Weather Concreting.
 6. ACI 306R - Cold Weather Concreting.
 7. ACI 315 - Details and Detailing of Concrete Reinforcement.

8. ACI 318 - Building Code Requirements for Structural Concrete.
9. ACI 350 - Code Requirement for Environmental Engineering Concrete Structures.

C. Concrete Reinforcing Steel Institute (CRSI)

1. MSP - Manual of Standard Practice

- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 QUALITY ASSURANCE

- A. Comply with ACI 318, ACI 350 and other stated specifications, codes and standards. Apply the most stringent requirements of stated specifications, codes, standards, and this Section if conflicts exist.
- B. If, during the progress of the work, it is impossible to secure concrete of the specified workability and strength with the materials being furnished, the Owner/Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the specified properties. Make all changes so ordered at the no additional cost to the Owner.
- C. All field testing services and related laboratory tests required will be provided by the Contractor at no additional cost to the Owner. The laboratory shall be certified by the SCDOT and approved in advance by the Owner/Engineer.
- D. Methods of testing will comply with the latest applicable ASTM methods.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Ship and store reinforcing steel with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same designations as those shown on the submitted placement drawings. Provide reinforcing steel free from mill scale, loose rust, mud, dirt, grease, oil, ice or other foreign matter. Store off the ground, protect from moisture and keep free from rust, mud, dirt, grease, oil, ice or other injurious contaminants.
- B. Store products in conformity with the manufacturer's recommendations.
- C. Store or stockpile sand, aggregates, cement and fly ash in conformity with ACI 301.

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.
- C. Materials shall comply with this Section and any applicable State or local requirements.

2.02 MATERIALS

- A. Cement: Domestic portland cement conforming to ASTM C150. Do not use air entraining cements. The allowable types of cement for each class of concrete are shown in Table 1.
- B. Fine Aggregate: Washed inert natural sand conforming to ASTM C33.
- C. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to ASTM C33, size 57. Limits of deleterious substances and physical property requirements as listed in ASTM C33, Table 3 for severe weathering regions.
- D. Water: Potable water free of oil, acid, alkali, salts, chlorides, (except those attributable to drinking water) organic matter, or other deleterious substances.
- E. Admixtures: Use admixtures free of chlorides and alkalis (except for those attributable to drinking water). The admixtures shall be from the same manufacturer when it is required to use more than one admixture in the same concrete mix. Use admixtures compatible with the concrete mix including other admixtures and made for use in contact with potable water after 30 days of concrete curing.
 - 1. Air Entraining Admixture: Conforming to ASTM C260. Proportion and mix in accordance with manufacturer's recommendations.
 - 2. Water Reducing Admixture: Conforming to ASTM C494, Type A. Proportion and mix in accordance with manufacturer's recommendations.
 - 3. Do not use admixtures causing retarded or accelerated setting of concrete without written approval from the Owner/Engineer. Use retarding or accelerating water reducing admixtures when so approved.
- F. Fly Ash: Class F fly ash complying with ASTM C618, including the requirements of Table 1 but with the Loss of Ignition (LOI) limited to 3 percent maximum and the optional physical requirements of Table 3.
- G. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.
- H. Welded Steel Wire Fabric: Conforming to ASTM A185.
- I. Reinforcing Steel Accessories
 - 1. Plastic Protected Wire Bar Supports: CRSI Bar Supports, Class 1 - Maximum Protection.
 - 2. Stainless Steel Protected Wire Bar Supports: CRSI Bar Supports, Class 2 - Moderate Protection with legs made wholly from stainless steel wire.
 - 3. Precast Concrete Bar Supports: CRSI Bar Supports, Precast Concrete Bar Supports. Precast concrete blocks that have equal or greater strength than the surrounding concrete.
- J. Tie Wires for reinforcement: 16 gauge or heavier black annealed wire.
- K. Sheet Curing Materials: Waterproof paper, polyethylene film or white burlap-polyethylene sheeting, all conforming to ASTM C171.

L. Fiber Reinforcement

1. Synthetic reinforcing fibers for concrete grout shall be 100 percent polypropylene collated, fibrillated fibers, Fibermesh 300 as manufactured by Propex Concrete Systems Corp, Chattanooga, TN, or equal. Fiber length and quantity for the concrete grout mix shall be in strict compliance with the manufacturer's recommendations as approved by the Owner/Engineer.

2.03 MIXES

- A. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce placeable, durable concrete conforming to these Specifications. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing free water to collect on the surface.
- B. Base concrete mixes on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if not available, develop concrete mixes by laboratory tests using the materials proposed for the work.
- C. Entrained air, as measured by ASTM C231, shall be as shown in Table 1.
- D. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 1.
- E. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of the other admixture(s).

TABLE 1

Class	Design Strength (1)	Cement ASTM C150	Cementitious Content (2)	W/C (3)	WR (4)	Slump Range Inches
A	2500	Type II	440	0.62 max	Yes	1-4
B	4000	Type II	560	0.44 max	Yes	3-5

TABLE 1 NOTES:

- (1) Minimum compressive strength in psi at 28 days
- (2) Minimum cementitious content in lbs per cubic yard [(where fly ash is used, cementitious content is defined as cement content plus fly ash content)]
- (3) W/C is Maximum Water Cementitious ratio by weight
- (4) WR is water reducing admixture
- (5) [Fly ash content in the range of 20-25 percent of the total cement content plus fly ash content, by weight]
- (6) All concrete classes shall have 3.5 to 5 percent air entrainment.

2.04 MEASURING, BATCHING, MIXING AND TRANSPORTING CONCRETE

- A. Measure, batch, mix and transport concrete in conformance with ASTM C94 and the requirements herein or as otherwise approved in writing by the Owner/Engineer.
- B. Ready-mixed concrete, whether produced by a concrete supplier or the Contractor shall conform to the requirements above. Do not hand mix.
- C. Dispense admixtures into the batch in conformity with the recommendations of the admixture manufacturer.
- D. Mix concrete until there is uniform distribution of the materials and discharge completely before the mixer is recharged. The mixer shall be rotated at a speed recommended by the mixer manufacturer and mixing shall be continued for at least 1-1/2 minutes after all the materials are in the mixer. Place concrete within 1-1/2 hours of the time at which water was first added, otherwise it will be rejected. Concrete which has been remixed or retempered, or to which an excess amount of water has been added, will also be rejected.

2.05 FORMS

- A. Provide forms free from roughness and imperfections, watertight and braced and tied to prevent motion when concrete is placed. Wooden spreaders will not be allowed in the concrete.
- B. Wire ties will not be allowed. Metal ties or anchorages which are necessary within the forms shall be so constructed that the metal work can be removed for a depth of at least 1-1/2-in from the concrete surface without damage by spalling. Clean forms before using and treat with form release agent, or other approved material.
- C. All exposed edges of the finished concrete shall be chamfered 3/4-in.

PART 3 EXECUTION

3.01 CONSTRUCTION JOINTS

- A. Locate construction joints where indicated or where approved by the Owner/Engineer.
- B. Continue all reinforcing steel through the joint.
- C. At construction joints and at concrete joints indicated to be "roughened", uniformly roughen the surface of the concrete to a full amplitude (distance between high and low points and side to side) of 1/4-in with chipping tools to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting and prepare for bonding. At least two hours before and again shortly before the new concrete is deposited, saturate the joints with water. After glistening water disappears, coat joints with neat cement slurry mixed to the consistency of very heavy paste. The surfaces shall receive a coating at least 1/8-in thick, scrubbed-in by means of stiff bristle brushes. Deposit new concrete before the neat cement dries.

3.02 REINFORCING STEEL

- A. Fabricate reinforcing steel accurately to the dimensions shown. Bend bars around a revolving collar having a diameter of not less than that recommended in ACI 318. All bars shall be bent cold.
- B. Provide tension lap splices in compliance with ACI 318. Stagger splices in adjacent bars where possible. Provide Class B tension lap splices at all locations unless otherwise indicated.
- C. Lap splices in welded wire fabric in accordance with the requirements of ACI 318 but not less than 12-in. Tie the spliced fabrics together with wire ties spaced not more than 24-in on center and lace with wire of the same diameter as the welded wire fabric. Offset splices in adjacent widths to prevent continuous splices.
- D. Use precast concrete blocks where the reinforcing steel is to be supported over soil. Use plastic protected bar supports or steel supports with plastic tips where the reinforcing steel is to be supported on forms for a concrete surface that will be exposed to weather, high humidity, or liquid. Use stainless steel supports or plastic tipped metal supports in all other locations unless otherwise noted on the Drawings or specified herein.
- E. Before placing in position, clean reinforcement of loose mill scale and rust, mud, dirt, grease, oil and other coatings, including ice that reduce or destroy bond. When there is a delay in depositing concrete after the reinforcement is in place, bars shall be reinspected and cleaned again when necessary.
- F. Coat reinforcement which is to be exposed for a considerable length of time after being placed with a heavy coat of cement grout.
- G. Do not cover any reinforcing steel with concrete until the amount and position of the reinforcement has been checked and the Owner/Engineer has given permission to proceed.

3.03 INSPECTION AND COORDINATION

- A. Batching, mixing, transporting, placing and curing of concrete shall be subject to the inspection of the Owner/Engineer at all times. Advise the Owner/Engineer of readiness to proceed at least six working hours prior to each concrete placement. The Owner/Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing and the alignment, cleanliness and tightness of formwork. Do not place concrete without the inspection and acceptance of the Owner/Engineer.

3.04 CONCRETE APPEARANCE

- A. Remix concrete showing either poor cohesion or poor coating of the coarse aggregate with paste. If this does not correct the condition, the concrete shall be rejected.
- B. Provide concrete having a homogeneous structure which, when hardened, will have the specified strength, durability and appearance. Provide mixtures and workmanship such that concrete surfaces, when exposed, will require no finishing except as specified herein.

3.05 PLACING AND COMPACTING

- A. Do not place concrete until forms, condition of subgrade and method of placement have been approved by the Owner/Engineer. Remove all debris, foreign matter, dirt, ice and standing water from the forms before depositing concrete. Do not place concrete on frozen subgrade, snow or ice. The contact surface between concrete previously placed and new concrete shall be cleaned and brushed with cement paste. Concrete, except as indicated on the Drawings, shall not be placed in water or submerged within 24 hours after placing, nor shall running water be permitted to flow over the surface of fresh concrete within 4 days after its placing.
- B. Deposit concrete as near its final position as possible to prevent segregation due to rehandling or flowing. Pumping of concrete will be permitted when an approved design mix and aggregate sizes suitable for pumping are used. Do not deposit concrete which has partially hardened or which has been contaminated by foreign materials. If the section cannot be placed continuously, place construction joints as specified or as approved. Place concrete for walls using tremie tubes in 12-in to 24-in lifts, keeping the surface horizontal. Do not drop concrete more than 4-ft.
- C. Use high frequency mechanical vibrators to obtain proper consolidation of the concrete. Do not use vibrators to move or transport concrete in the forms. Do not over-vibrate so as to segregate. Continue vibration until the frequency returns to normal, trapped air ceases to rise and the surface appears liquefied, flattened and glistening. Use spades, rods or forks so that concrete is completely worked around reinforcement, embedded items, pipe stubs, and openings and into corners of forms.

3.06 FINISHING CONCRETE

- A. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to the satisfaction of the Owner/Engineer.
- B. Steel Trowel Finish. Finish by screeding and floating with straightedges to bring the surfaces to the elevations indicated and to a true plane with a tolerance of 1/8-in when checked with a 10-ft straightedge. Pitch surface to drain unless otherwise noted on the Drawings. While the concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, the

surface shall be wood floated to a true, even plane with no coarse aggregate visible. Apply sufficient pressure on the wood floats to bring moisture to the surface. After surface moisture has disappeared, hand steel trowel to produce a smooth, impervious surface, free from trowel marks. Trowel the surface again for the purpose of burnishing. The final troweling shall produce a ringing sound from the trowel. Do not use dry cement or additional water in troweling.

3.07 CURING AND PROTECTION

- A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.
- B. Cure all concrete in conformance with ACI 301. Concrete that is to be used for the containment of water shall be water cured. Water curing shall be by ponding, by continuous sprinkling or by covering with continuously saturated burlap. Other concrete shall be cured by either water curing, sheet material curing or liquid membrane curing compound except that liquid membrane curing compound shall not be used on any concrete surface where additional concrete is to be placed or where the concrete surface is to be coated or painted.
- C. Protect finished surfaces and slabs from the direct rays of the sun to prevent checking and crazing.
- D. During cold weather concrete shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 306R. Do not use salt, manure or other chemicals for cold weather protection.
- E. During hot weather concrete shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305R. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints. Immediately cover plastic concrete with sheet curing material during hot weather.

3.08 FIELD TESTS

- A. Sets of field control cylinder specimens shall be taken by the Contractor during the progress of the work, in compliance with ASTM C31. The number of sets of concrete test cylinders taken of each class of concrete placed each day will not be less than one set per day, nor less than one set for each 150 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls. Specimens will be formed in 6-in diameter by 12-in long non-absorbent cylindrical molds.
 - 1. A "set" of test cylinders shall consist of four cylinders: one to be tested at seven days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if 28 day test results are low.
 - 2. When the average 28 day compressive strength of the cylinders in any set falls below the required compressive strength or below proportional minimum seven-day strengths (where proper relation between seven and 28 day strengths have been established by tests), change proportions, cementitious content, or temperature conditions to achieve the required strengths at no additional cost to the Owner.
- B. Cooperate in the making of tests by allowing free access to the work for the selection of samples. Provide an insulated closed curing box for the specimens and protect the specimens

against injury or loss through construction operations. Furnish material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the Owner.

- C. Slump tests will be made in the field by the Contractor in conformity with ASTM C143.
- D. Tests for air content will be made in the field by the Contractor in compliance with either the pressure method (ASTM C231) or by the volumetric method (ASTM C173).

3.09 STRIPPING AND FINISHING CONCRETE

- A. Do not remove forms before the concrete has attained a strength of at least 30 percent of the specified design strength nor before reaching approximately "100 day-degrees" of moist curing (whichever is the longer). Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (e.g., 7 days at an average 50 degrees F = 350 degree-days).
- B. Exercise care to prevent damaging edges or obliterating the lines of chamfers, rustications or corners when removing the forms or doing any other work adjacent thereto.
- C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to the satisfaction of the Owner/Engineer.
- D. Immediately after removal of forms remove tie cones and metal portions of ties. Fill holes promptly upon stripping as follows: Moisten the hole with water, followed by a 1/16-in brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spider web. Trowel smooth with heavy pressure. Avoid burnishing.
- E. Defective concrete and honeycombed areas: Chip down square and at least 1-in deep to sound concrete with hand chisels or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded in the parent concrete. If honeycomb exists around reinforcement, chip to provide a clear space at least 3/8-in wide all around the steel. For areas less than 1-1/2-in deep, the patch may be made in the same manner as described above for filling form tie holes, care being exercised to use adequately dry (non-trowelable) mixtures and to avoid sagging. Thicker repairs will require build-up in successive 1-1/2-in layers on successive days, each layer being applied (with slurry, etc.) as described above.
- F. Concrete to receive dampproofing and concrete not exposed in the finished work shall have off-form finish with fins and other projections removed and tie cones and defects filled as specified above.
- G. Screed top surface of slabs to the established grades and to a true plane with a tolerance of 1/8-in when checked with a 10-ft straightedge. Pitch surface to drain unless otherwise noted on the Drawings. Finish the surface to give a smooth, hard, even surface free from high or low spots or other defects. Concrete subject to pedestrian traffic shall be given a broom finish. Failure to meet these conditions shall be cause for removal, grinding, or other correction as directed by the Owner/Engineer.

3.10 SCHEDULE

- A. The following (Table 2) are the general applications for the various concrete design strengths to be used:

TABLE 2

Class	Design Strength (psi)	Description
A	2,500	Concrete fill, thrust blocks, and pipe encasement
B	4,000	Slabs on grade, sidewalks, gutters, driveway aprons, and all other structural concrete

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