

Issued for Bid

## **Brunswick County Northwest Water Treatment Plant Concentrate Discharge Pipeline**



**October 2019**

CDM Smith Project No.:  
250459-232662

5400 Glenwood Avenue, Suite 400  
Raleigh, NC 27612  
Tel: (919) 325-3500  
NC License No. F-1255





**Division 00**  
**Procurement and Contracting Requirements**



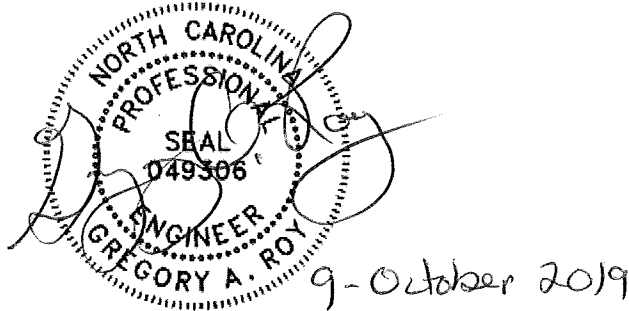


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1.1 DESIGN PROFESSIONALS OF RECORD

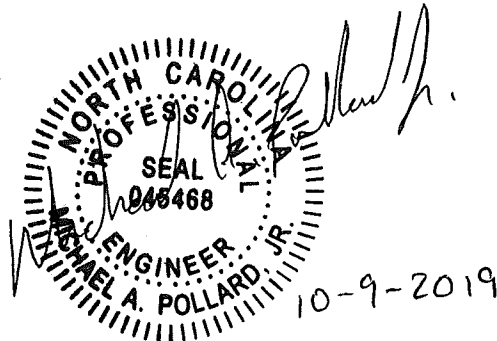
A. Project Manager for Design:

1. Gregory A. Roy
2. NC license # 049306
3. Responsible for Divisions 00-46 Sections except where indicated as prepared by other design professionals of record.



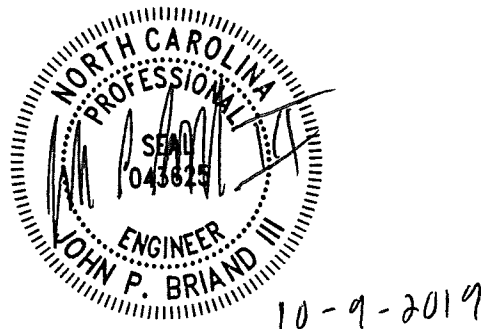
B. Project Technical Lead Engineer:

1. Michael A. Pollard
2. NC license # 045468
3. Responsible for Divisions 00-46 Sections except where indicated as prepared by other design professionals of record.



C. Project Geotechnical Engineer:

1. John Briand
2. NC license #043625
3. Responsible for Divisions 310515, 310519.13, 310900, 312000, 312319, 312333, 313600, 315000, 316216, 330507.13, 330507.25



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## **BRUNSWICK COUNTY**



### **INVITATION TO BID**

Sealed proposals will be received until 3:00 p.m. on Thursday, December 12, 2019, in the Brunswick County Public Utilities Operations Center in Supply, NC, for the construction of: **Northwest Water Treatment Plant - Concentrate Discharge Pipeline**, and shortly thereafter the bids will be opened publicly and read aloud. The contract shall be awarded as a Single Prime Contract. A general description of the work includes:

Furnish and install approximately 4.5 miles of 18-inch pipe (PVC & HDPE) via open-cut, bore & jack, and HDD from the existing Northwest Water Treatment Plant to the discharge at the Cape Fear River. Work includes clearing, seeding, pipe installation, pavement repair/replacement, valves, precast concrete structures, coffer dam, and rock-filled gabions. Estimated construction cost is approximately \$7 million

**Pre-Bid Meeting:** An open pre-bid meeting will be held for all interested bidders and vendors at 10:00 a.m., October 30, 2019, at the Brunswick County Public Utilities Operations Center, 250 Grey Water Road NE, Supply, NC 28462. A site visit will occur in the afternoon of the same day at the Northwest Water Treatment Plant, 3954 Clearwell Drive, Leland, NC 28451.

**Site Visitation:** Individual inspection of the proposed construction on private property may be allowed only by approval of Brunswick County. Telephone Glenn Walker, Thad Hill, or Justin Loiacono at (910) 371-3490.

Copies of the Contract Documents may be purchased including full size drawings, specifications, and CD of electronic files for \$100, or just a CD of electronic files of drawings and specifications for \$25. These documents are expected to become available October 22 and can be obtained by contacting CDM Smith (cash or check/money order payable to *CDM Smith*):

**Contact:**

Bob Tweedy, PE  
Brunswick County Public Utilities  
P. O. Box 249  
Bolivia, NC 28422  
Telephone: (910) 253-2680  
bob.tweedy@brunswickcountync.gov

**Contact:**

Joanne Bunch  
CDM Smith  
5400 Glenwood Avenue, Suite 400  
Raleigh, NC 27612  
Telephone: (919) 325-3500

For those wishing to be included on the bidders list for receipt of addenda, they must request Contract Documents from CDM Smith. No refund for any Contract Documents shall be made and no partial sets of the Contract Documents will be issued. The Contract Documents may also be examined at the following locations:

- ConstructConnect online [www.constructconnect.com](http://www.constructconnect.com)
- Carolinas A.G.C. Digital Plan Room online [www.cagc.org](http://www.cagc.org) on IBuild®
- CDC News Office online [www.cdcnews.com](http://www.cdcnews.com)
- McGraw Hill Construction Dodge Digital Plan Room online [www.dodge.construction.com](http://www.dodge.construction.com)
- Construction Market Data online [www.cmdgroup.com](http://www.cmdgroup.com)
- Hispanic Contractors Association of the Carolinas online [www.hcacarolinas.org](http://www.hcacarolinas.org)
- Brunswick County Public Utilities Operations Center (8 a.m. – 4:30 p.m. business days)

Brunswick County reserves the unqualified right to reject any and all proposals. A 5% bid bond or deposit is required. Brunswick County has implemented a Minority Business Enterprise Policy that requires Contractors to exhibit a good-faith effort to contact minority business subcontractors whose work on the project would represent 10% of the total value of the work. Contractors must be properly licensed. Additional instructions to bidders are included in the Contract Documents.

# NOTICE TO BIDDERS

Sealed proposals will be received until 3:00 p.m. on Thursday, December 12, 2019 in the Brunswick County Public Utilities Operations Center in Supply, NC for the furnishing of labor, material, and equipment entering into the construction of: **Northwest Water Treatment Plant, Concentrate Discharge Pipeline** and shortly thereafter the bids will be opened publicly and read aloud.

**Sealed bids shall be labeled with the project name, Contractor's name, address, and license number and must be marked "SEALED BID, DO NOT OPEN." Bids shall be sent to:**

Alternate Shipping Service or Hand Delivery  
Brunswick County Public Utilities  
Utilities Operations Center  
Attention: Bob Tweedy, PE  
250 Grey Water Road NE  
Supply, NC 28462  
(910) 253-2680

US Post Office  
Brunswick County Public Utilities  
Attention: Bob Tweedy, PE  
P. O. Box 249  
Bolivia, NC 28422

**Project Description:** Furnish and install an 18-inch PVC concentrate pipeline, over 4.5 miles, from the existing Northwest Water Treatment Plant to the discharge at the Cape Fear River.

The foregoing description shall not be construed as a complete description of all work required.

Bids will be received as a **Single Prime Contract**. All proposals shall be lump sum with provisions for unit prices, allowances and alternates as indicated in the Form of Proposal. The entire project shall be Substantially Complete before February 1, 2021. Work "in the river" as shown on Drawings C-CP-27 and C-CP-28 can only be performed between July 1, 2020 and January 31, 2021 due to anadromous migrations of certain fish and other environmental restrictions but cannot exceed 90 consecutive calendar days within that period. Work "in the river" refers to actual construction below the ordinary high water mark for the Cape Fear River and does not include above-water preparation such as equipment mobilization by barge or floating of pipe during HDD pullback operations. Contractors shall receive notice to proceed within the 120 day Bid Security period. There are liquidated damages associated with this project. Liquidated damages will be in the amount of \$2,500 per day for each calendar day beyond the Substantial Completion date (February 1, 2021). Liquidated damages will increase to the amount of \$10,000 per day for each calendar day beyond July 1, 2021.

**Site Visitation:** Inspection of the proposed construction site may be allowed outside of the pre-bid meeting by approval of Brunswick County. Telephone the above noted contact person in order to schedule a visit.

**Pre-Bid Meeting:** An open pre-bid meeting will be held for all interested bidders and vendors at 10:00 AM on October 30, 2019. The pre-bid meeting will occur at the Brunswick County Public Utilities, Utilities Operation Center, 250 Grey Water Road NE, Supply, NC 28462. A site visit will occur in the afternoon of the same day at the Northwest Water Treatment Plant, 3954 Clearwell Drive, Leland, NC 28451.

The pre-bid meeting will address project specific questions, issues, and bidding procedures. Additional information and Addenda will be made available to the public by fax and/or email

approximately seven (7) days prior to the bid date. The Contractor is responsible for ensuring that their contact information (email and fax) is correct and on file with the person designated below. All questions or requests for clarifications must be submitted no later than ten (10) days prior to the bid date by email or fax. These shall be directed to:

Michael Pollard, PE  
CDM Smith  
Email: pollardma@cdmsmith.com  
Phone: 919-325-3500

**Insurance Requirements:** The Contractor is required to have insurance as outlined in the General Conditions, as modified by the Supplementary Conditions.

**Licensing:** All Contractors are hereby notified that they must have proper license as required under the state laws governing their respective trades. General Contractors are notified that Chapter 87, General Statutes of North Carolina, will be observed in receiving and awarding general contracts. General Contractors submitting bids on this project must have license classification for (Building, Public Utilities, or Unclassified).

**NOTE:** Under NCGS 87-1, a Contractor that superintends or manages construction of any building, highway, public utility, grading, structure, or improvement shall be deemed a "General Contractor" and shall be so licensed. Therefore, a single prime project that involves other trades will require the Single Prime Contractor to hold a proper General Contractor's license.

**NOTE:** The bidder shall identify on its bid proposal the minority business participation it will use on the project form (*Identification of Minority Business Participation*) and shall include either *Affidavit A* or *Affidavit B* as applicable. Forms and instructions are included within the Proposal Form in the bid documents. Failure to complete these forms is grounds for rejection of the bid. (NCGS143-128.2c Effective 1/1/2002.) General contractors are notified that Chapter 143, General Statutes of North Carolina, and the "Brunswick County Minority Business Enterprise Policy" (MBE) will be observed in receiving and awarding general contracts. Brunswick County requires contractors that are not self-performing 100% of the total value of the work to verify that they have contacted MBE subcontractors whose work on the project would represent at least ten percent (10%) of the total value of work.

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company, insured by the Federal Deposit Insurance Corporation, of an amount equal to not less than five percent (5%) of the proposal, or in lieu thereof a bidder may offer a bid bond of five percent (5%) of the bid executed by a surety company licensed under the laws of North Carolina to execute the contract in accordance with the Bid Bond. Said deposit shall be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten (10) days after the award or to give satisfactory surety as required by law.

A performance bond and a payment bond will be required for one hundred percent (100%) of the contract price. An additional bond with the North Carolina Department of Transportation may be required for work performed in the right-of-way. Surety companies must be authorized to do business in North Carolina.

Contractor agrees that the Contractor and the Contractor's subcontractors shall comply with the requirements of Article 2 of Chapter 64 of the North Carolina General Statutes. E-Verify is

a program in which the employment eligibility of all newly hired employees will be confirmed after the Employment Eligibility Verification Form (Form I-9) has been completed.

Payment will be made based on ninety-five percent (95%) of monthly estimates and final payment made upon completion and acceptance of work.

The owner reserves the right to reject any or all bids and to waive informalities.

Designer:

Michael Pollard, PE  
CDM Smith  
5400 Glenwood Ave, Suite 400  
Raleigh, NC 27612  
Phone: 919-325-3500

Owner:

Bob Tweedy, PE  
Brunswick County  
250 Grey Water Road NE  
Supply, NC 28462  
Phone: 910-253-2680

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## **BRUNSWICK COUNTY, NORTH CAROLINA**



### **INSTRUCTIONS TO BIDDERS**

**For a proposal to be considered it must be in accordance with the following instructions:**

#### **1. PROPOSALS**

Proposals must be made in accordance with the Form of Proposal provided, and all blank spaces for bids, alternates, and unit prices applicable to Bidder's Work shall be properly filled in. When requested alternates are not bid, the proposal may be considered incomplete. The Bidder agrees that a bid on the Form of Proposal detached from specifications will be considered and will have the same force and effect as if attached thereto. Faxed proposals will not be considered. Numbers shall be stated both in writing and in figures for the base bids and alternates.

The proposal shall include the following:

- a. Form of Proposal
- b. Identification of Minority Business Participation form
- c. MBE Affidavit A (Listing of Good Faith Efforts) **or** Affidavit B (Intent to Perform Contract with Own Workforce)
- d. Form of Bid Bond **or** cash deposit.

Any modifications to the Form of Proposal (including alternates and/or unit prices) may disqualify the bid and may cause the bid to be rejected.

The Bidder shall fill in the Form of Proposal as follows:

- a. If the documents are executed by a sole Owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.

- b. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.
- c. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.
- d. If the proposal is made by a joint venture, it shall be executed by each member of the joint venture in the above form for sole Owner, partnership or corporation, whichever form is applicable.
- e. All signatures shall be properly witnessed.
- f. If the Contractor's license of a Bidder is held by a person other than an Owner, partner or officer of a firm, then the licensee shall also sign and be a party to the proposal. The title "Licensee" shall appear under his/her signature.

Proposals shall be addressed as indicated in the Notice to Bidders and shall be delivered, enclosed in an opaque sealed envelope, marked "SEALED BID, DO NOT OPEN" and bearing the project name, name of the Bidder, address of the Bidder, and the Contractor's license number. Bidders shall clearly mark on the outside of the bid envelope which Contract(s) they are bidding.

Bidder shall identify on the bid the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts or an affidavit indicating Work under Contract will be self-performed, as required by NCGS 143-128.2(c) and NCGS 143-128.2(f). Failure to comply with these requirements is grounds for rejection of the bid. Upon notification of being the apparent low bidder, the apparent low Bidder and any other Bidder so requested, will within seventy-two hours of the notification submit an affidavit that includes a description of the portion of Work to be executed by minority businesses, which is equal to or more than the applicable goal (Affidavit C), or submit an affidavit documenting the Contractor's good faith efforts to meet the goal (Affidavit D).

For projects bid in the single-prime alternative, the names and license numbers of major Subcontractors shall be listed on the proposal form.

It shall be the specific responsibility of the Bidder to deliver his bid to the proper official at the selected place and prior to the announced time for the opening of bids. Later delivery of a bid for any reason, including delivery by the United States Postal Service or other delivery service, shall disqualify the bid.



Modifications of previously deposited bids will be acceptable only if delivered in writing or by telegram or fax to the place of the bid opening prior to the time for opening bids. Telegraphic and fax modifications must be confirmed in writing within 72 hours after the opening of bids.

Unit prices quoted in the proposal shall include overhead and profit and shall be the full compensation for the Contractor's cost involved in the Work. See General Conditions, "Changes in the Work" Paragraph (C 1).

## **2. EXAMINATION OF CONDITIONS AND CONTRACT DOCUMENTS**

It is understood and mutually agreed that by submitting a bid the Bidder acknowledges that he has carefully examined all documents pertaining to the Work; the location, accessibility, and general character of the site of the Work and all existing buildings, structures, and utility facilities within and adjacent to the site; and has satisfied himself as to the nature of the Work; sequences or procedures of construction (if any); the condition of existing buildings and structures; the conformation of the ground; the character, quality, and quantity of the material to be encountered; the subsurface conditions (including type and depth of rock and soil layers); the character of the equipment, machinery, plant and any other facilities needed preliminary to and during prosecution of the Work; the general and local conditions; federal, state, and local laws and regulations; the construction hazards; and all other matters, including, but not limited to, the labor situation which can in any way affect the Work under the Contract; and including all safety measures required by the Occupational Safety and Health Act of 1970 and all rules and regulations issued pursuant thereto. It is further mutually agreed that by submitting a proposal the Bidder acknowledges that he has satisfied himself as to the feasibility and meaning of the plans, drawings, specifications, and other Contract Documents for the construction of the Work and that he accepts all the terms, conditions, and stipulations contained therein; and that he is prepared to Work in cooperation with other Contractors performing Work on the site. Neither the Owner nor Designer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Contract Documents.

Reference is made to Contract Documents for the identification of those surveys and investigation reports of subsurface or latent physical conditions at the site or otherwise affecting performance of the Work which have been relied upon by the Designer in preparing the documents. In no event shall these surveys and investigation reports be considered part of the Contract Documents. The Owner will make copies of all such surveys and reports available to the Bidder upon request. Neither the Owner nor the Designer assumes any responsibility for the accuracy or completeness of the information provided.

Each Bidder may, at his own expense, make such additional surveys and investigations as he may deem necessary to determine his bid price for the performance of the Work. Any on-site investigation shall be done at the convenience of the Owner. Reasonable requests for access to the site will be honored by the Owner. It is the responsibility of the Bidder

to clean up and restore the site to its former condition upon completion of such explorations, investigations, tests, and studies. Such Work shall be done in a manner that in no way hinders or complicates normal operation and maintenance of existing facilities.

The Contractor performing excavation Work shall be responsible for locating underground utilities prior to excavation. The utility locations shown in the Plans are approximate and for information only. The Contractor may obtain the services of a commercial utilities locator and/or call the various utility companies who may have lines in the area.

### **3. AVAILABILITY OF LANDS FOR WORK**

The lands upon which the Work is to be performed, rights-of-way, and easements for access thereto and other lands designated for use by the Contractor in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage for materials and equipment to be incorporated into the Work are to be obtained and paid for by the Contractor. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by the Owner unless otherwise provided in the Contract Documents.

### **4. PRE-BID CONFERENCE**

Prior to the date set for receiving bids, the Designer may arrange and conduct a Pre-Bid Conference for all prospective Bidders. The purpose of this conference is to review project requirements and to respond to questions from prospective Bidders and their Subcontractors or material suppliers related to the intent of bid documents. Attendance by prospective Bidders shall be as required by the "Notice to Bidders." Brunswick County strongly encourages attendance at the pre-bid meeting. It should be noted that attendance may help to fulfill necessary MBE requirements.

### **5. SUBSTITUTIONS**

In accordance with the provisions of NCGS 133-3, material, product, or equipment substitutions proposed by the Bidders to those specified herein can only be considered during the bidding phase until ten (10) days prior to the receipt of bids when submitted to the Designer with sufficient data to confirm material, product, or equipment equality. Proposed substitutions submitted after this time will be considered only as potential change orders.

Submittals for proposed substitutions shall include the following information:

- a. Name, address, and telephone number of manufacturer and supplier as appropriate.
- b. Trade name, model, or catalog designation.

- c. Product data including performance and test data, drawings with dimensions, specifications, catalog cut-sheets, electrical requirements and schematic diagrams, materials of construction of all components, reference standards, and technical descriptions of material, product, or equipment. Include color samples and samples of available finishes as appropriate.
- d. Detailed comparison with specified products including performance capabilities, warranties, maintenance schedule, and test results. Any deviations to the specified product requirements shall be noted.
- e. Other pertinent data including data requested by the Designer to confirm product equality. This may include examples of the substitutes in use on other projects along with performance records. The Contractor shall demonstrate that the Substitution will function equally or better than the specified product, taking into account the Owner's need of standardization and compatibility with other infrastructure components.
- f. Listing of spare parts to be included with Substitution.
- g. A comparison of the impact on the Contractor's schedule between using the proposed Substitution item and the specified product.

If a proposed material, product, or equipment substitution is deemed adequate by the Designer, all Bidders of record will be notified by Addendum.

## **6. BULLETINS AND ADDENDA**

Any addenda to specifications issued prior to the bid opening shall be considered covered in the Proposal and in closing a Contract they will become a part thereof. Addenda may include, but are not limited to, answers to questions, clarifications, and amendments of the Contract Documents. It shall be the Bidder's responsibility to ascertain prior to bid time the addenda issued and to see that his bid includes any changes thereby required.

Should the Bidder find discrepancies, errors, conflicts, ambiguities, or omissions from the drawings or documents; conflicts between Bidder's observations and the Contract

Documents; or should he be in doubt as to the meaning of the Contract Documents; he shall at once notify the Designer or Owner who will provide written instructions in the form of addenda. The Bidder shall submit all questions or requests for clarifications in writing (email or fax is acceptable) no later than ten (10) days prior to the bid date. The Notice to Bidders indicates the contact person for submittal of questions. Notification of addenda shall be issued by the Owner approximately seven (7) days prior to the date set for receipt of bids. Neither the Owner nor the Designer will be responsible for any oral instructions.

In the event that discrepancies, errors, conflicts, ambiguities, or omissions are discovered by the Bidder and have not been resolved by the Designer or Owner prior to submitting the bid, the Bidder shall include in the bid the greater quantity or better quality of Work, or compliance with the more stringent requirement resulting in greater cost. Such greater cost shall be included in the bid.

All addenda shall be acknowledged by the Bidder(s) on the Form of Proposal.

## **7. BID SECURITY**

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company insured by the Federal Deposit Insurance Corporation, or a bid bond in an amount equal to not less than five percent (5%) of the Bidder's maximum bid price, said deposit to be retained by the Owner as liquidated damages in event of failure of the successful Bidder to execute the Contract within ten (10) days after the award or to give satisfactory surety as required by law (NCGS 143-129).

Bid bond shall be conditioned that the surety will, upon demand, forthwith make payment to the obligee upon said bond if the Bidder fails to execute the Contract. The Owner may retain bid securities of any Bidder(s) who may have a reasonable chance of award of Contract until the 120<sup>th</sup> day after the bid opening. Other bid securities may be released sooner, at the discretion of the Owner. All bid securities (cash or certified checks) shall be returned to the Bidders within ten (10) days after award of Contract. Standard Form of Bid Bond is included in these specifications.

## **8. RECEIPT OF BIDS**

Bids shall be received in accordance with requirements of the General Statutes of North Carolina and Brunswick County policy. Bid security shall be required as prescribed by statute. Prior to the deadline for receipt of bids, the Bidder will be permitted to change or withdraw his bid.

## **9. OPENING OF BIDS**

Upon opening, all bids shall be read aloud. Once any bid is opened, there shall not be any withdrawal of bids by any Bidder and no bids may be returned by the Designer to any Bidder. After the bid opening, a Bidder may request that his bid be withdrawn from consideration without forfeiture of his bid security in accordance with the provisions of the NCGS 143-129.1. In accordance with NCGS 143-129.1, a request for withdrawal of a bid must be made in writing to the Owner within seventy-two (72) hours after the bid opening (excluding Saturdays, Sundays, Brunswick County holidays, and other days in which the Brunswick County government offices are closed). Except under the provisions of NCGS 143-129.1, all bids shall remain valid a minimum of ninety (90) days from the opening of bids. Approval of the proposal by the Brunswick County Board of Commissioner's at a public meeting or a signed "Notice of Award" shall constitute acceptance of the bidder's proposal. Should the successful Bidder default and fail to

execute a Contract, the Contract may be awarded to the next lowest and responsible Bidder. The Owner reserves the unqualified right to reject any and all bids. Reasons for rejection may include, but shall not be limited to, the following:

- a. If the Form of Proposal furnished to the Bidder is not used or is altered.
- b. If the Bidder fails to insert a price for all bid items, alternate and unit prices requested.
- c. If the Bidder adds any provisions reserving the right to accept or reject any award.
- d. If there are unauthorized additions or conditional bids, or irregularities of any kind which tend to make the proposal incomplete, indefinite, or ambiguous as to its meaning.
- e. If the Bidder fails to complete the proposal form where information is requested so the bid may be properly evaluated by the Owner.
- f. If the unit prices contained in the bid schedule are unacceptable to the Owner.
- g. If the Bidder fails to comply with other instructions stated herein.
- h. If the Owner suspects the Bidders of collusion.
- i. If the Bidder does not submit all the required proposal forms.
- j. If the Bidder does not execute the complete Contract (with performance and payment bonds) within ten (10) days of receipt of the Notification of Award.

## **10. BID EVALUATION AND BIDDER QUALIFICATIONS**

The award of the Contract will be made to the lowest responsible Bidder as soon as practical. The Owner may award on the basis of the base bid, unit prices, any alternates the Owner chooses, as well as meeting the requirements for consideration as a responsible Bidder. Discrepancies on the Bidder's proposal shall be resolved based on the Owner's inspection and interpretation of the proposal as a whole. In cases where it is not evident what portion of a proposal is errant, discrepancies shall be resolved as follows:

- Words shall take precedence over numerical symbols.
- Unit prices shall take precedence over the associated extended price (quantity multiplied by the unit price).
- The correct sum of any column of figures shall take precedence over the indicated sum.

Before awarding a Contract, the Owner may require the apparent low Bidder to qualify himself to be a responsible Bidder by furnishing any or all of the following data:

- a. The latest financial statement showing assets and liabilities of the company or other information satisfactory to the Owner.
- b. A listing of completed projects of similar size and type.
- c. Project references.
- d. Permanent name and address of place of business.
- e. The number of regular employees of the organization and length of time the organization has been in business under present name.
- f. The name and home office address of the surety proposed and the name and address of the responsible local claim agent.
- g. The names of members of the firms who hold appropriate trade licenses, together with license numbers and the corporate officer who will give his personal attention to the Work.
- h. Qualifications and references of the resident project superintendent.
- i. Other commitments scheduled within the project's projected timeframe.
- j. The Contractor shall perform Work amounting to at least fifty percent (50%) of the Contract using his own personnel and equipment (owned). No portion of the Contract shall be sublet, assigned, or otherwise disposed of without the expressed written consent of the Owner. If the Contractor fails to demonstrate to the Owner that he has the ability to perform the specified percentage of the Work with his own personnel and equipment, his bid may be considered nonresponsive.
- k. An experience statement with pertinent information as to similar projects and other evidence of the qualifications for each subcontractor, person, equipment manufacturer, or organization that will furnish labor or materials. If the Owner or Designer, after investigation, has reasonable objection to any such entity, he may request an acceptable substitute without any increase in the bid price. This does not remove any responsibilities for the substitute to comply with the Contract specifications.

Requested information shall be furnished to the Owner within five (5) days after bid opening. Failure or refusal to furnish any of the above information, if requested, shall constitute a basis for disqualification of any Bidder.

In determining the lowest responsible, responsive Bidder, the Owner shall take into consideration the Bidder's compliance with the requirements of NCGS 143-128.2(c) and County policy, the past performance of the Bidder on construction Contracts for the County with particular concern given to completion times, quality of Work, cooperation with other Contractors, and cooperation with the Designer and Owner. Failure of the low Bidder to furnish affidavit and/or documentation as required by NCGS 143-128.2(c) may constitute a basis for disqualification of the bid.

If the Owner determines that the apparent low Bidder is not the lowest responsible, responsive Bidder by virtue of the above information, said apparent low Bidder will be so notified and his bid security shall be returned to him.

#### **11. CONTRACT, PERFORMANCE BOND, PAYMENT BOND, INSURANCE, E-VERIFY**

The successful Bidder, within ten (10) days of receipt of the "Notice of Award," shall sign and deliver the required number of Contract counterparts, a performance bond in an amount equal to one hundred percent (100%) of the Contract Price, a payment bond in an amount equal to one hundred percent (100%) of the Contract Price, and all necessary certificates of insurance. Contractor shall comply with the requirements of Article 2 of Chapter 64 of the General Statutes. Further, if Contractor utilizes a subcontractor, Contractor shall require the subcontractor to comply with the requirements of Article 2 of Chapter 64 of the General Statutes. An additional performance guarantee with the North Carolina Department of Transportation may be required for work performed in the right-of-way. In this event, the successful Bidder, within ten (10) days of receipt of the "Notice of Award," shall supply the Owner with a copy of the executed performance guarantee and evidence of acceptance by the NCDOT. See the Supplementary General Conditions and General Conditions sections "Terminology and Intent of Documents," "Execution of Documents," "Performance Bond and Payment Bond," and "Minimum Insurance Requirements".

#### **12. PAYMENTS**

Payments to the successful Bidders (Contractors) will be made on the basis of monthly estimates. See "Requests for Payment," General Conditions.

### **13. MINORITY BUSINESS PARTICIPATION**

Bidders are notified that NCGS 143-128.2 and the “Brunswick County Minority Enterprise Policy” shall be observed in receiving and awarding Contracts. As noted in this document under the heading “PROPOSALS,” appropriate forms and affidavits must be submitted with the bids. The state document entitled “Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts” may be used for reference. It may be obtained from the State Construction Office website (<http://www.nc-sco.com>). A listing of Historically Underutilized Businesses may be obtained through the North Carolina Department of Administration Office for Historically Underutilized Businesses at <http://www.doa.state.nc.us/HUB/>. Brunswick County promotes the notification and use of Brunswick County based businesses. The “Brunswick County Minority Enterprise Policy” follows:



## **BRUNSWICK COUNTY MINORITY ENTERPRISE POLICY**

RESOLUTION APPROVING AND ADOPTING A VERIFIABLE FIVE PERCENT (5%) GOAL FOR PARTICIPATION BY MINORITY BUSINESSES IN THE TOTAL VALUE OF WORK FOR EACH PROJECT IN BRUNSWICK COUNTY EXCEEDING ONE HUNDRED THOUSAND DOLLARS (\$100,000.00) FOR WHICH A CONTRACT OR CONTRACTS ARE AWARDED AFTER RECEIVING BIDS FOR SAID PROJECT BY EITHER A MULTI-PRIME OR A SINGLE-PRIME APPROACH

The Brunswick County Board of Commissioners in regular session duly assembled on December 18, 1989, does hereby resolve as follows:

**THAT WHEREAS**, North Carolina General Statute 143-128(c), effective June 28, 1989 requires the public body of each county in the State of North Carolina to adopt an appropriate verifiable percentage goal for participation by minority businesses in the total value of work for which a contract or contracts exceeding One Hundred Thousand Dollars (\$100,000.00) are awarded on either a multi-prime or single-prime basis; and

**WHEREAS**, the term “minority business” is defined by Statute to mean a business;

- a. In which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation in which at least fifty-one percent (51%) of the stock is owned by one of more minority persons; and
- b. Of which the management and daily business operations are controlled by one or more of the minority persons who own it; and

**WHEREAS**, the term “minority person” is defined by Statute to mean a person who is a citizen or lawful permanent resident of the United States and who is:

- a. Black, that is, a person having origins in any of the black racial groups in Africa; or
- b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race; or
- c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, the Pacific Islands; or
- d. American Indian or Alaskan Native, that is, a person having origins in any of the original peoples of North America; or
- e. Female; and

**WHEREAS**, the term “verifiable goal” is defined by Statute to mean for purposes of the separate prime contract system, that the awarding authority has adopted written guidelines specifying the actions that will be taken to ensure a good faith effort in the recruitment and selection of minority businesses for participation in contracts awarded under N.C.G.S. 143-128; and

**WHEREAS**, the term “verifiable goal” is defined by Statute to mean for purposes of the single-prime contract system, that the awarding authority has adopted written guidelines

specifying the actions that the prime contractor must take to ensure a good faith effort in the contracts awarded under N.C.G.S. 143-128; and

**WHEREAS**, the Brunswick County Board of Commissioners, pursuant to public notice duly given, has held a public hearing on establishing an appropriate verifiable percentage goal for participation by minority businesses in public construction contracts awarded by the County by either multi-prime or single-prime contracts, and the Board of Commissioners has considered the comments of persons who requested to be heard; and

**WHEREAS**, the Board of Commissioners desires to adopt a verifiable percentage goal as heretofore defined for Brunswick County.

**NOW, THEREFORE, BE IT RESOLVED, AS FOLLOWS:**

1. That the appropriate verifiable percentage goal for participation by minority businesses in the total value of work for each project in Brunswick County which is awarded pursuant to and in compliance with N.C.G.S. 143-128 shall be five percent (5%).
2. That for the purposes of the separate prime (or multi-prime) contract system, the County shall be responsible for ensuring a good faith effort in the recruitment and selection of minority businesses for participation in contracts awarded.
3. That in order to demonstrate this good faith effort, the County shall take the following actions in awarding contracts pursuant to a separate prime system:
  - a. Advertise the project for bids both locally, regionally and state-wide, stating in each advertisement for bids that the County is seeking minority business participation of at least five percent (5%);
  - b. Cause this Resolution to be forwarded to the North Carolina Association of County Commissioners and supervising and/or administrative agencies of the State of North Carolina to apprise those agencies of Brunswick County's goal and to seek their assistance in the recruitment of minority businesses; and
  - c. Award all public contracts as required by N.C.G.S. 143-128 without regard to race, religion, color, creed, national origin, sex, age or handicapped condition, as defined by N.C.G.S. 168A-3.
4. That for the purposes of the single-prime contract system, it shall be the responsibility of the prime contractor to ensure to the County by written documentation that it has made a good faith effort in the recruitment and selection of minority businesses for participation in contracts awarded.
5. That in order to demonstrate the good faith effort of the single-prime contractor, the contractor shall by written documentation notify the County on its bid that it has taken the following steps:
  - a. Actively sought the participation of minority businesses by contracting known minority businesses who may be interested in participation in a Brunswick County project.

- b. Verify that it has contacted minority-business subcontractors whose work on the project would represent ten percent (10%) of the total value of work, in order to achieve the five percent (5%) goal.
  - c. Verify to the County the names and addresses of the minority-businesses contacted and their respective bids on the sub-contract work sought.
- 6. Notwithstanding the above, the County or the single-prime contractor shall not be required to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who do not submit the lowest responsible bid or bids or who do not comply with the provisions of the Request For Bids or the applicable statutory provisions.
  - 7. The Clerk to the Board is hereby authorized and directed to provide a certified copy of the Resolution to the North Carolina Association of County Commissioners, North Carolina Commissioner of Labor, North Carolina Commissioner of Insurance, and the State Licensing Board for General Contractors.
  - 8. This Resolution shall take effect upon its passage.

This the 18<sup>th</sup> day of December, 1989.

BRUNSWICK COUNTY BOARD OF  
COMMISSIONERS

s/ L. E. Pinkerton, Chairman

ATTEST:

s/ Regina W. Alexander, Clerk

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## SECTION 003132 - GEOTECHNICAL DATA

### 1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.
- B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Engineer and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.
- C. Soil-boring data for Project, obtained by Froehling & Robertson, Inc., is appended to this Document.
- D. A geotechnical investigation report for the Project, prepared by the Engineer, is available for viewing by contacting the Owner.
  - 1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
  - 2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.
- E. Related Requirements:
  - 1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.

END OF DOCUMENT 003132

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## SECTION 003140 - PERMIT INFORMATION

### 1.1 PERMIT APPLICATION INFORMATION

- A. This Document with its referenced documents is part of the Procurement and Contracting Requirements for the Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations.

### 1.2 SECURED PERMITS

- A. The following permits have been or will soon be secured by the Owner:
1. Clean Water Act Section 404 and 401 Permits
  2. CAMA Permit
  3. NC DEQ Sewer System Extension Permit
  4. NC DEQ Sedimentation and Erosion Control Permit and Stormwater NPDES
  5. NC DEQ State Stormwater Permit
  6. NPDES Permit
  7. NCDOT Encroachment Agreement
  8. NCDOT Driveway Permit
  9. Brunswick County Floodplain Development Permit (No-Rise Certificate)
- B. See Appendix Section at end of Specifications for copies of the approved permits.

END OF DOCUMENT 003143

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## FORM OF PROPOSAL

To: **BRUNSWICK COUNTY**

From: *Bidder* \_\_\_\_\_

*Address* \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

*Tele./Fax* \_\_\_\_\_

*Date of Bid* \_\_\_\_\_

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the Contract to be entered into; that this proposal is made without connection with any other person, company, or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud. By signing this proposal, the bidder affirms they are not listed and will not utilize a subcontractor or vendor listed on the Final Divestment List created by the State Treasurer pursuant to NCGS 143-6A-4, Iran Divestment Act Certification. The Bidder further declares that he has examined the site of the work and the Contract Documents relative thereto and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed.

The Bidder proposes and agrees, if this proposal is accepted, to Contract with **Brunswick County** in the form of Contract specified below, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation, supplies, labor, etc. necessary to complete the construction of:

### Concentrate Discharge Pipeline

in full in complete accordance with the plans, specifications, and Contract Documents, to the full and entire satisfaction of **Brunswick County** and their representatives with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and the Contract Documents, for the sum of:

#### **SINGLE PRIME CONTRACT:**

##### **Base Bid:**

(All work covered in the Contract Documents **including** unit price items and allowance items)

Dollars(\$)\_\_\_\_\_

Words\_\_\_\_\_

Words (cont'd)\_\_\_\_\_

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**UNIT PRICES**

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Unit prices quoted and accepted shall apply throughout the life of the Contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the scope of the work all in accordance with the Contract Documents.

Bidder acknowledges that quantities are approximate only and are given as the basis for comparison of Bids. The Owner may increase or decrease the quantity of any item or portion of the work as may be deemed necessary or expedient. An increase or decrease in the quantity of any item will not be regarded as sufficient grounds for an increase or decrease in the unit prices, nor in the time allowed for the completion of the work, except as provided for in the General Conditions.

The quantities shown on the proposal form are for the base bid only unless the contract documents specifically indicate that the item(s), or any portion thereof, are part of an alternate bid element. It is the responsibility of the Contractor to apportion the cost of unit price items to the base bid and any alternates listed in the Proposal using information in the Contract Documents.

In the event that the Owner selects an alternate that clearly increases or decreases the estimated quantity of a unit price item shown on the proposal form, after selection of the Contractor, the Contractor shall be provided an updated list of estimated unit price quantities reflective of the alternates chosen. This updated list shall be used in determining any variation between the actual quantities and the estimated quantities of the unit price work. An estimated unit price quantity shall be updated only in the event that the Contract Documents clearly indicate that the unit price item was indeed part of the Owner-selected alternate. The cost for all unit price items shall be included within either the base bid or an alternate, as applicable.

**UNIT PRICE ITEMS:**

<b>Pay Item</b>	<b>Pay Item Description</b>	<b>Unit</b>	<b>Est. Quantity</b>	<b>Unit Price</b>	<b>Extended Price</b>
1	Change Order (Allowance)			<i>\$150,000</i>	\$150,000
2	Materials Testing (Allowance)			<i>\$40,000</i>	\$40,000
3	AC Pavement Replacement	SY	2,900	\$	\$
4	Concrete Driveway Replacements	SY	525	\$	\$
5	15" RCP Culvert Replacements	LF	860	\$	\$
6	18" RCP Culvert Replacements	LF	65	\$	\$
7	30" RCP Culvert Replacements	LF	110	\$	\$
8	Remove and Replace Unsuitable Pipe Subgrade Material	CY	100	\$	\$
	<b>Unit Price Items (Total Extended Items 1-8)</b>			\$	

Notes:

1. The base bid shall include all items as indicated on this form. Base bid amount shall be recorded where indicated on Form of Proposal page F-1, above.
2. Bidder is advised that pay items 1 and 2 are allowances and will be measured and paid for based on actual costs incurred as indicated in the contract documents.
3. Bidder is advised that Unit Price Items stipulated as part of these contract documents shall be measured and paid for based on the actual quantities installed.
4. Units: LF – Linear Feet. SY – Square Yard. CY – Cubic Yard

## **TIME OF COMPLETION**

The bidder further proposes and agrees hereby to commence work under this Contract on a date to be specified in a written order of the Designer and shall fully complete all work thereunder within the time specified in the Notice to Bidders.

Applicable liquidated damages amount is also stated in the Notice to Bidders (see General Conditions "Time of Completion, Delays, Extension of Time".)

## **MINORITY BUSINESS PARTICIPATION REQUIREMENTS:**

*Provide with the bid* - Under NCGS 143-128.2(c) the undersigned Bidder shall identify **on its bid** (Identification of Minority Business Participation Form) the minority businesses that it will use on the project with the total dollar value of the bids that will be performed by the minority businesses. **Also** list the good faith efforts (Affidavit **A**) made to solicit minority participation in the bid effort.

**NOTE:** A Contractor that performs all of the work with its own workforce may submit an Affidavit **B** to that effect in lieu of Affidavit **A** required above. The Minority Business Participation Form must still be submitted even if there is zero participation.

*After the bid opening* - The Owner will consider all bids and alternates and determine the lowest responsible, responsive bidder. Upon notification of being the apparent low Bidder, the Bidder shall then file within seventy-two (72) hours of the notification of being the apparent lowest Bidder, the following:

An Affidavit **C** that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total Contract price, which is equal to or more than the goal established as indicated in the Notice to Bidders. This affidavit shall give rise to the presumption that the Bidder has made the required good faith effort and Affidavit **D** is not necessary;

**OR**

If less than the goal, Affidavit **D** of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations, and other specific actions demonstrating recruitment and selection of minority businesses for participation in the Contract.

**Note:** Bidders must always submit **with their bid** the Identification of Minority Business Participation Form listing all Minority Business contractors, vendors, and suppliers that will be used. If there is no Minority Business participation, then enter none or zero on the form. Affidavit **A** **or** Affidavit **B**, as applicable, also must be submitted with the bid. Failure to file a required affidavit or documentation with the bid or after being notified apparent low Bidder is grounds for rejection of the bid.

**PROPOSAL SIGNATURE PAGE**

The undersigned further agrees that in the case of failure on his part to execute the said Contract, provide performance and payment bonds, and certificates of insurance within ten (10) consecutive calendar days after being given written notice of the award of Contract, the certified check, cash, or bid bond accompanying this bid shall be paid into the funds of the Owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash, or bid bond accompanying this proposal shall be returned to the undersigned.

Respectfully submitted this day of \_\_\_\_\_

\_\_\_\_\_  
(Name of Firm or Corporation Making Bid)

WITNESS:

\_\_\_\_\_  
(Proprietorship, Partnership, or LLC)

By: \_\_\_\_\_

Signature

Name: \_\_\_\_\_

Print or Type

Title: \_\_\_\_\_

(Owner/Co-Partner/President/Vice President/Manager)

Address: \_\_\_\_\_

ATTEST:

By: \_\_\_\_\_

License No. \_\_\_\_\_

Title: \_\_\_\_\_

(Corp. Sec. or Asst. Sec. only)

Federal I.D. No. \_\_\_\_\_

(CORPORATE SEAL)

Addendum received and used in computing bid:

Addendum No. 1 \_\_\_\_\_ Addendum No. 3 \_\_\_\_\_ Addendum No. 5 \_\_\_\_\_ Addendum No. 7 \_\_\_\_\_

Addendum No. 2 \_\_\_\_\_ Addendum No. 4 \_\_\_\_\_ Addendum No. 6 \_\_\_\_\_ Addendum No. 8 \_\_\_\_\_

**ATTACHED DOCUMENTS**

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The following documents are attached to and made a Condition of this Bid:

- Form of Bid Bond
- Identification of Minority Business Participation form
- Brunswick County AFFIDAVIT A – Listing of Good Faith Efforts
- Brunswick County AFFIDAVIT B – Intent to Perform Contract with Own Workforce
- Brunswick County AFFIDAVIT C – Portion of the Work to be Performed by Minority Firms
- Brunswick County AFFIDAVIT D – Good Faith Efforts

## FORM OF BID BOND

**BIDDER** *(Name and Address):*

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**SURETY** *(Name and Address of Principal Place of Business):*

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**OWNER:**

**Brunswick County**

**P. O. Box 249**

**Bolivia, NC 28422**

**BID**

BID DUE DATE: \_\_\_\_\_

PROJECT *(Brief Description Including Location):*

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**BOND**

BOND NUMBER: \_\_\_\_\_

DATE: *(Not Later than Bid Due Date):* \_\_\_\_\_

PENAL SUM: \_\_\_\_\_

IN WITNESS WHEREOF, Surety and Bidder, intending to be legally bound hereby, subject to the terms of the Contract Documents, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative. THE CONDITION OF THE ABOVE OBLIGATION is such, that if the Bidder shall be awarded the Contract for which the bid is submitted and shall execute the Contract and give bond for the faithful performance thereof within ten (10)days after the award of same to the Bidder, then this obligation shall be null and void; but if the Bidder fails to so execute such Contract and give performance bond as required by NCGS 143-129, the surety shall, upon demand, forthwith pay to the Owner the penal sum amount set forth above. Provided further, that the bid may be withdrawn as provided by NCGS 143-129.1

BIDDER

SURETY

\_\_\_\_\_  
(Seal)

Bidder's Name and Corporate Seal

\_\_\_\_\_  
(Seal)

Surety's Name and Corporate Seal

By: \_\_\_\_\_  
Signature and Title

By: \_\_\_\_\_  
Signature and Title  
(Attach Power of Attorney)

Attest: \_\_\_\_\_  
Signature and Title

Attest: \_\_\_\_\_  
Signature and Title

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Note: (1) Above addresses are to be used for giving required notice.  
(2) Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

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## IDENTIFICATION OF MINORITY BUSINESS PARTICIPATION

I, \_\_\_\_\_,  
(Name of Bidder)

do hereby certify that on this project, we will use the following Minority Business Enterprises (MBE) as construction subcontractors, vendors, suppliers, or providers of professional services.

[illegible]

\*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**), Socially and Economically Disadvantaged (**D**)

**The total value of minority business contracting will be**

(\$)



## Brunswick County    **AFFIDAVIT A - Listing of Good Faith Efforts**

Affidavit of \_\_\_\_\_  
(Name of Bidder)

I have made a good faith effort to comply under the following areas checked:

**Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive.** (1 NC Administrative Code 30 I.0101)

- ☐ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the Contractor, or available on State or local government-maintained lists, at least ten (10) days before the bid date and notified them of the nature and scope of the work to be performed.
- ☐ **2 – (10 pts)** Made the construction plans, specifications, and requirements available for review by prospective minority businesses, or providing these documents to them at least ten (10) days before the bids are due.
- ☐ **3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ☐ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses that provide assistance in recruitment of minority businesses.
- ☐ **5 – (10 pts)** Attended pre-bid meetings scheduled by the owner.
- ☐ **6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for Subcontractors.
- ☐ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ☐ **8 – (25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the Bidder's suppliers in order to help minority businesses in establishing credit.
- ☐ **9 – (20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ☐ **10 – (20 pts)** Provided quick pay agreements and policies to enable minority Contractors and suppliers to meet cash-flow demands.
- ☐ **11 – (20 pts)** A minimum of two (2) or all, if only one (1) is indicated, of the MBE firms indicated on the "Identification of Minority Business Participation" form are **Brunswick County** based.

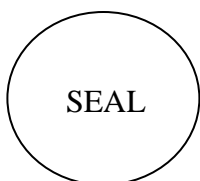
The undersigned, if apparent low Bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of Contract to be executed with the Owner. Substitution of Contractors must be in accordance with NCGS143-128.2(d). Failure to abide by this statutory provision will constitute a breach of the Contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the Bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_

Signature: \_\_\_\_\_

Title: \_\_\_\_\_



State of \_\_\_\_\_, County of \_\_\_\_\_  
Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_  
Notary Public  
My commission expires \_\_\_\_\_

## Brunswick County    **AFFIDAVIT B - Intent to Perform Contract with Own Workforce**

Affidavit of \_\_\_\_\_  
(Name of Bidder)

I hereby certify that it is our intent to perform one hundred percent (100%) of the work required for the

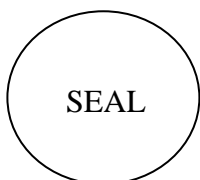
\_\_\_\_\_ Contract.  
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the Owner in support of the above statement.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_



Signature: \_\_\_\_\_

Title: \_\_\_\_\_

State of \_\_\_\_\_, County of \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_

Notary Public \_\_\_\_\_

My commission expires \_\_\_\_\_

## Brunswick County    **AFFIDAVIT C - Portion of the Work to be Performed by Minority Firms**

(Note this form is to be submitted only by the apparent lowest responsible, responsive Bidder.)

If the portion of the work to be executed by minority businesses as defined in NCGS143-128.2(g) is equal to or greater than the percentage goal listed in the Notice to Bidders of the Bidders total Contract price, then the Bidder must complete this affidavit. This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **seventy-two (72) hours** after notification of being low Bidder.

Affidavit of \_\_\_\_\_ I do hereby certify that on the \_\_\_\_\_  
(Name of Bidder)

\_\_\_\_\_ (Project Name)  
Amount of Bid \$ \_\_\_\_\_

I will expend a minimum of \_\_\_\_\_% of the total dollar amount of the Contract with Minority Business Enterprises. Minority businesses will be employed as construction Subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below.

Attach additional sheets if required

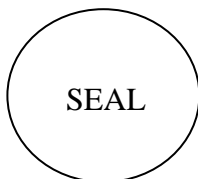
Name and Phone #	*Minority Category	Work Description	Dollar Value

\*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**), Socially and Economically Disadvantaged (**D**)

Pursuant to NCGS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a Contract with the Owner. Failure to fulfill this commitment may constitute a breach of the Contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the Bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_



Signature: \_\_\_\_\_

Title: \_\_\_\_\_

State of \_\_\_\_\_, County of \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_

Notary Public \_\_\_\_\_

My commission expires \_\_\_\_\_

## Brunswick County AFFIDAVIT D - Good Faith Efforts

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the percentage goal of participation by minority business listed in the Notice to Bidders **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of \_\_\_\_\_ I do hereby certify that on the  
(Name of Bidder)

\_\_\_\_\_  
(Project Name)

Amount of Bid \$ \_\_\_\_\_

I will expend a minimum of \_\_\_\_\_% of the total dollar amount of the Contract with Minority Business Enterprises. Minority businesses will be employed as construction Subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone #	*Minority Category	Work Description	Dollar Value

\*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**), Socially and Economically Disadvantaged (**D**)

**Examples** of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

- A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this Contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date, and time when quotes must be received.
- B. Copies of quotes or responses received from each firm responding to the solicitation.
- C. A telephone log of follow-up calls to each firm sent a solicitation.
- D. For subcontracts where a minority business firm is not considered the lowest responsible Sub-Bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.
- E. Documentation of any Contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.
- F. Copy of pre-bid roster.
- G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.
- H. Letter detailing reasons for rejection of minority business due to lack of qualification.
- I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive Bidder.

Do Not Attach to Bid

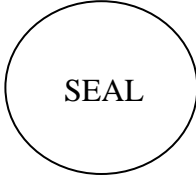
Do Not Attach to Bid

Do Not Attach to Bid

Pursuant to NCGS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a Contract with the Owner. Failure to fulfill this commitment may constitute a breach of the Contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the Bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_



Signature: \_\_\_\_\_

Title: \_\_\_\_\_

State of \_\_\_\_\_, County of \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_

Notary Public \_\_\_\_\_

My commission expires \_\_\_\_\_

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**NOTICE OF AWARD**

Dated \_\_\_\_\_, 20 \_\_\_\_

To: \_\_\_\_\_  
(BIDDER)

Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Owner: **BRUNSWICK COUNTY**

Owner's Contract No. **N/A**

Project: \_\_\_\_\_  
\_\_\_\_\_  
(Insert Name of Contract as it Appears in the Construction Documents)

You are hereby notified that your bid dated \_\_\_\_\_, 20 \_\_\_\_ for the above described project has been considered and has been accepted by the Owner.

The amount of your Contract is: \_\_\_\_\_  
\_\_\_\_\_ Dollars (\$ \_\_\_\_\_)

Enclosed with this Notice of Award are the following:

2 Form of Construction Contract  
2 Form of Construction Performance Bond, Form of Construction Payment Bond, Form of Certificate of  
Insurance, Affidavit of Compliance with NC E-Verify Statutes

You must comply with the following conditions precedent within twelve (12) days of the date of this Notice of Award, that is by:

\_\_\_\_\_, 20 \_\_\_\_

1. You must deliver to the Owner 2 fully executed counterparts of the Contract. Each of the Documents must bear your signature.
2. You must deliver to the Owner 2 each of the fully executed Performance Bond, Payment Bond, Form of Insurance and Affidavit of Compliance with NC E-Verify Statutes. Each of the Documents must bear your signature.

3. List other condition precedents:

None

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Failure to comply with these conditions within the time specified will entitle Owner to consider your bid in default, to annul this Notice of Award and to declare your Bid Security forfeited.

After you have satisfactorily complied with the above conditions, Owner will return to you one (1) fully signed counterpart of the Contract.

**BRUNSWICK COUNTY**  
\_\_\_\_\_  
(OWNER)

By: \_\_\_\_\_  
(AUTHORIZED SIGNATURE)

\_\_\_\_\_  
(TITLE)

**ACCEPTANCE OF AWARD**

\_\_\_\_\_  
(CONTRACTOR)

By: \_\_\_\_\_  
(AUTHORIZED SIGNATURE)

\_\_\_\_\_  
(TITLE)

\_\_\_\_\_  
(DATE)

COPY to ENGINEER  
(Use Certified Mail, Return Receipt Requested)

Name:  
Address:



**NORTH CAROLINA**

**CONSTRUCTION AGREEMENT**

**BRUNSWICK COUNTY**

**THIS CONSTRUCTION OR REPAIR AGREEMENT** (hereinafter referred to as the “Agreement” or “Contract”) is made and entered into by and between Brunswick County, a body politic and corporate of the State of North Carolina, (hereinafter referred to as “County” or “Owner”), party of the first part, and {Contractor Name}, (hereinafter referred to as “Contractor”), party of the second part.

**WITNESSETH:**

**1. PROJECT; FEES**

Contractor shall furnish and deliver all materials and perform all work in the manner and form as provided by enumerated plans, specifications and documents, including, without limitation and as applicable: the Invitation to Bid; Notice to Bidders; Instructions to Bidders; General Conditions; Supplementary General Conditions; Specifications; Addenda; Accepted Proposal; Notice to Proceed; Performance Bond; Payment Bond; MBE forms; Power of Attorney; Workers’ Compensation, Public Liability, Property Damage and Builder’s Risk Insurance Certificates; Approval by the Board of Commissioners; Tax Statement and Certification; Notice of Substantial Completion; Notice of Final Completion and Acceptance; and Drawings (hereinafter referred to collectively as the “Bid Documents”) titled:

**Project: Northwest Water Treatment Plant – Concentrate Discharge Pipeline**

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Consisting of the following sheets **Northwest Water Treatment Plant – Concentrate Discharge Pipeline**

dated **October 2019**

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And the following addenda:

Addendum No. \_\_\_\_\_

Dated: \_\_\_\_\_

Addendum No. \_\_\_\_\_

Dated: \_\_\_\_\_

Addendum No. \_\_\_\_\_

Dated: \_\_\_\_\_

Addendum No. \_\_\_\_\_

Dated: \_\_\_\_\_

Addendum No. \_\_\_\_\_

Dated: \_\_\_\_\_

Addendum No. \_\_\_\_\_

Dated: \_\_\_\_\_

The Bid Documents are incorporated by reference and made an integral part of this Agreement. To the extent the terms of such documents conflict with the terms of this Agreement, the terms of this Agreement shall prevail.

## **2. TERM OF AGREEMENT**

The term of this Agreement begins upon issuance of the Notice to Proceed by Brunswick County (the "Effective Date") and continues in effect, entire project achieves Substantial Completion before **February 1, 2021**, unless extended or sooner terminated as provided for in the Brunswick County General Conditions of the Contract.

## **3. BRUNSWICK COUNTY GENERAL CONDITIONS OF THE CONTRACT**

This Agreement, in addition to any construction documents prepared hereunder, shall be subject to the Brunswick County, North Carolina General Conditions of the Contract (for construction contracts), unless the County directs otherwise. In the event of a conflict between the General Conditions of the Contract and this Agreement, this Agreement shall prevail.

## **4. NONAPPROPRIATION**

If the Board of County Commissioners does not appropriate the funding needed by the County to make payments under this Agreement for a given fiscal year, the County will not be obligated to pay amounts due beyond the end of the last fiscal year for which funds were appropriated. In such event, the County will promptly notify the Contractor of the non-appropriation and this Agreement will be terminated at the end of the last fiscal year for which funds were appropriated. No act or omission by the County which is attributable to non-appropriation of funds shall constitute a breach of or default under this Agreement.

## **5. COMPENSATION**

The County agrees to pay Contractor the total amount of **{Contract Amount - Alpha} Dollars (\$ {Contract Amount - Numeric})** for the Project. Payment shall be subject to additions and deductions as provided in the specifications or Bid Documents. County shall make monthly progress payments to Contractor on the basis of a duly certified and approved estimate of work performed during a given calendar month, less five percent (5%) of the amount of such estimate which is to be retained by County until all work has been performed strictly in accordance with this Agreement and such work has been accepted by County. The County shall not require further retainage after fifty percent (50%) of the work has been satisfactorily completed on schedule as more fully set forth in the General Conditions included with the Bid Documents. County shall make full and final payment to Contractor within thirty (30) days after completion of the Project and acceptance of such work by County and upon Contractor's submittal of satisfactory evidence that all payrolls, material bills and other costs incurred in connection with the Project have been paid in full. Notwithstanding the foregoing, County will not pay late fees on any charges under

this Agreement. If County disputes any portion of the charges, the County shall inform Contractor in writing of the disputed charges.

The Contractor is hereby notified that there are liquidated damages associated with this project. Liquidated damages will be in the amount of **\$2,500** per day for each calendar day beyond the Substantial Completion date (**February 1, 2021**). Liquidated damages will increase to the amount of **\$10,000** per day for each calendar day beyond **July 1, 2021**.

## **INDEPENDENT CONTRACTOR**

Both County and Contractor agree that Contractor shall act as an independent contractor and shall not represent itself as an agent or employee of the County for any purpose in the performance of its duties under this Agreement. Contractor represents that it has or will secure, at its own expense, all personnel required in performing the work under this Agreement. Accordingly, Contractor shall be responsible for payment of all federal, state and local taxes arising out of its activities in accordance with this Agreement, including, without limitation, federal and state income tax, social security tax, unemployment insurance taxes and any other taxes or business license fees as required. Contractor shall not be entitled to participate in any plans, arrangements or distributions by the County pertaining to or in connection with any pension, stock, bonus, profit sharing or other benefit extended to County employees.

In the event the Internal Revenue Service should determine that Contractor is, according to Internal Revenue Service guidelines, an employee subject to withholding and social security contributions, then Contractor hereby acknowledges that all payments hereunder are gross payments, and the Contractor is responsible for all income taxes and social security payments thereon.

## **6. CONTRACTOR REPRESENTATIONS**

- (1) Contractor is a duly organized entity or corporation qualified to do business and in good standing under the laws of the State of North Carolina;
- (2) Contractor has all requisite corporate power and authority to execute, deliver and perform its obligations under this Agreement;
- (3) No approval, authorization or consent of any governmental or regulatory authority is required to be obtained or made by it in order for Contractor to enter into and perform its obligations under this Agreement;
- (4) Contractor shall not violate any agreement with any third party by entering into or performing the work under this Agreement;
- (5) Contractor will perform all work in conformity with the specifications and requirements of this Agreement;
- (6) Unless otherwise agreed by the parties, Contractor agrees that all materials will be new

and of good quality;

- (7) The work provided by Contractor under this Agreement will not violate, infringe or misappropriate any patent, copyright, trademark or trade secret rights of any third party, or any other third-party rights (including without limitation non-compete agreements);
- (8) Contractor will perform the work in a professional and workmanlike manner exercising reasonable care and diligence and will ensure that it adheres to the highest generally accepted standards in the industry when performing said work;
- (9) Contractor acknowledges that if any specific licenses, certifications or related credentials are required in its performance of the work, it will ensure that such credentials remain current and active and not in a state of suspension or revocation; and
- (10) Contractor shall ensure that whenever its employees or agents are on County property, they will strictly abide by all instructions and directions issued by the County with respect to rules, regulations, policies and security procedures applicable to work on the County's premises. Such rules, regulations, policies and security procedures shall include, but not be limited to: (i) not possessing any controlled substances; (ii) smoking only in designated smoking areas, if any; and (iii) not possessing weapons, except for weapons possessed by law enforcement officials.

## **7. NON-ENDORSEMENT AND PUBLICITY**

County is not endorsing Contractor or its work, and Contractor is not permitted to reference this Agreement or County in any manner without the prior written consent of County. Notwithstanding the foregoing, the parties agree that Contractor may list the County as a reference in response to requests for proposals and may identify County as a customer in presentations to potential customers.

## **8. NON-EXCLUSIVITY**

Contractor acknowledges that County is not obligated to contract solely with Contractor for the work covered under this Agreement.

## **9. DIVESTMENT FROM COMPANIES THAT BOYCOTT ISRAEL**

Contractor hereby certifies that it has not been designated by the North Carolina State Treasurer as a company engaged in the boycott of Israel pursuant to N.C.G.S. § 147-86.81.

## **10. DEBARMENT**

Contractor hereby certifies that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participation

in this Agreement by any governmental department or agency. Contractor must notify County within thirty (30) days if debarred by any governmental entity during this Agreement.

## **11. MINORITY BUSINESS ENTERPRISES**

Contractor will make a good faith effort to utilize Minority Business Enterprises (MBEs) per N.C. Gen. Stat. 143-128 as subcontractors in the performance of this Agreement.

## **12. WORKERS' COMPENSATION**

To the extent required by law, Contractor shall comply with the North Carolina Workers' Compensation Act and shall provide for the payment of workers' compensation to its employees in the manner and to the extent required by such Act. In the event Contractor is excluded from the requirements of such Act and does not voluntarily carry workers' compensation coverage, Contractor shall carry or cause its employees to carry adequate medical/accident insurance to cover any injuries sustained by its employees or agents while fulfilling Contractor's obligations under this Agreement. Contractor agrees to furnish County proof of compliance with said Act or adequate medical/accident insurance coverage upon request.

## **13. TAXES**

Contractor shall be responsible for paying all taxes, fees, assessments and premiums of any kind payable on its employees and operations. Contractor shall substantiate, on demand by the County, that all taxes and other charges are being properly paid.

## **14. COMPLIANCE WITH E-VERIFY PROGRAM**

Pursuant to N.C.G.S. § 143-133.3, Contractor understands that it is a requirement of this Agreement that Contractor and its subcontractors must comply with the provisions of Article 2 of Chapter 64 of the North Carolina General Statutes. In doing so, Contractor agrees that, unless it is exempt by law, it shall verify the work authorization of its employees utilizing the federal E-Verify program and standards as promulgated and operated by the United States Department of Homeland Security, and Contractor shall require its subcontractors to do the same. Upon request, Contractor agrees to provide County with an affidavit of compliance or exemption.

## **15. CONFIDENTIAL INFORMATION**

For purposes of this Agreement, the party disclosing Confidential Information is the "Discloser," and the party receiving Confidential Information is the "Recipient." "Confidential Information" shall mean any nonpublic information concerning the parties' respective businesses including, but not limited to, all tangible, intangible, visual, electronic, present or future information such as: (a) trade secrets; (b) financial information, including pricing; (c) technical information, including research, development, procedures, algorithms, data, designs and know-how; (d) business information, including operations, planning, marketing interests and products; and (e) the terms of any agreement between the parties and the discussions, negotiations and proposals related thereto. Confidential Information disclosed to the other party must be clearly

identified. Written Confidential Information must be clearly marked in a conspicuous place with an appropriate legend identifying the information as “Confidential.” Confidential Information that is not written must be identified as confidential at the time of disclosure and confirmed in writing delivered to Recipient within fifteen (15) days of disclosure.

The restrictions regarding the use and disclosure of Confidential Information do not apply to information that is:

- (1) in the public domain through no fault of the Recipient;
- (2) within the legitimate possession of the Recipient, with no confidentiality obligations to a third party;
- (3) lawfully received from a third party having rights in the information without restriction, and without notice of any restriction against its further disclosure;
- (4) independently developed by the Recipient without breaching this Agreement or by parties who have not had, either directly or indirectly, access to or knowledge of the Confidential Information;
- (5) disclosed with the prior written consent of the Discloser; or
- (6) required to be disclosed by law, regulation or court or governmental order, specifically including requests pursuant to the Public Records Laws of North Carolina contained in Chapter 132 of the North Carolina General Statutes. In the event Recipient receives such a request, it shall notify Discloser and Discloser shall have the opportunity to defend against production of such records at Discloser’s sole expense.

## **16. NO ASSIGNMENT WITHOUT CONSENT**

Neither party shall assign this Agreement (or assign any right or delegate any obligation contained herein whether such assignment is of service, of payment or otherwise) without the prior written consent of the other party hereto. Any such assignment without the prior written consent of the other party hereto shall be void. An assignee shall acquire no rights, and County shall not recognize any assignment in violation of this provision.

## **17. GOVERNING LAW AND VENUE**

This Agreement shall be governed by applicable federal law and by the laws of the State of North Carolina without regard for its choice of law provisions. All actions relating in any way to this Agreement shall be brought in the General Court of Justice of the State of North Carolina in Brunswick County or in the Federal District Court for the Eastern District of North Carolina, Wilmington division.

## **18. DISPUTE RESOLUTION**

Should a dispute arise as to the terms of this Agreement, both parties agree that neither may initiate binding arbitration. The parties may agree to non-binding mediation, as more fully set forth in the General Conditions of the Contract.

## **19. GOVERNMENTAL IMMUNITY**

County, to the extent applicable, does not waive its governmental immunity by entering into this Agreement and fully retains all immunities and defenses provided by law with regard to any action based on this Agreement.

## **20. NON-WAIVER**

Failure by County at any time to require the performance by Contractor of any of the provisions of this Agreement shall in no way affect County's right hereunder to enforce the same, nor shall any waiver by County of any breach be held to be a waiver of any succeeding breach or a waiver of this Section.

## **21. ENTIRE AGREEMENT**

This Agreement constitutes the entire agreement between the parties with respect to the subject matter herein. There are no other representations, understandings or agreements between the parties with respect to such subject matter. This Agreement supersedes all prior agreements, negotiations, representations and proposals, written or oral, related specifically to the Project herein.

## **22. HEADINGS**

The headings in this Agreement are for convenience of reference only and shall not define or limit any of the terms or provisions hereof.

## **23. SEVERABILITY**

The invalidity of one or more of the phrases, sentences, clauses or sections contained in this Agreement shall not affect the validity of the remaining portion of the Agreement so long as the material purposes of this Agreement can be determined and effectuated. If a provision of this Agreement is held to be unenforceable, then both parties shall be relieved of all obligations arising under such provision, but only to the extent that such provision is unenforceable, and this Agreement shall be deemed amended by modifying such provision to the extent necessary to make it enforceable while preserving its intent.

## 24. AMENDMENTS

Amendments or changes to this Agreement shall not be valid unless in writing and signed by authorized agents of both Contractor and County.

## 25. NOTICES

(1) **DELIVERY OF NOTICES.** Unless otherwise specified in the General Conditions, any notice, consent or other communication required or contemplated by this Agreement shall be in writing, and shall be delivered in person, by U.S. mail, by overnight courier, by electronic mail or by facsimile to the intended recipient at the address set forth below.

(2) **EFFECTIVE DATE OF NOTICES.** Any notice shall be effective upon the date of receipt by the intended recipient; provided that any notice which is sent by facsimile or electronic mail shall also be simultaneously sent by mail deposited with the U.S. Postal Service or by overnight courier.

(3) **NOTICE ADDRESS.**

a. Communications that relate to any breach, default, termination, amendment or waiver of any provision of this Agreement shall be sent to:

For the County: Bob Tweedy  
Brunswick County  
P.O. Box 249  
Bolivia, NC 28422

b. Communications that relate to any delay in performance, prevention of performance, modification or extension of this Agreement shall be sent to:

For the County: Bob Tweedy  
Brunswick County Attorney  
P.O. Box 249  
Bolivia, NC 28422

c. All communications to Contractor shall be sent to:

For the Contractor: Name  
Address



## 26. SIGNATURES

This Agreement, together with any amendments or modifications, may be executed in one or more counterparts, each of which shall be deemed an original and all of which shall be considered one and the same agreement. This Agreement may also be executed electronically. By signing electronically, the parties indicate their intent to comply with the Electronic Commerce in Government Act (N.C.G.S § 66-358.1 et seq.) and the Uniform Electronic Transactions Act (N.C.G.S § 66-311 et seq.). Delivery of an executed counterpart of this Agreement by either electronic means or by facsimile shall be as effective as a manually executed counterpart.

ATTEST:

**BRUNSWICK COUNTY**

\_\_\_\_\_  
Clerk to the Board

By: \_\_\_\_\_  
Frank Williams  
Chairman

[SEAL]

**{CONTRACTOR NAME}**

By: \_\_\_\_\_

Printed Name: {Contractor Signatory Name}

Title: {Contractor Signatory Title}

Date: \_\_\_\_\_

“This instrument has been preaudited in the manner required by the Local Government Budget and Fiscal Control Act.”

\_\_\_\_\_  
Julie A. Miller, Finance Director  
Brunswick County, North Carolina

APPROVED AS TO FORM

\_\_\_\_\_  
Robert V. Shaver, Jr., County Attorney /  
Bryan W. Batton, Assistant County Attorney

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# NOTICE TO PROCEED

Dated \_\_\_\_\_, 20 \_\_\_\_

To: \_\_\_\_\_  
(CONTRACTOR)

Address: \_\_\_\_\_  
\_\_\_\_\_

Owner: **BRUNSWICK COUNTY**

Owner's Contract No. **N/A**

Project: **Northwest Water Treatment Plant, Concentrate Discharge Pipeline**

You are notified that the Contract times under the above Contract will commence to run on:  
\_\_\_\_\_.

By that date, you are to start performing your obligations under the Contract Documents. Your Contract completion date is therefore:\_\_\_\_\_.

The Contract provides for the assessment of liquidated damages for each consecutive calendar day that the work remains incomplete after the above established completion date.

Before you may start any Work at the site, you must deliver the required certificates of insurance to the Owner.

Also, before you may start any Work at the site, you must:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Brunswick County**  
(OWNER)

By: \_\_\_\_\_  
(AUTHORIZED SIGNATURE)

\_\_\_\_\_  
(TITLE)

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***Rain Day Record  
Brunswick County***

**Project Name:** \_\_\_\_\_ **Period: From** \_\_\_\_\_ **to** \_\_\_\_\_.  
(1<sup>st</sup> Day of month to last day of month)

**Designer:** \_\_\_\_\_ **Contractor:** \_\_\_\_\_.

**Designer Rep:** \_\_\_\_\_ **Contractor Rep:** \_\_\_\_\_.

---

The Contractor shall submit this form with each pay request. Extension of the Time of Completion shall be made in accordance with the Article "Time of Completion, Delays, Extension of Time" in the General Conditions. Rain days noted on this form shall be used as a means of determining the validity of requests for extensions to the Time of Completion but shall not be construed to mean that all days herein itemized shall lead to an extension of the Time of Completion. Time extensions shall not be granted for rain, wind, snow, or other natural phenomena of normal intensity.

☐ "During the normal work days of this period, no delays were incurred due to rain or wet conditions at the site."

**OR**

☐ "During the normal work days of this period, no substantial work could be performed on the project due to rain or wet conditions during the following days":

\_\_\_\_\_, 20\_\_\_\_  
\_\_\_\_\_, 20\_\_\_\_  
\_\_\_\_\_, 20\_\_\_\_  
\_\_\_\_\_, 20\_\_\_\_  
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\_\_\_\_\_, 20\_\_\_\_  
\_\_\_\_\_, 20\_\_\_\_

\_\_\_\_\_, 20\_\_\_\_  
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\_\_\_\_\_, 20\_\_\_\_  
\_\_\_\_\_, 20\_\_\_\_  
\_\_\_\_\_, 20\_\_\_\_  
\_\_\_\_\_, 20\_\_\_\_

**SIGNATURES:**

\_\_\_\_\_  
Contractor Date

Inspector Comments (Note agreement/disagreement): \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Resident Inspector Date

**Request for Payment  
Brunswick County**

**Project Name:** \_\_\_\_\_

**Period: From** \_\_\_\_\_ **to** \_\_\_\_\_.  
(1<sup>st</sup> day of month to last day of month)

**Designer:** \_\_\_\_\_

**Contractor:** \_\_\_\_\_

Contract Value as Awarded: \$ \_\_\_\_\_

Time of Completion as Awarded: \_\_\_\_\_ days

Date of Completion as Awarded: \_\_\_\_\_

CHANGE ORDERS:                      Amount                      Days

#1	\$ _____	
#2	\$ _____	
#3	\$ _____	
#4	\$ _____	

Total Change Orders: \$ \_\_\_\_\_

Adjusted Contract Value: \$ \_\_\_\_\_

The undersigned Contractor certifies that 1) all previous progress payments received from Owner on account of work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with Work covered by prior Applications for Payment; 2) title of all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all liens, security interests and encumbrances (except such as are covered by a Bond acceptable to Owner indemnifying Owner against any such liens, security interests, or encumbrances); 3) all Work covered by this Request for Payment is in accordance with the Contract Documents and is not defective; and 4) that, to the best of his knowledge, the estimate is correct, due, and unpaid.

Certified By: \_\_\_\_\_  
Contractor                                      Date

Reviewed By: \_\_\_\_\_  
Resident Project Representative      Date

Reviewed By: \_\_\_\_\_  
Designer                                      Date

Approved By: \_\_\_\_\_  
Brunswick County                              Date

This instrument has been preaudited in the manner required by the Local Government Budget and Fiscal Control Act.

\_\_\_\_\_  
Julie A. Miller, Finance Officer  
Brunswick County, North Carolina

**PREVIOUS PAYMENTS AUTHORIZED**

Req.	Payment Authorized	Req.	Payment Authorized
#1	_____	#9	_____
#2	_____	#10	_____
#3	_____	#11	_____
#4	_____	#12	_____
#5	_____	#13	_____
#6	_____	#14	_____
#7	_____	#15	_____
#8	_____	#16	_____

Total Value of Completed Work	\$	_____
5% Retained	-	\$ _____
95% of Material on Hand	+	\$ _____
Liquidated Damages _____ Days _____/Days	-	\$ _____
Net Total	=	\$ _____
Previous Payments	-	\$ _____
Total Due This Payment	=	\$ _____

To Be Completed by Designer:

Record Drawings are complete & Up to Date:	YES - NO
Monthly Rain Day Record Submitted:	YES - NO
Erosion Control Documentation Submitted:	YES - NO
MBE Document. for Contract Payments Submitted:	YES - NO
Updated Schedule Submitted:	YES - NO
Tax Statement & Certification Submitted:	YES - NO
Status Report Submitted:	YES - NO

**Project:**  
**Date:**  
**Brunswick County**

**Contractor Submittal**  
**Submittal #:** \_\_\_\_\_

ATTENTION:

TO (Designer):

ADDRESS:

ATTENTION:

FROM (Contractor):

ADDRESS:

WE ARE SENDING YOU:

☒ First Submittal

☐ Re-submittal # \_\_\_\_\_

☐ Shop Drawings

☐ O&M Manuals

☐ Specifications

☐ Samples

☐ Or-Equal Item

☐ Substitution Item

☐ Other \_\_\_\_\_

MANUFACTURER	COPIES	SPEC. SECTION #	SCHEDULED SUBMITTAL DATE	DESCRIPTION

THESE ARE TRANSMITTED AS CHECKED BELOW:

☒ For approval

☐ For your use

☐ As Requested

☐ For review and comment

"I certify that I have reviewed the Contract Documents and that the information herein submitted meets the requirements outlined in the Contract Documents except as specifically stated on this submittal form."

(Affix Contractor's Stamp of Approval Above)

REMARKS (Include any exceptions to the Contract Documents):


COPY TO:

SIGNED:

ATTENTION:  
TO (Designer):  
ADDRESS:

ATTENTION:  
FROM (Contractor):  
ADDRESS:

ATTACHED TO THIS RFI FORM, WE ARE SENDING YOU:

☐ First Submittal

☐ Re-submittal # \_\_\_\_\_

☐ Annotated Shop Drawings

☐ Annotated Specifications

☐ Samples

☐ Sketches

☐ Other \_\_\_\_\_

☐ Other \_\_\_\_\_

AFFECTED DRAWINGS:

AFFECTED SPECIFICATIONS:

REQUEST (Describe specific issue and include supporting material - annotated drawings, specifications):

COPY TO:

SIGNED:

(Contractor)



---

***Directive/Written Notice/Correspondence/Order/Minor Change in the Work  
Brunswick County***

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ a.m./p.m. **Project Name:** \_\_\_\_\_

**Designer:** \_\_\_\_\_ **Contractor:** \_\_\_\_\_

**Designer Rep:** \_\_\_\_ **Contractor Rep:** \_\_\_\_

---

In accord with the Article "Construction Supervision" of the General Conditions, the Contractor, by signing below, 1) acknowledges receipt of this correspondence, and 2) acknowledges that, unless noted otherwise under Contractor's comments, he/she agrees that the correspondence contained herein does **not** constitute a "Change In The Work" or an "Extra Cost" (as defined in the General Conditions) that would require additional compensation or an extension of the Contract time.

*Contractor's Comments:*

(The Contractor is directed to the General Conditions when making "Claims for Extra Cost." If the Contractor views instructions from the Designer as requiring additional compensation or an extension of the Contract time, the contractor shall not proceed with the work affected until further advised.)

**Signature/Date:** \_\_\_\_\_ **Print Name:** \_\_\_\_\_

**Representing:** \_\_\_\_\_ **Position:** \_\_\_\_\_

---

**Work Change Directive**  
**Brunswick County**

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ a.m./p.m. **Project Name:** \_\_\_\_\_  
**Designer:** \_\_\_\_\_ **Contractor:** \_\_\_\_\_  
**Designer Rep:** \_\_\_\_\_ **Contractor Rep:** \_\_\_\_\_

---

Directive:

Reason for Change:

The preceding directive requires the following actions by the Contractor before \_\_\_\_\_ (Date):

**CONTRACTOR:**

The total lump sum cost for the change noted above shall not exceed \$\_\_\_\_\_.

**OR**

The estimated quantities, maximum unit prices, and maximum extended prices for each item are as follows:

<u>Item</u>	<u>Estimated Quantity</u>	<u>Unit Price</u>	<u>Extended Price</u>
-------------	---------------------------	-------------------	-----------------------

The total change to the Time of Completion shall be an increase/decrease of \_\_\_\_\_ days.

**DESIGNER:**

The work change noted above is in the best interests of the owner. The price and Contract Time adjustment have been evaluated and are reasonable. The changes will be effected by a final adjusting change order at the close of the project **or** by \_\_\_\_\_(date), whichever is sooner.

**OWNER:**

The Owner agrees to the change as being in the Owner's best interest.

**SIGNATURES:**

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Date

\_\_\_\_\_  
Designer

\_\_\_\_\_  
Date

\_\_\_\_\_  
Owner  
Original Designer

Yellow Contractor

\_\_\_\_\_  
Date  
Pink Owner

BRUNSWICK COUNTY  
CHANGE ORDER NO. \_\_\_\_

PROJECT:  
ORIG. TIME OF COMP.  
ORIG. DATE OF COMP.

CAUSE CODE:

**FOR BC USE ONLY**

- ☐ OR Owner Request
- ☐ CR Contractor Request
- ☐ DR Designer Request
- ☐ CC Concealed Condition
- ☐ DE Design Error
- ☐ DO Design Omission
- ☐ SC Schedule Change
- ☐ OT Other

Under the terms of the Contract and without invalidating the original provisions thereof, the following change(s) in work is(are) authorized for the change in Contract amount herein set forth: (Description of change order with detailed breakdown attached)

The Time of Completion including previous orders is \_ calendar days and shall be (increased) (decreased) (unchanged) by calendar days by this change order for a revised Contract date of completion of \_\_\_\_\_. (Detailed analysis supporting the requirements for a change in duration is attached)

**CONTRACT COST SUMMARY**

					TOTALS
1. Original Contract Amount					\$
2. Amount of Previous Orders	ADD	\$0	Deduct	\$0	
3. Amount of This Order:	ADD	\$0	Deduct	\$0	
4. Total additions lines 2 & 3			Minus Total Deducts:	\$0	\$
(Line 4 shall show the net amount to be added or [deducted] from the <b>original</b> Contract amount.)					
5. Revised Contract Total Amount					\$

I certify that my Bonding Company will be notified forthwith that my Contract has been changed by the amount of this change order, and that a copy of the approved change order will be mailed upon receipt by me to my surety.

_____	By:	_____	_____
(Contractor)			(Date)
_____	By:	_____	_____
(Designer)			(Date)
_____	By:	_____	_____
(Owner)			(Date)
_____	By:	_____	_____
(County Commissioners)		Frank Williams, Chairman	(Date)

This instrument has been preaudited in the manner required  
by the Local Government Budget and Fiscal Control Act.

Approved as to Form

\_\_\_\_\_  
Brunswick County Finance Officer

\_\_\_\_\_  
Brunswick County Attorney

DISTRIBUTION:      1 original to Owner      1 original to Contractor

## DESIGNER'S REQUEST FOR AUTHORIZATION TO CHANGE

DATE:

REQUEST NO.:

PROJECT NAME:

OWNER:

CONTRACTOR:

DESIGNER:

CONTRACT FOR:

---

REASON FOR CHANGE:

---

**SUMMARY REVIEW OF CONTRACTOR'S ESTIMATE FOR TIME AND COST: (Attach Contractor's detailed cost breakdown of labor and materials)**

---

**DESIGNER SUMMARY:**

1. Schedule items affected by this change:
2. Can Contractor mitigate the change without requiring a Contract time extension?
3. Will the change require a Contract time extension for other Contractors? Which?
4. Are additional costs indicated by reason of the time extension If so they must be included in 5 & 6 Below.

**CONTRACTOR'S ESTIMATE**

**DESIGNER'S ESTIMATE**

5. Estimated cost of change:

6. Estimated time extension field cost (if any):

**DESIGNER RECOMMENDATION AND CERTIFICATION:**

I certify that I have reviewed all aspects of this change order and have determined that it is in the best interest of the Owner to have the work accomplished. I have also determined that the cost and time allotment are fair and equitable, and I recommend acceptance by the Owner.

Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

Title: \_\_\_\_\_

---

***Certificate of Compliance  
Brunswick County***

PROJECT:
LOCATION:
DATE OF FINAL ACCEPTANCE
CONTRACTOR:

I (we) certify that the work on the above-referenced Project has been inspected in accordance with Chapter 133, Article 1, of the General Statutes, and that:

(1) The inspections of the construction, repairs, or installations have been conducted with the degree of care and professional skill and judgment ordinarily exercised by a member of my (our) profession; and

(2) to the best of my (our) knowledge, and in my (our) professional opinion as an architect or engineer, the Contractor has fulfilled the obligations of such plans, specifications and Contract.

Signed this \_\_\_\_\_ day of \_\_\_\_\_

(SEAL)

\_\_\_\_\_  
Designer

\_\_\_\_\_  
Title

State of North Carolina, County of \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_.

Notary Public: \_\_\_\_\_ (SEAL)

My Commission Expires: \_\_\_\_\_

---

**Certificate of Completion**  
**Brunswick County**

PROJECT \_\_\_\_\_

LOCATION \_\_\_\_\_

DATE \_\_\_\_\_

OWNER \_\_\_\_\_

DESIGNER \_\_\_\_\_

PRIME CONTRACTOR \_\_\_\_\_

I (we), as Designer, certify that all work on the above referenced project has been completed according to the plans, specifications, addenda and approved change orders and that the project is ready for owner occupancy.

The final inspection was made on \_\_\_\_\_, 20\_\_\_\_. The guarantee period begins on \_\_\_\_\_, 20\_\_\_\_, and shall terminate on \_\_\_\_\_, 20\_\_\_\_.

The contractors report that final payments have been made to all material suppliers, employees and subcontractors, and copies of their lien waivers are attached.

Builder's risk insurance was cancelled as of \_\_\_\_\_, 20\_\_\_\_, and a copy of the cancellation notice is attached hereto.

The total time for completion as allowed in the contract plus granted time extensions is \_\_\_\_\_ days. The actual time required for completion was \_\_\_\_\_ days, and the contractor(s) is/is not (are/are not) liable for liquidated damages. The contractor(s) has (have) been notified of any proposed assessments of liquidated damages. Copies of each notification and my (our) letter of recommendations as to the amount of liquidated damages are attached.

Copies of the following items are attached as indicated below:

Written guarantees:

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Affidavits:

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Consent of surety company to final payment: \_\_\_\_\_

Manuals of operation instructions:

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Final report \_\_\_\_\_

As-built drawings \_\_\_\_\_

Other required closing papers of the contractor:

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There are no unsettled disputes between the Owner and Contractor, Owner and Designer, or the Designer and Contractor at this time.

Signed this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_.

(SEAL)

\_\_\_\_\_  
Designer

Title

---

*Contractor's Affidavit of Release of Liens  
Brunswick County*

State of \_\_\_\_\_

County of \_\_\_\_\_

\_\_\_\_\_,  
(Name) (Title)

of \_\_\_\_\_, being first duly sworn, deposes and says that:

1. The undersigned is authorized to execute this Affidavit, Release, and Waiver of Claim on behalf of the Contractor and has personal knowledge of all facts set forth herein;
2. This Affidavit, Release, and Waiver of Claim is made concerning the construction of the following project \_\_\_\_\_;
3. All payrolls, material bills, sales tax, social security, state and federal unemployment insurance, and all other liabilities and taxes owed by the Contractor and arising in any manner from the above-described Project have been paid in full;
4. No claim or lien exists in favor of any supplier of materials or labor or in favor of any Subcontractor furnishing materials or labor on the above-described Project;
5. Notwithstanding the foregoing, if the Owner or property of the Owner is subjected to any claim or lien which arises in any manner from the failure of the Contractor to pay any liability described above, the Contractor will indemnify and hold the Owner harmless for any amount which the Owner is required to pay to discharge such lien or settle such claim and further will pay the Owner's expenses, costs, and attorney fees incurred in connection therewith;
6. All claims, suits, and proceedings of every name, description, or nature as arising out of the Project against the Owner, its officers, employees, and agents have been settled;
7. The Contractor releases and waives any and all claims of every type and description which the Contractor may have against the Owner arising in any manner from the construction of the above-described Project.

\_\_\_\_\_  
\_\_\_\_\_

Title \_\_\_\_\_

Sworn to and subscribed before me this the  
\_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

Date \_\_\_\_\_

\_\_\_\_\_  
Notary Public

My Commission expires: \_\_\_\_\_



---

***Change Proposal  
Brunswick County***

**Date:** \_\_\_\_\_

**Project Name:** \_\_\_\_\_

**Designer:** \_\_\_\_\_

**Contractor:** \_\_\_\_\_

**Designer Rep:** \_\_\_\_\_

**Contractor Rep:** \_\_\_\_\_

---

The Contractor recommends the following change to the project with associated changes to the Time of Completion and/or total project cost:

This change will:      ADD              SUBTRACT              NOT CHANGE              (circle as appropriate) the total project cost by \$\_\_\_\_\_.

The total change to the Time of Completion shall be an:      INCREASE      DECREASE  
(circle as appropriate) of \_\_\_\_\_ days.

A breakdown of the proposed work is attached. No work shall be commenced until authorized by the Owner. All work shall be in accordance with the terms, stipulations, and conditions of the Contract Documents.

**SIGNATURES:**

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Date

Designer's Action:    ☐ Recommend                      ☐ Do Not Recommend

☐ Recommend with the following changes

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Designer

\_\_\_\_\_  
Date

BRUNSWICK COUNTY  
PERIODIC PAYMENT TAX CERTIFICATION  
COUNTY SALES AND USE TAX

CONTRACTOR: \_\_\_\_\_

Page \_\_\_\_\_ of \_\_\_\_\_

PROJECT: \_\_\_\_\_

FOR PERIOD: \_\_\_\_\_

	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL ALL COUNTIES
CONTRACTOR							
SUBCONTRACTOR(S)*							
COUNTY TOTAL							

\* Attach subcontractor(s) report(s)

NOTE: Totals above must balance with Detail Sheet(s)

I certify that the above figures include only tax paid on supplies, materials, fixtures, and equipment that actually became a part of or annexed to the constructed facilities. I certify that, to the best of my knowledge, the information provided here is true, correct, and complete.

Sworn to and subscribed before me,

This the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_

\_\_\_\_\_  
Signed

\_\_\_\_\_  
Notary Public

My Commission Expires: \_\_\_\_\_

\_\_\_\_\_  
Print or Type Name of Above

Seal

NOTE:

This certified statement may be subject to audit

BRUNSWICK COUNTY  
PERIODIC PAYMENT ITEMIZED TAX STATEMENT  
COUNTY SALES AND USE TAX

CONTRACTOR: \_\_\_\_\_

Page \_\_\_\_\_ of \_\_\_\_\_

SUBCONTRACTOR \_\_\_\_\_

FOR PERIOD: \_\_\_\_\_

PROJECT: \_\_\_\_\_

PURCHASE DATE	VENDOR NAME	INVOICE NUMBER	TYPE OF PROPERTY	INVOICE TOTAL	TOTAL TAXABLE AMOUNT	COUNTY TAX PAID	COUNTY OF SALE *
				\$	\$	\$	
TOTAL:				\$	\$	\$	

\* If this is an out-of-state vendor, the County of Sale should be the county to which the merchandise was shipped.

**BRUNSWICK COUNTY  
FINAL TAX CERTIFICATION  
COUNTY SALES AND USE TAX**

CONTRACTOR: \_\_\_\_\_  
PROJECT: \_\_\_\_\_

Page \_\_\_\_\_ of \_\_\_\_\_

DATE: \_\_\_\_\_

PERIODIC PAYMENT NUMBER AND PERIOD END DATE	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL ALL COUNTIES
#							
#							
#							
#							
#							
#							
#							
#							
#							
#							
#							
#							
<b>COUNTY TOTAL</b>							

NOTE: Attach each Periodic Payment Tax Certification Sheet. (Totals above must balance with Periodic Payment Tax Certifications).

I certify that the above figures include only tax paid on supplies, materials, fixtures, and equipment that actually became a part of or annexed to the constructed facilities. I certify that, to the best of my knowledge, the information provided here is true, correct, and complete.

Sworn to and subscribed before me,

This the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_

\_\_\_\_\_  
Signed

\_\_\_\_\_  
Notary Public

My Commission Expires: \_\_\_\_\_  
Seal

\_\_\_\_\_  
Print or Type Name of Above

NOTE: This certified statement may be subject to audit

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**Minority Business Enterprise (MBE) Documentation for Contract Payments**  
**Brunswick County**

**Project Name:** \_\_\_\_\_ **Period: From** \_\_\_\_\_ **to** \_\_\_\_\_.  
(1<sup>st</sup> day of month to last day of month)

**Designer:** \_\_\_\_\_ **Contractor:** \_\_\_\_\_.

---

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

\*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Social and Economically Disadvantage (D)

Date: \_\_\_\_\_ Approved/Certified By: \_\_\_\_\_  
(Contractor) Name

\_\_\_\_\_ Title

\_\_\_\_\_ Signature

---

**CONTRACTOR TO SUBMIT WITH EACH REQUEST FOR PAYMENT & REQUEST FOR FINAL PAYMENT**

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***Certificate of Substantial Completion  
Brunswick County***

**Date:** \_\_\_\_\_ **Project Name:** \_\_\_\_\_.

**Designer:** \_\_\_\_\_ **Contractor:** \_\_\_\_\_.

---

**This Certificate of Substantial Completion Applies to:**

☐ All work under the Contract Documents: ☐ The following specific portions:


Date of Substantial Completion

The Work performed under this Contract has been reviewed and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby declared.

A list of items to be completed or corrected is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

**The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance, and warranties shall be provided in the Contract Documents except as amended as follows:**

☐ Amended Responsibilities ☐ Not Amended

Owner's Responsibilities:


Contractor's Responsibilities:


The following documents are attached to and made part of this certificate:


This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Engineer	Date
Contractor	Date
Owner	Date

## FORM OF PERFORMANCE BOND

Date of Contract: \_\_\_\_\_

Date of Execution: \_\_\_\_\_

Name of Principal:  
(Contractor) \_\_\_\_\_

Name of Surety: \_\_\_\_\_

Name of Contracting  
Body: \_\_\_\_\_

Amount of Bond: \_\_\_\_\_

Project: \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind, ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain Contract with the contracting body, identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said Contract during the original term of said Contract and any extensions thereof that may be granted by the contracting body, with or without notice to the surety, and during the life of any guaranty required under the Contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in \_\_\_\_\_ counterparts.

Witness:

\_\_\_\_\_  
(Proprietorship or Partnership)

Attest: (Corporation)

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Corp. Sec. or Asst. Sec. Only)

(Corporate Seal)

\_\_\_\_\_  
Contractor: (Trade or Corporate Name)

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Owner, Partner, or Corp.  
President or Vice President Only)

\_\_\_\_\_  
(Surety Company)

Witness:

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Attorney in Fact)

Countersigned:

(Surety Corporate Seal)

\_\_\_\_\_  
(N.C. Licensed Resident Agent)

\_\_\_\_\_  
(Name and Address-Surety Agency)

\_\_\_\_\_  
(Surety Company Name and N.C.  
Regional or Branch Office Address)



## FORM OF PAYMENT BOND

Date of Contract: \_\_\_\_\_

Date of Execution: \_\_\_\_\_

Name of Principal  
(Contractor) \_\_\_\_\_

Name of Surety: \_\_\_\_\_

Name of Contracting  
Body: \_\_\_\_\_

Amount of Bond: \_\_\_\_\_

Project: \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain Contract with the contracting body identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall promptly make payment to all persons supplying labor/material in the prosecution of the work provided for in said Contract, and any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in \_\_\_\_\_ counterparts.

Witness:

\_\_\_\_\_  
Contractor: (Trade or Corporate Name)

\_\_\_\_\_  
(Proprietorship or Partnership)

By: \_\_\_\_\_

Attest: (Corporation)

Title: \_\_\_\_\_  
(Owner, Partner, or Corp.  
Pres. or Vice Pres. only)

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Corp. Sec. or Asst. Sec. Only)

(Corporate Seal)

\_\_\_\_\_  
(Surety Company)

Witness:

By: \_\_\_\_\_

\_\_\_\_\_

Title: \_\_\_\_\_  
(Attorney in Fact)

Countersigned:

\_\_\_\_\_

(Surety Corporate Seal)

\_\_\_\_\_  
(N.C. Licensed Resident Agent)

\_\_\_\_\_

\_\_\_\_\_  
(Name and Address - Surety Agency)

\_\_\_\_\_

\_\_\_\_\_  
(Surety Company Name and N.C.  
Regional or Branch Office Address)

## CERTIFICATE OF INSURANCE (Workmen's Compensation and Liability)

This certificate of insurance neither affirmatively nor negatively amends, extends, or alters the coverage afforded by the policy(ies) listed on this certificate.

Project \_\_\_\_\_ Location \_\_\_\_\_

Owner Brunswick County Address P. O. Box 249; Bolivia, NC 28422  
Contractor (Insured) \_\_\_\_\_ Address \_\_\_\_\_

The undersigned hereby certifies that the following policies, subject to their terms, conditions, and exclusions have been issued by the named companies to the above insured and are presently in full force and effect:

**A. WORKMEN'S COMPENSATION:**

Policy No. \_\_\_\_\_ Expiration Date \_\_\_\_\_  
Insurance Co. \_\_\_\_\_ Address \_\_\_\_\_

COVERAGE: Statutory Workmen's Compensation. Employers Liability Limit \$ \_\_\_\_\_ Each Accident.

Locations Covered: \_\_\_\_\_

**B. COMPREHENSIVE GENERAL LIABILITY & PROPERTY DAMAGE:**

Policy No. \_\_\_\_\_ Expiration Date \_\_\_\_\_  
Insurance Co. \_\_\_\_\_ Address \_\_\_\_\_

**LIMITS:**

Bodily Injury, including Personal Injury.  
\$ \_\_\_\_\_ Each Person  
\$ \_\_\_\_\_ Each Occurrence  
\$ \_\_\_\_\_ Aggregate

Property Damage \$ \_\_\_\_\_ Each Occurrence  
\$ \_\_\_\_\_ Aggregate  
Other \_\_\_\_\_

**COVERAGE PROVIDED (Check Applicable Squares):**

	Yes	No	Property Damage Liability Includes:	Yes	No
Premises Operations	<input type="checkbox"/>	<input type="checkbox"/>	Damage Due to Blasting (explosion)	<input type="checkbox"/>	<input type="checkbox"/>
Subcontractor Operations	<input type="checkbox"/>	<input type="checkbox"/>	Damage Due to Collapse	<input type="checkbox"/>	<input type="checkbox"/>
Personal Injury	<input type="checkbox"/>	<input type="checkbox"/>	Damage to Underground Facilities	<input type="checkbox"/>	<input type="checkbox"/>
Completed Operations	<input type="checkbox"/>	<input type="checkbox"/>	Broad Form Property Damage:	<input type="checkbox"/>	<input type="checkbox"/>
Contractual Liability (Per Spec)	<input type="checkbox"/>	<input type="checkbox"/>	Operations of Contractor	<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	Contractual	<input type="checkbox"/>	<input type="checkbox"/>

**C. COMPREHENSIVE AUTOMOBILE LIABILITY & PROPERTY DAMAGE:**

Policy No. \_\_\_\_\_ Expiration Date \_\_\_\_\_  
Insurance Co. \_\_\_\_\_ Address \_\_\_\_\_

**LIMITS:**

Bodily Injury  
\$ \_\_\_\_\_ Each Person  
\$ \_\_\_\_\_ Each Occurrence  
\$ \_\_\_\_\_ Aggregate

Property Damage \$ \_\_\_\_\_ Each Occurrence  
Other \_\_\_\_\_

COVERAGE PROVIDED - for operation of all owned, non-owned, and hired vehicles.

**D. UMBRELLA EXCESS LIABILITY:**

Policy No. \_\_\_\_\_ Expiration Date \_\_\_\_\_  
Insurance Co. \_\_\_\_\_ Address \_\_\_\_\_

LIMITS: Single Limit Bodily Injury and Property Damage \$ \_\_\_\_\_ Each Occurrence.

COVERAGE PROVIDED - applies in excess of the coverages listed above for Employer's Liability, Comprehensive General, Automotive, and Property Damage Coverage.

The undersigned further certifies that in the event of cancellation or any material change in any of the above policies, thirty (30) days prior written notice of such cancellation or change shall be delivered by registered or certified mail to the above Owner.

**BRUNSWICK COUNTY, ITS OFFICERS, AGENTS AND EMPLOYEES ARE INCLUDED AS ADDITIONAL INSURED UNDER CONTRACTOR'S GENERAL LIABILITY INSURANCE**

Name of Agency \_\_\_\_\_ Address \_\_\_\_\_  
Date \_\_\_\_\_ By \_\_\_\_\_

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## BRUNSWICK COUNTY, NORTH CAROLINA



### GENERAL CONDITIONS OF THE CONTRACT Version date – May 2019

**This document is intended for use on Brunswick County capital construction projects and shall not be used on any project that is not reviewed and approved by Brunswick County. Extensive modification to the General Conditions by means of “Supplementary General Conditions” is strongly discouraged.**

The use or reproduction of this document or any part thereof is authorized for and limited to use on projects of Brunswick County, North Carolina, and is distributed by, through, and at the discretion of Brunswick County, for that distinct and sole purpose.

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## ARTICLE 1 – DEFINITIONS

**Addenda** shall mean written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the Contract Documents.

**Approval** means written or imprinted acknowledgement that materials, equipment, or methods of construction are acceptable for use in the Work.

**Asbestos** is any material that contains more than one percent (1%) asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

**Bid** shall mean the offer or proposal of a bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

**Bidding Documents** shall mean the Bidding Requirements and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

**Bidding Requirements** shall mean the Advertisement or Invitation to Bid, Instructions to Bidders, Bid security form, if any, MBE forms, and the Proposal form with any supplements.

**Bonds** shall mean performance and payment bonds and other instruments of security.

**Change Order**, as used herein, shall mean a written order to the Contractor subsequent to the signing of the Contract authorizing a change in the Contract (addition, deletion, or revision to Contract Price or Time of Completion). The Change Order shall be signed by the Contractor, Designer, and the Owner, and approved by the County Commissioners, in that order (see Article “Changes in the Work”).

**Claim** shall mean a demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Time of Completion, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

**Clarification or Request for Information (RFI)** is a request from the Contractor seeking an interpretation or clarification by the Designer relative to the Contract Documents. The RFI, which shall be labeled (RFI), shall clearly and concisely set forth the issue or item requiring clarification or interpretation and why the response is needed. The RFI must set forth the Contractor’s interpretation or understanding of the Contract Documents requirements in question, along with reasons for such an understanding.

**Contract**, as used herein, is the written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

**Contract Documents** consist of the Invitation to Bid; Notice to Bidders; Instructions to Bidders; General Conditions of the Contract; special conditions if applicable; Supplementary General Conditions; the Drawings and Specifications, including all bulletins, Addenda or other modifications of the Drawings and Specifications incorporated into the documents prior to their execution; the accepted proposal; the Contract; the performance bond; the payment bond; insurance certificates; MBE forms; power of attorney; Notice to Proceed; Written Directives; Work Change Directives; Change Orders; Certificates of Substantial Completion; Notice of Final Completion and Acceptance; and approval of County Commissioners. All of these items together form the Contract. Approved shop Drawings are **not** Contract Documents.

**Contract Price** shall mean the moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents.

**Contractor**, as used herein, shall be deemed to be either of the several contracting parties called the “Party of the First Part” in either of the several contracts in connection with the total Project. Where, in special instances hereinafter, a particular Contractor is intended, an adjective precedes the word “Contractor,” as “general,” “heating,” etc. For the purposes of a single prime contract, the term “Contractor” shall be deemed to be the single contracting entity identified as the “Party of the First Part” in the single Construction Contract. Any references or adjectives that name or infer multiple prime Contractors shall be interpreted to mean the single prime Contractor.

**Day** shall constitute a calendar day of twenty-four (24) hours measured from midnight to the next midnight.

**Defective**, when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or has been damaged prior to the Designer’s recommendation of final payment.

**Designer(s)** are those referred to within this Contract, or their authorized representatives. The Designer(s), as referred to herein, shall mean architect and/or Engineer or other professional. They will be referred to hereinafter as if each were of the singular number, masculine gender. In instances where the Owner performs functions typically done by the Designer, references to the Designer may also refer to the Owner.

**Drawings** shall mean that part of the Contract Documents prepared or approved by Designer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

**Effective Date of the Contract** shall mean the date indicated in the Contract on which it becomes effective, but if no such date is indicated, it means the date on which the Contract is signed and delivered by the last of the two parties to sign and deliver.

**“Equal to” or “Approved Equal” or “Or-Equal”** shall mean materials, products, equipment, assemblies, or installation methods considered equal by the Owner in all characteristics (physical, functional, and aesthetic) to those specified in the Contract Documents.

**Hazardous Environmental Condition** shall mean the presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

**Hazardous Waste** shall have the meaning provided in the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

**Inspection** shall mean examination or observation of Work completed or in progress to determine its compliance with the Contract Documents.



**Laws and Regulations; Laws or Regulations** shall mean any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

**Liens**, as used herein, shall mean charges, security interests, or encumbrances upon Project funds, real property, or personal property.

**Liquidated Damages**, as used herein, is an amount reasonably estimated in advance to cover the losses incurred by the Owner by reason of failure of the Contractor(s) to complete the Work within the time specified.

**Milestone**, as used herein, shall mean a principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

**Notice of Award** shall mean the Approval of the proposal by the Brunswick County Board of Commissioners at a public meeting or a signed "Notice of Award" form stating that upon timely compliance by the apparent successful bidder with the conditions precedent listed therein, Owner will execute the Contract.

**Notice to Proceed** shall mean a written notice given by Owner to Contractor fixing the date on which the time of completion will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

**Owner** shall mean Brunswick County or any entity or department thereof. Typically, references to Owner shall refer to the County department responsible for overseeing the Work. However, the context may indicate the specific entity of the County referred to. The "County Commissioners" refers to the specific board in its official duty that governs County affairs and, based on context, may also be synonymous with the term "Owner."

**Partial Utilization** is use by Owner of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

**PCBs** are polychlorinated biphenyls.

**Petroleum**, including crude oil or any fraction thereof, which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

**Project** is the total construction Work to be performed under the Contract Documents by the various contractors.

**Project Expediter**, as used herein, is an entity stated in the Contract Documents, designated to effectively facilitate scheduling and coordination of Work activities. See Articles "Construction Supervision" and "Schedule" for responsibilities of a Project Expediter. **For the purposes of a single prime contract, the single prime Contractor shall be designated as the Project Expediter.**

**Project Manual** shall mean the bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

**Radioactive Material** shall mean source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

**Request for Payment** shall mean the form acceptable to Designer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

**Routine Written Communications Between the Designer and the Contractor** are any communication other than a “request for information” provided in letter, memo, or transmittal format, sent by mail, courier, electronic mail, hand delivery, or facsimile. Written directives are included in this definition. Such communications cannot be identified as a “request for information.”

**Samples** are physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

**Shop Drawings** are all Drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

**Site** means lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

**Specifications** are that part of the Contract Documents consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

**Subcontractor**, as used herein, shall be understood to be one who has entered into a direct contract with a Contractor or another Subcontractor, and includes one who furnishes materials worked to a special design in accordance with plans and Specifications covered by the Contract, but does not include one who only sells or furnishes materials not requiring work so described or detailed.

**Substantial Completion** is the time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Designer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.

**“Substitution” or “Substitute”** shall mean materials, products, equipment, assemblies, or installation methods deviating in at least one characteristic (physical, functional, or aesthetic) from those specified or deviating from the specific manufacturers listed in the Technical Specifications when “Only” the specific manufacturer is indicated as being acceptable. Substitutions shall, in the opinion of the bidder, improve competition and/or enhance the finished installation.

**Supplementary Conditions** are that part of the Contract Documents which amend or supplement these General Conditions.

**Supplier** is a manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or any Subcontractor.

**Surety**, as used herein, shall mean the bonding company or corporate body which is bound with and for the Contractor, and which engages to be responsible for the Contractor and his acceptable performance of the Work.

**Time of Completion**, as stated in the Contract Documents, is to be interpreted as consecutive calendar days measured from the date established in the written Notice to Proceed, or such other date as may be established herein (Article "Time of Completion, Delays, Extension of Time").

**Underground Facilities** are all underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

**Unit Price Work** is Work to be paid for on the basis of unit prices.

**Work**, as used herein as a noun, is intended to be the completed construction including materials, labor, and workmanship of the appropriate Contractor as required by the Contract Documents.

**Work Change Directive**, as used herein, shall mean a written statement to Contractor issued on or after the Effective Date of the Contract and signed by Owner and recommended by Designer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Time of Completion but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Time of Completion.

**Written Notice or Written Directive** shall be defined as notice in writing delivered in person to the Contractor, or to a partner of the firm in the case of a partnership, or to a member of the contracting organization, or to an officer of the organization in the case of a corporation, or sent to the last known business address of the contracting organization.

## **ARTICLE 2 – TERMINOLOGY AND INTENT OF DOCUMENTS**

- A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. The intent of the Contract Documents is to establish the scope of all labor, materials, transportation, equipment, and any and all other things necessary to provide a complete job. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to the Owner.
- B. In case of discrepancy or disagreement in the Contract Documents, the order of precedence shall be: Form of Contract, Instructions to Bidders, Notice to Bidders,

Invitation to Bid, Instructions to Bidders, Supplementary General Conditions, Specifications, General Conditions, large-scale Drawings, small-scale Drawings.

- C. The wording of the Specifications shall be interpreted in accordance with common usage of the language except that words having a commonly used technical or trade meaning shall be so interpreted in preference to other meanings.

**D. Intent of Certain Terms or Adjectives**

Whenever in the Contract Documents the terms “as allowed,” “as approved,” or terms of like effect or import are used, or the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Designer as to the Work, it is intended that such action or determination will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to Designer any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of the Article “Designer’s Status” or any other provision of the Contract Documents.

**E. Furnish, Install, Perform, Provide**

1. “Furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
2. “Install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
3. “Perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
4. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied.

**ARTICLE 3 – EXECUTION OF DOCUMENTS**

The Contractor shall execute each copy of the proposal, Contract, performance bond and payment bond as follows:

- A. If the documents are executed by a sole owner, that fact shall be evidenced by the word “Owner” appearing after the name of the person executing them.
- B. If the documents are executed by a partnership, that fact shall be evidenced by the word “Co-Partner” appearing after the name of the partner executing them.

- C. If the documents are executed on the part of a limited liability company, they shall be executed by a Manager with authority to commit the company to the Contract and the title of the office of such person shall appear after their signature.
- D. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.
- E. If the documents are made by a joint venture, they shall be executed by each member of the joint venture in the above form for sole owner, partnership, company, or corporation, whichever form is applicable to each particular member.
- F. All signatures shall be properly witnessed.
- G. If the Contractor's license is held by a person other than an owner, partner or officer of a firm, then the licensee shall also sign and be a party to the Contract. The title "Licensee" shall appear under his/her signature.
- H. The bonds shall be executed by an attorney-in-fact. There shall be attached to each copy of the bond a certified copy of power of attorney properly executed and dated.
- I. Each copy of the bonds shall be countersigned by an authorized individual agent of the bonding company licensed to do business in North Carolina. The title "Licensed Resident Agent" shall appear after the signature.
- J. The seal of the bonding company shall be impressed on each signature page of the bonds.
- K. The Contractor's signature on the performance bond and the payment bond shall correspond with that on the Contract.

#### **ARTICLE 4 – REVIEW OF CONTRACT DOCUMENTS AND CLARIFICATIONS**

- A. **Contractor's Review of Contract Documents.** Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Designer any conflict, error, ambiguity, omission, or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from Designer before proceeding with any Work affected thereby; however, Contractor shall not be liable to Owner or Designer for failure to report any conflict, error, ambiguity, omission, or discrepancy in the Contract Documents unless Contractor knew or reasonably should have known thereof.
- B. In such cases where the nature of the Work requires clarification by the Designer, such clarification shall be furnished by the Designer with reasonable promptness by means of written instructions or detail Drawings, or both. Clarifications and Drawings shall be consistent with the intent of Contract Documents, and shall become a part thereof.

- C. The Contractor(s) and the Designer shall prepare, if deemed necessary, a schedule fixing dates upon which foreseeable clarifications will be required. The schedule will be subject to addition or change in accordance with progress of the Work. The Designer shall furnish Drawings or clarifications in accordance with that schedule. The Contractor shall not proceed with the Work without such detail Drawings and/or written clarifications.
- D. Where needed Specifications or details are omitted from the Contract Documents, the Contractor shall promptly report such omissions to the Designer and wait for clarification before proceeding with the Work. Brunswick County details and Specifications, latest versions, will be used to determine Work description, materials, construction methods, and method of measurement, unless directed otherwise by the Designer.

## **ARTICLE 5 – SITE DOCUMENTATION**

The Contractor is required to provide detailed video or photo documentation of Site conditions prior to mobilization. The extent of the Project Site shall be video/photo documented including, but not limited to: all access roads into and out of the Site, haul roads, existing utilities, staging and stockpile areas, culverts, bridges, drainage features, adjacent driveways, adjacent structures, existing facilities, stream and floodplains adjacent and immediately downstream of the Project area, and any other areas that might potentially be impacted by construction. Videos and photos shall have the dates and times taken digitally indicated.

## **ARTICLE 6 – REFERENCE TO STANDARDS, CODES, LAWS, AND REGULATIONS**

- A. Reference to standards, Specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
- B. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of Owner, Contractor, or Designer, or any of their Subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to Owner, Designer, or any of Designer's Consultants, agents, or employees any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.
- C. If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, Contractor shall report it to Designer in writing at once. Contractor shall not proceed with the Work affected thereby (except in an emergency) until an amendment or supplement to the Contract Documents has been issued.

- D. The Contractor shall give all notices and comply with all laws, ordinances, codes, encroachment agreements, rules and regulations bearing on the conduct of the Work under this Contract. Any necessary changes required after Contract award shall be made by Change Order in accordance with Article “Changes in the Work.” If the Contractor performs any Work knowing it to be contrary to such laws, ordinances, codes, encroachment agreements, rules and regulations, and without such notice to the Designer, he shall bear all cost arising therefrom. Additional requirements implemented after bidding will be subject to equitable negotiations.
- E. All Work under this Contract shall conform to the North Carolina State Building Code and other state, local and national codes as are applicable. The cost of all required inspections and permits shall be the responsibility of the Contractor.

#### **ARTICLE 7 – PERMITS**

Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening Bids, or, if there are no Bids, on the Effective Date of the Contract. Contractor shall pay all charges of utility owners for connections to the Work.

#### **ARTICLE 8 – COPIES OF DESIGN DRAWINGS AND SPECIFICATIONS**

The Designer shall furnish free of charge to the Contractors copies of plans and Specifications as follows:

- A. General Contractor and single-prime Contractor - Up to five (5) sets of general Contractor Drawings and Specifications. One of these sets shall be used by the Contractor to clearly and legibly record all work-in-place that is at variance with the Contract Documents.
- B. Each other Contractor - Up to five (5) sets of the appropriate Drawings and Specifications. One of these sets shall be used by the Contractor to clearly and legibly record all work-in-place that is at variance with the Contract Documents.
- C. Additional sets shall be furnished at cost, including mailing, to the Contractor upon request by the Contractor.

#### **ARTICLE 9 – APPROVING SUBSTITUTES AND “OR EQUAL” ITEMS**

- A. Products are generally specified by ASTM or other reference standard and/or by manufacturer’s name and model number or trade name. When specified only by reference standard, the Contractor may select any product meeting this standard, by any manufacturer. 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 general style, type, character, function, appearance, and quality required. Equivalent products are acceptable and bidders are not restricted to the specific brand, make, manufacturer or specific name unless the specification indicates that “only” the specific manufacturer is acceptable or the description contains words

reading that no like, equivalent, or substitution is permitted. Other items of material or equipment or material or equipment of other Suppliers may be submitted to Designer for review under the circumstances described below and as outlined in the Instructions to Bidders Article “Substitutions”.

1. **“Or-Equal” Items:** In cases where the technical specification indicate a specific brand, if in the Designer’s and Owner’s discretion an item of material or equipment proposed by 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 Designer as an “or-equal” item, in which case review and approval of the proposed item may, in Designer’s discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this paragraph a proposed item of material or equipment will be considered functionally equal to an item so named if:
  - a. in the exercise of reasonable judgment Designer determines that: (i) it is at least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;
  - b. Contractor certifies that: (i) there is no increase in cost to the Owner; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.

## 2. **Substitute Items**

- a. If in Designer’s and Owner’s discretion an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item under the paragraph above, it will be considered a proposed substitute item.
- b. Request for substitution of materials, items, or equipment shall be submitted to the Designer for approval or disapproval ten days prior to the opening of bids. Substitution submittals made after this point shall be reviewed at the discretion of the Designer.
- c. Contractor shall submit sufficient information as provided below and as stated in the Instructions to Bidders to allow Designer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Designer from anyone other than prime bidders.
- d. By making requests for substitutions, the Contractor:
  - i. Represents that he has personally investigated the proposed substitute product and determined that it is of equal or superior in all aspects to that specified;
  - ii. Represents that he will provide, at minimum, the same warranty for the substitute that he would for that specified.
  - iii. Certifies that the cost of data presented is complete and includes all related costs under this Contract but excludes costs under separate contracts, and



excludes the Designers redesign costs, and waives all claims for additional costs related to the substitution which subsequently becomes apparent; and

- iv. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

- B. **Preferred Brands:** In accordance with the provisions of NCGS 133-3 the Contract Documents may list one or more preferred brands to provide overall cost savings to the Owner and/or to maintain or improve the functioning of any process or system affected by the preferred item or items. The use of Preferred Brands on the Project is at the sole discretion of the Owner. In the event that the Contractor's proposal does not indicate an increased cost for the use of Preferred Brands, the Contractor shall use Preferred Brands on the Project, unless notified otherwise in writing by the Owner. The Owner's preference of Preferred Brands for specific items shall be stated in the Contract Documents, typically on an Approved Products List in the Supplementary General Conditions, the Proposal Form, or in the Technical Specifications. A bid alternate may be used on the Proposal Form to determine the cost difference between Preferred Brands and other products meeting the performance specification. Where there is a cost differential between a Preferred Brand item and the other equivalent item, the Contractor shall provide a listing of the equivalent item type, manufacturer, model, item number, and cost savings compared to using a Preferred Brand item. When Preferred Brands are indicated in the Contract Documents for specific items, but the Owner chooses not to require the use of Preferred Brands for a specific item, the Contractor is advised that any product submitted for use on the Project must still be approved in accordance with the section "Or-Equal Items".
- C. **Substitute Construction Methods or Procedures:** If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Designer. Contractor shall submit sufficient information to allow Designer, in Designer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents.
- D. **Designer's Evaluation:** Designer will be allowed a reasonable time within which to evaluate each proposal or submittal. Designer will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed, or utilized until Designer's review is complete, which will be evidenced by either a Directive for a substitute or an approved Shop Drawing for an "or-equal." Designer will advise Contractor in writing of any negative determination.
- E. **Special Guarantee:** Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other Surety with respect to any substitute.
- F. **Contractor's Expense:** Contractor shall provide all data, including any required engineering, in support of any proposed substitute or "or-equal" at Contractor's expense.

## **ARTICLE 10 – SHOP DRAWINGS, SUBMITTALS, SAMPLES, DATA**

- A. Within ten (10) consecutive calendar days after the Notice to Proceed, each prime Contractor shall submit a schedule for anticipated submittal of all Shop Drawings, Product Data, Samples, and similar submittals to the Project Expediter and the Designer. This schedule shall indicate the items, relevant specification sections, other related submittal, data, and the date when these items will be furnished to the Designer.
- B. The Contractor shall review, approve and submit to the Designer all Shop or Setting Drawings, Product Data, Samples, Color Charts, and similar submittal data required or reasonably implied by the Contract Documents. Shop Drawing submittals shall be made using the “Contractor Submittal” form and shall be made in accordance with the Project schedule. Required Submittals shall bear the Contractor’s stamp of approval and any exceptions to the Contract Documents shall be noted on the submittals. A minimum of three (3) copies of each submittal shall be submitted to the Designer to retain and the Contractor shall supply, at the request of the Designer, additional copies as needed. Submittals shall be presented to the Designer with reasonable promptness and time so as to cause no delay in the activities of the Owner or of separate Contractors.
- C. Shop Drawing submittals shall be complete with respect to quantities, dimensions, Drawings, specified performance, design criteria, and materials and shall be detailed sufficiently to enable the Designer to determine compliance with the Contract Documents.
- D. The Designer shall review required submittals promptly, noting desired corrections if any, and returning a copy of the annotated Shop Drawings to the Contractor no later than twenty (20) days from the date of receipt by the Designer. When resubmittals are required, the submittal procedure shall be the same as for the original submittals. The Contractor shall not be entitled to any Time of Completion extension for review and approval of Shop Drawings by the Designer.
- E. Approval of Shop Drawings by the Designer shall not be construed as relieving the Contractor from responsibility for compliance with the design or terms of the Contract Documents nor from responsibility of errors of any sort in the Shop Drawings, unless such lack of compliance or errors first have been called in writing to the attention of the Designer by the Contractor.
- F. The Owner may assess the Contractor the cost of Shop Drawing review for Shop Drawing submittals in excess of three (3) for any one item.

## **ARTICLE 11 – REFERENCE POINTS AND CONSTRUCTION SURVEYING**

- A. Engineering surveys shall be provided to establish reference points for construction which in Designer’s judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without prior written approval. Contractor shall report to Designer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by a registered professional surveyor.

- B. The Contractor shall be responsible for all of the field horizontal layout and vertical control of the facilities. Construction Surveying shall include, but not be limited to, furnishing personnel, all surveying equipment, stakes, layout drawings, calculations, stakeout records, all materials necessary to perform the surveying work, staking clearing limits, staking centerlines, miscellaneous staking necessary for construction, locating reference points and benchmarks, and any other survey incidental to construction. Unless directed otherwise by the Designer, Survey personnel shall be under the direct supervision of a North Carolina Registered Professional Land Surveyor in conformance with NCGS 89C. Benchmarks and reference points shall be indicated by a metal monument cap set on a minimum 36" long #5 reinforcing bar with an adjacent carsonite witness stake and shall be permanently preserved.
- C. Upon completion of the stakeout and prior to beginning construction, the Contractor shall give the Designer a 48-hour notice in order to inspect the construction staking. The Designer's review of the Contractor's work in no way relieves the Contractor of responsibility for conformance with the Contract Documents. Failure by the Designer to point out unsatisfactory Work, from lack of discovery or for any other reason, in no way prevents later rejection or corrections to the unsatisfactory Work, when discovered, at no cost to the Owner. No claims will be allowed for losses suffered due to any necessary removal or repairs resulting from the unsatisfactory Work. When requested by the Designer, the accuracy of the stakeout will be checked by the Contractor.
- D. When surveying is required that could not have been reasonably anticipated, the Contractor shall notify the Designer in writing prior to beginning such Work and will proceed according to the General Conditions of the Contract for "Claims for Extra Cost."

## **ARTICLE 12 – RECORD DRAWINGS AND SPECIFICATIONS AT THE JOB SITE**

The Contractor shall maintain, in readable and secure condition at his job office, one complete set of the Contract Documents including record Drawings, Specifications, Addenda, Change Orders, Written Directives, Work Change Directives, and written interpretations and clarifications. Additionally, a copy of all Shop Drawings and the Project Manual shall be maintained at the job office. These materials shall be annotated to show changes made during construction. The Contractor shall maintain at the job office, a day-to-day record of work-in-place that is at variance with the Contract Documents. Such materials shall be made available for use by the Owner, Designer, or his authorized representative and shall be submitted to the Owner upon Project completion and prior to final payment.

## **ARTICLE 13 – AS-BUILT DRAWINGS**

Unless otherwise indicated in the Supplementary General Conditions, the Contractor is responsible for furnishing certified "As-Built" Drawings in the form of signed and sealed (professional surveyor or professional engineer) plans per the North Carolina Board of Engineers and Surveyors guidelines. Electronic copies (Acrobat PDF file format and either MicroStation or Autocad format) and two (2) sets of photographic mylars or vellums shall be furnished to the Owner prior to final payment. As-built Drawings shall verify or adjust elevations, dimensions, locations, and materials incorporated into the completed Work.

## **ARTICLE 14 – OWNERSHIP OF WORK PRODUCT**

All Drawings and Specifications (including electronic media) are instruments of service and remain the property of the Owner. The use of these instruments on Work other than this Contract without permission of the Owner is prohibited. Contractor and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with Owner: (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Designer or Designer's Consultant, including electronic media editions; and (ii) shall not reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other Project without written consent of Owner. This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes or for furnishing as-built Drawings. Any other documents generated by Contractor's performance hereunder shall become the property of Owner and may be used by Owner for this Project or future projects without additional compensation to Contractor. Owner acknowledges that its use of such documents on projects other than the Project covered by this Contract shall be at its own risk.

## **ARTICLE 15 – MATERIALS, EQUIPMENT, EMPLOYEES**

- A. The Contractor shall, unless otherwise specified, supply and pay for all labor, transportation, materials, tools, apparatus, lights, power, heat, sanitary facilities, water, scaffolding and incidentals necessary for the completion of his Work, and shall install, maintain and remove all equipment of the construction, other utensils or things, and be responsible for the safe, proper and lawful construction, maintenance and use of same, and shall construct in the best and most workmanlike manner, a complete job and everything incidental thereto, as shown on the plans, stated in the Specifications, or reasonably implied therefrom, all in accordance with the Contract Documents.
- B. All materials shall be new and of quality specified, except where reclaimed material is authorized herein and approved for use. Workmanship shall at all times be of a grade accepted as the best practice of the particular trade involved, and as stipulated in written standards of recognized organizations or institutes of the respective trades except as exceeded or qualified by the Specifications.
- C. Upon notice, the Contractor shall furnish evidence as to quality of materials.
- D. Each Contractor shall obtain written approval from the Designer for the use of products, materials, equipment, assemblies or installation methods claimed as equal to those specified. Such approvals must be obtained as soon after Contract awards as possible and before any materials are ordered. Applications for approvals shall be made by the Contractor and not by Subcontractors or material Suppliers within thirty (30) days following award of Contract. When the submittal schedule provided under Article "Shop Drawings, Submittals, Samples, Data" Paragraph (A) is approved, no further substitutions will be permitted except in unusual or extenuating circumstances. If no list is submitted, the Contractor shall supply materials specified.
- E. The Designer is the judge of equality for proposed substitution of products, materials or equipment.

- F. If at any time during the construction and completion of the Work covered by these Contract Documents, the conduct of any workman of the various crafts be adjudged a nuisance to the Owner or Designer, or if any workman be considered detrimental to the Work, the Contractor shall order such parties removed immediately from grounds.

#### **ARTICLE 16 – EQUAL OPPORTUNITY CLAUSE**

The non-discrimination clause contained in Section 202 (Federal) Executive Order 11246, as amended by Executive Order 11375, relative to equal employment opportunity for all persons without regard to race, color, religion, sex, sexual orientation, gender identity or national origin, and the implementing rules and regulations prescribed by the Secretary of Labor, are incorporated herein. Contractor shall not discriminate against any employee or applicant for employment based on the foregoing or based on age, religion, disability, ancestry, citizenship, genetic information, political affiliation or military/veteran status or any other status protected by Laws or Regulations. Contractor shall take affirmative action to ensure that applicants are employed and that employees are treated fairly during employment. In the event Contractor is determined by the final order of an appropriate agency or court of competent jurisdiction to be in violation of any non-discrimination provision of any Laws or Regulations, the Contractor may be declared ineligible for future business opportunities with Owner.

#### **ARTICLE 17 – EMPLOYMENT OF THE HANDICAPPED**

The Contractor(s) agree not to discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices.

#### **ARTICLE 18 – ROYALTIES, LICENSES, AND INTELLECTUAL PROPERTY**

It is the intention of the Contract Documents that the Work covered herein will not constitute in any way infringement of any intellectual property right.. In addition to the indemnity provisions set forth herein, the Contractor shall protect and save harmless the Owner against suit on account of alleged or actual infringement. The Contractor shall pay all royalties and/or license fees required on account of any material protected by intellectual property laws, whether such rights are evidenced hereinafter.

#### **ARTICLE 19 – USE OF PREMISES**

- A. **Owner shall furnish the Site.** Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities.
- B. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

- C. The Contractor(s) shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the Designer and shall not exceed those established limits in his operations.
- D. The Contractor(s) shall not load or permit any part of any structure or property to be loaded with a weight that will endanger its safety or that of subsurface facilities.
- E. The Contractor(s) shall enforce the all instructions regarding signs, advertisements, fires and smoking.
- F. No firearms, any type of alcoholic beverages, or drugs (other than those prescribed by a physician) will be permitted at the Site.

## **ARTICLE 20 – SUBSURFACE AND PHYSICAL CONDITIONS**

- A. The Project Manual may contain reports, explorations, tests, or Drawings of subsurface conditions and subsurface structures at or contiguous to the Site. Contractor may rely upon the general accuracy of the “technical data” contained in such reports and Drawings, but such reports and Drawings are not Contract Documents. Such “technical data” is identified in the Project Manual. Except for such reliance on such “technical data,” Contractor may not rely upon or make any Claim against Owner, Designer, or any Designer’s Consultants with respect to:
  - 1. The completeness of such reports and Drawings for Contractor’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
  - 2. Other data, interpretations, opinions, and information contained in such reports or shown or indicated in such Drawings; or
  - 3. Any Contractor interpretation of or conclusion drawn from any “technical data” or any such other data, interpretations, opinions, or information.
- B. **Differing Subsurface or Physical Conditions**
  - 1. **Notice:** If Contractor believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:
    - a. is of such a nature as to establish that any “technical data” on which Contractor is entitled to rely as indicated above is materially inaccurate; or
    - b. is of such a nature as to require a change in the Contract Documents; or
    - c. differs materially from that shown or indicated in the Contract Documents; or
    - d. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency), notify Owner and Designer in writing about such condition.

Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

- C. **Designer's Review:** After receipt of written notice as required by above, Designer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Designer's findings and conclusions.

D. **Possible Price and Times Adjustments**

1. The Contract Price or the Time of Completion, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
  - a. such condition must meet any one or more of the categories described above under "Differing Subsurface or Physical Conditions" and
  - b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of Unit Price Work.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Time of Completion if:
  - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner in respect of Contract Price and Time of Completion by the submission of a Bid or becoming bound under a negotiated contract; or
  - b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or
  - c. Contractor failed to give the written notice within the time and as required by the section "Differing Subsurface of Physical Conditions."
3. **NOTE ON TRENCHLESS EXCAVATION** (Horizontal Directional Drill, Bore & Jack, etc.) – Encountering rock or other hardened material during the installation of pipe by trenchless excavation methods shall not be considered a "Differing Subsurface Condition or Physical Condition" and no adjustment to the Contract Price or Time of Completion shall be approved. The Contractor is hereby notified that rock and other hardened material is routinely encountered in and around Brunswick County, NC. Per the "Instructions To Bidders", the Contractor is required to satisfy himself as to the nature of subsurface conditions and the Owner recommends that the Contractor perform subsurface investigation prior to submitting a bid.
4. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Time of Completion, or both, a Claim may be made therefor as provided elsewhere in the General Conditions. However, Owner, Designer, and Designer's Consultants shall not be

liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) sustained by Contractor on or in connection with any other Project or anticipated Project.

## **ARTICLE 21 – UNDERGROUND FACILITIES**

**A. Shown or Indicated:** The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Designer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary General Conditions:

1. Owner and Designer shall not be responsible for the accuracy or completeness of any such information or data; and
2. The cost of all the following will be included in the Contract Price, and Contractor shall have full responsibility for:
  - a. reviewing and checking all such information and data,
  - b. locating all Underground Facilities shown or indicated in the Contract Documents and maintaining all utility markings (paintings, stakes, etc.) until the Owner provides written acceptance of the Project.
  - c. coordination of the Work with the owners of such Underground Facilities, including Owner, prior to and during construction, and
  - d. the safety and protection of Underground Facilities and repairing any damage resulting from the Work inclusive of required relocations, and
  - e. the Contractor will be responsible for coordinating and obtaining approval for utility interruptions caused by the Work and for all costs associated with the repair and disruption of any underground utility facility.

### **B. Not Shown or Indicated**

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency) identify the owner of such Underground Facility and give written notice to that owner and to Owner and Designer. Designer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
2. If Designer concludes that a change in the Contract Documents is required, a Work Change Directive or Written Directive, as applicable, will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Time of Completion, or both, to the extent that they are



attributable to the existence or location of any Underground Facility that was not shown or indicated in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Time of Completion, Owner or Contractor may make a Claim therefore as provided elsewhere in the General Conditions.

## **ARTICLE 22 – CUTTING, PATCHING, AND DIGGING**

- A. The Contractor shall do all cutting, fitting or patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by work of other contractors shown upon or reasonably implied by the Drawings and Specifications for the completed structure, as the Designer may direct.
- B. Any cost brought about by defective or ill-timed Work shall be borne by the party responsible therefore.
- C. No Contractor shall endanger any Work of another Contractor by cutting, digging or other means. No Contractor shall cut or alter the Work of any other Contractor without the consent of the Designer and the affected Contractor(s).

## **ARTICLE 23 – UTILITIES, STRUCTURES, SIGNS**

- A. The Project Expediter shall provide necessary and adequate facilities for water, electricity, gas, oil, sewer, and other utility services, which may be necessary and required for completion of the Project. Any permanent meters installed shall be listed in the Project Expediter's name until his Work is fully accepted by the Owner. As stipulated in the Supplementary General Conditions, the Owner may: (1) pay utilities cost directly, (2) have the Project Expediter to pay all utilities cost, (3) or reimburse the Project Expediter for the actual cost of utilities. The Owner or Project Expediter, as applicable, may recover actual costs of metered utilities from the responsible party should delays occur in Project completion.
- B. Meters shall be relisted in the Owner's name on the day following completion and acceptance of the Project Expediter's work, and the Owner shall pay for services used after that date.
- C. The Owner shall be reimbursed for all metered utility charges after the meter is relisted in the Owner's name and prior to completion and acceptance of the Work of **all** contractors. Reimbursement shall be made by the Contractor whose work has not been completed and accepted. If the Work of two or more Contractors has not been completed and accepted, reimbursement to the Owner shall be paid by the Contractors involved on the basis of assessments by the Designer.
- D. Prior to the operation of permanent systems, the Project Expediter will provide temporary power, lighting, water, and heat to maintain space temperature above freezing, as required for construction operations.
- E. All Contractors shall have any permanent building systems in sufficient readiness for furnishing temporary climatic control at the time a building is enclosed and secured. The HVAC systems shall maintain climatic control throughout the enclosed portion

of the building sufficient to allow completion of the interior finishes of buildings. A building shall be considered enclosed and secured when windows, doorways (exterior, mechanical, and electrical equipment rooms), and hardware are installed; and other openings have protection which will provide reasonable climatic control. The appropriate time to start the mechanical systems and climatic condition shall be jointly determined by the Contractor(s) and the Designer. Use of the equipment in this manner shall in no way affect the warranty requirements of the Contractor(s).

- F. The Electrical Contractor shall have any building's permanent power wiring distribution system in sufficient readiness to provide power as required by the HVAC Contractor for temporary climatic control.
- G. The Electrical Contractor shall have any building's permanent lighting system ready at the time the general Contractor begins interior painting and shall provide adequate lighting in those areas where interior painting and finishing is being performed.
- H. Each prime Contractor shall be responsible for his permanently fixed service facilities and systems in use during progress of the Work. The following procedures shall be strictly adhered to:
  - 1. Prior to acceptance of Work by the Owner, each Contractor shall remove and replace any parts of the permanent building systems damaged through use during construction.
  - 2. Temporary filters shall be installed in each of the heating and air conditioning units and at each return grille during construction. New filters shall be installed in each unit prior to the Owner's acceptance of the Work.
  - 3. Extra effort shall be maintained to keep the building and the site adjacent to the building clean and under no circumstances shall air systems be operated if finishing and Site Work operations are creating dust in excess of what would be considered normal if the building were occupied.
  - 4. It shall be understood that any warranty on equipment presented to the Owner shall extend from the day of final acceptance by the Owner. The cost of warranting the equipment during operation in the finishing stages of construction shall be borne by the Contractor whose system is utilized.
  - 5. The Electrical Contractor shall have all lamps in proper working condition at the time of final Project acceptance.
- I. The Project Expediter shall provide, if required and where directed, a shed for toilet facilities and shall furnish and install in this shed all water closets required for a complete and adequate sanitary arrangement. These facilities will be available to other contractors on the job and shall be kept in a neat and sanitary condition at all times. Chemical toilets are acceptable.
- J. The Project Expediter shall, if required by the Supplementary General Conditions and where directed, erect a temporary field office, complete with lights, telephone, heat and air conditioning. A portion of this office shall be partitioned off, of sufficient size, for the use of a resident inspector, unless otherwise directed by the Designer.
- K. On multi-story construction projects, the Project Expediter shall provide temporary elevators, lifts, or other special equipment for the general use of all contractors. The

cost for such elevators, lifts or other special equipment and the operation thereof shall be included in the Project Expediter's bid.

- L. The Project Expediter will erect one sign on the Project, unless otherwise directed by the Designer. The sign shall be of sound construction neatly lettered with black letters on white background in accordance with Brunswick County standard details. The sign shall bear the name of the Project, and the names of prime Contractors on the Project, and the name of the Designer and consultants. Directional signs may be erected on the Owner's property subject to approval of the Owner with respect to size, style, and location of such directional signs. Such signs may bear the name of the Contractor and a directional symbol. No other signs will be permitted except by permission of the Owner.

## **ARTICLE 24 – HAZARDOUS ENVIRONMENTAL CONDITIONS**

- A. The Project Manual may contain reports, explorations, tests, or Drawings of known Hazardous Environmental Conditions at or contiguous to the Site. Contractor may rely upon the general accuracy of the "technical data" contained in such reports and Drawings, but such reports and Drawings are not Contract Documents. Such "technical data" is identified in the Project Manual. Except for such reliance on such "technical data," Contractor may not rely upon or make any Claim against Owner, Designer, or any Designer's Consultants with respect to:
  - 1. the completeness of such reports and Drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
  - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such Drawings; or
  - 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.
- B. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.
- C. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify Owner and Designer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Designer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any.
- D. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered to Contractor written notice: (i) specifying that such condition

and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Time of Completion, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim as provided elsewhere in the General Conditions.

- E. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Time of Completion as a result of deleting such portion of the Work, then either party may make a Claim as provided elsewhere in the General Conditions. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article "Owners Right to Do Work."
- F. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, Designer, Designer's Consultants, and the officers, directors, partners, employees, agents, other consultants, and Subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this paragraph shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- G. The Owner has attempted to address all asbestos-containing materials that are to be disturbed in the Project. However, there may be other asbestos-containing materials in the Work areas that are not to be disturbed and do not create an exposure hazard. Contractors are reminded of the requirements of instructions under Instructions to Bidders and General Conditions of the Contract, titled Examination of Conditions. Statute 130A, amended August 3, 1989, established the Asbestos Hazard Management Program that controls asbestos abatement in North Carolina. The latest edition of *Guideline Criteria for Asbestos Abatement* available from the NC State Construction Office is to be incorporated in all asbestos abatement projects for the Capital Improvement Program.

## **ARTICLE 25 – PROTECTION OF WORK AND PROPERTY**

- A. The Contractors shall be jointly responsible for the entire Site and the building or construction of the same and provide all the necessary protections, as required by the Owner or Designer, and by Laws or Regulations governing such conditions. They shall be responsible for any damage to the Owner's property, or of that of others on the job, by them, their personnel, or their Subcontractors, and shall make good such damages. They shall be responsible for and pay for any damages caused to the Owner. All Contractors shall have access to the Project at all times.
- B. The Contractor shall provide cover and protect all portions of the structure when the Work is not in progress, provide and set all temporary roofs, covers for doorways,

sash and windows, and all other materials necessary to protect all the Work on the building, whether set by him, or any of the Subcontractors. Any Work damaged through the lack of proper protection or from any other cause, shall be repaired or replaced without extra cost to the Owner.

- C. No fires of any kind will be allowed inside or around the operations during the course of construction without special permission from the Designer and Owner.
- D. The Contractor shall protect all trees and shrubs designated to remain in the vicinity of the operations by building substantial boxes around same. All ornamental trees and landscaping shall be protected, whether such protection is indicated or not within the Contract Documents. If ornamental trees and landscaping plantings are in the way of construction, the Contractor shall remove, maintain, and reinstall at locations designated by the Designer. Any ornamental trees and landscaping plantings damaged or that die within the warranty period shall be replaced by the Contractor at the Contractor's expense. Where equipment must cross walks, landscaping areas, or ramps, the Contractor shall provide steel plates or minimum 3/4" plywood sheets for protection of these areas.
- E. The Contractor shall barricade all walks, roads, etc., and any areas directed by the Designer to keep the public away from the construction. All trenches, excavations or other hazards in the vicinity of the Work shall be well barricaded and properly lighted at night.
- F. In the event of emergency affecting the safety of life, the protection of Work, or the safety of adjoining properties, the Contractor is hereby authorized and is obligated to act at his own discretion, without further authorization from anyone, to prevent such threatened injury or damage. Any compensation claimed by the Contractor on account of such action shall be determined as provided for under Article "Changes in the Work," Paragraph (B).

## ARTICLE 26 – SAFETY

- A. The Contractor shall be solely responsible for initiating, maintaining, providing, and supervising all necessary safety precautions, safety programs, and safety measures for the protection of all persons on the job, including the requirements of the A.G.C. *Accident Prevention Manual in Construction*, as amended, and shall fully comply with all state Laws or Regulations and North Carolina State Building Code requirements to prevent accident or injury to persons on or about the location of the Work. He shall clearly mark or post signs warning of hazards existing, and shall barricade excavations, elevator shafts, stairwells and similar hazards. He shall protect against damage or injury resulting from falling materials and he shall maintain all protective devices and signs throughout the progress of the Work.
- B. The Contractor shall adhere to the rules, regulations and interpretations of the North Carolina Department of Labor relating to Occupational Safety and Health Standards for the Construction Industry (Title 29, Code of Federal Regulations, Part 1926, published in Volume 39, Number 122, Part II, June 24, 1974, *Federal Register*), and revisions thereto as adopted by General Statutes of North Carolina 95-126 through 155.

- C. The Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.
- D. The Contractor shall designate a qualified and experienced member of his organization as safety inspector, whose duties shall include accident prevention on the Work Project. The name of the safety inspector shall be made known to the Designer at the time the Work is started.

## **ARTICLE 27 – TRAFFIC CONTROL**

- A. The Contractor will be required to maintain traffic within the limits of the Project, including all existing roadways that cross or intersect the Project. To the extent dependent on the Contractor, the Contractor shall be responsible for maintaining in a safe, passable, and convenient condition all roads used by him during construction of the Project. Traffic shall be maintained from the time the Contractor begins Work on the Project Site until acceptance of the Project, including any periods during which the Contractor's operations are suspended. The Contractor shall conduct his Work in a safe manner that will create a minimum amount of inconvenience to traffic.
- B. The Contractor shall be responsible for determining, utilizing, and maintaining traffic control measures as outlined in the *Manual on Uniform Traffic Control Devices (MUTCD)*, latest version. Unless otherwise directed by the Designer, the Contractor is required to have an English copy of the *Manual on Uniform Traffic Control Devices (MUTCD)*, latest version, on the Project Site.
- C. During the progress of any Work within road rights-of-way, mark all hazards with well-maintained signs, barricades, drums, or other warning or channelizing devices. At each location where Work is started which creates a safety hazard, continue the Work until completed to the extent that the safety hazard is eliminated. If the Work is not completed in a continuous manner to the extent that the safety hazard is eliminated, the Designer will not allow any other Work on the Project to be performed until the existing safety hazard is eliminated. During the process of excavating in a travelway or in the clear zone of a travelway where traffic is to be later maintained, make provisions to backfill and repair any excavated or damaged pavement before allowing traffic to proceed over the affected lanes. If not otherwise specified, the clear zone is the immediate area within 30" of the outside edge of lane. In low speed areas (35 MPH or less) metal plates may be used to cover excavated areas. Continuous, safe vehicular access shall be maintained to all residences, businesses, schools, police stations, fire stations, hydrants, other emergency services, hospitals, and mailboxes. Operations shall be conducted in a manner that limits inconvenience to property owners. When Work is not in progress, keep all personnel, equipment, machinery, tools, construction debris and supplies at least 40 feet away from active travel lanes. Personal vehicles shall not be parked adjacent to travelways in road rights-of-way.
- D. During lane closures, all equipment and personnel shall operate within the designated Work area. Traffic control devices for lane closures shall be installed with the traffic flow, beginning with devices on the upstream side of traffic. Traffic control devices for lane closures shall be removed against the traffic flow, beginning with devices on the downstream side of traffic.

**ARTICLE 28 – SEDIMENTATION POLLUTION CONTROL ACT OF 1973**

- A. Any land-disturbing activity performed by the Contractor(s) in connection with the Project shall comply with all erosion control measures set forth in the Contract Documents and any additional measures which may be required in order to ensure that the Project is in full compliance with the Sedimentation Pollution Control Act of 1973, as implemented by Title 15, North Carolina Administrative Code, Chapter 4, Sedimentation Control, Subchapters 4A, 4B and 4C, as amended (15 N.C.A.C. 4A, 4B and 4C). The Owner makes no representation as to the type and intensity of rainfall or storms that shall occur during the life of the Project. Southeastern North Carolina is in an area susceptible to hurricanes, severe rainfall, and storm events; these events are not uncommon to the area. No additional compensation shall be made for compliance with the Sedimentation Pollution Control Act of 1973 and NCDENR permits due to severe rainfall and storm events.
- B. Upon receipt of notice that a land-disturbing activity is in violation of said act, the Contractor(s) shall be responsible for ensuring that all steps or actions necessary to bring the Project in compliance with said act are promptly taken.
- C. The Contractor(s) shall be responsible for defending any legal actions instituted pursuant to NCGS 113A-64 against any party or persons described in this article.
- D. To the fullest extent permitted by law and without limiting any other indemnity obligation set forth herein, the Contractor(s) shall indemnify and hold harmless the Owner, the Designer and the agents, consultants and employees of the Owner and Designer, from and against all claims, damages, civil penalties, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance of Work or failure of performance of Work, provided that any such claim, damage, civil penalty, loss or expense is attributable to a violation of the Sedimentation Pollution Control Act. Such obligation shall not be construed to negate, abridge or otherwise reduced any other right or obligation of indemnity which would otherwise exist as to any party or persons described in this article. Any claim, damage, civil penalty, loss or expense levied on or incurred by the Owner may be paid in a timely manner by the Owner and deducted from the monies owed to the Contractor(s).
- E. The Contractor shall comply with the following requirements:
  - 1. Equipment utilized during the construction activity on a Site must be operated and maintained in such a manner as to prevent the potential or actual pollution of the surface or ground waters of the state. Fuels, lubricants, coolants, and hydraulic fluids, or any other petroleum products, shall not be discharged on to the ground or into surface waters. Spent fluids shall be disposed of in a manner so as not to enter the waters, surface or ground, of the state and in accordance with applicable state and federal disposal regulations. Any spilled fluids shall be cleaned up to the extent practicable and disposed of in a manner so as not to allow their entry into the waters, surface of ground, of the state.
  - 2. Herbicide, pesticide, and fertilizer usage during the construction activity shall be restricted to those materials approved by EPA and shall be in accordance with label restrictions.

3. All wastes composed of building materials shall be disposed of in accordance with North Carolina General Statutes, Chapter 130A, Article 9 - Solid Waste Management, and rules governing the disposal of solid waste (North Carolina Administrative Code Section 15A NCAC 13B).
4. All sedimentation and erosion control of facilities shall be inspected by the Contractor at least once every seven (7) calendar days and within twenty-four (24) hours after any storm event of greater than 0.1 inches of rain per twenty-four (24)-hour period or any day that has been claimed by the Contractor as a rain delay.
5. The Contractor shall submit to the Owner a written report of weekly inspections. Visible sedimentation found off the Site shall be recorded with a brief explanation as to the measures taken to prevent future releases as well as any measures taken to clean up the sediment that has left the Site. This record shall be made available to DENR or authorized agent upon request.
6. The Contractor shall be fully responsible for growing and maintaining a vegetative cover on all areas of the Site in accordance with DENR Land Quality requirements.

## **ARTICLE 29 – INSPECTION OF THE WORK**

- A. It is a condition of this Contract that the Work shall be subject to inspection by the Designer, Owner, designated official representatives of the Owner, and those persons required by state law to test special work for official approval. The Contractor shall therefore provide safe access to the Work at all times for such inspections.
- B. All instructions to the Contractor will be made only by or through the Designer, Owner, or the Designer or Owner's designated Project representative. Observations made by official representatives of the Owner shall be conveyed to the Designer for review and coordination when the Designer is acting as the construction administrator/inspector.
- C. Should any Work be covered up or concealed prior to inspection and approval by the Designer, such Work shall be uncovered or exposed for inspection, if so requested by the Designer in writing. Inspection of the Work will be made promptly upon notice from the Contractor. All cost involved in uncovering, repairing, replacing, recovering and restoring to design condition the Work that has been covered or concealed will be paid by the Contractor involved.
- D. Prompt notice of all defective Work of which Owner or Designer has actual knowledge shall be given to the Contractor.
- E. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any Surety for, or employee or agent of any of them.



- F. The presence of the Designer, Owner, or Inspector at the Work Site shall in no way lessen the Contractor's responsibility for conformity with the Contract Documents. Should the Designer, Owner, or Inspector, prior to or during construction, fail to point out or reject materials or Work that does not conform with plans and Specifications, whether from lack of discovery or from any other reason, it shall in no way prevent later rejection or correction to the unsatisfactory materials or Work when discovered. The Contractor shall have no claim for losses suffered due to any necessary removals or repairs resulting from the unsatisfactory Work.
- G. The Contractor shall notify the Inspector a minimum of twenty-four (24) hours in advance of the Contractor's intent not to work any given day, or in the event of weather conditions prohibiting execution of the Work, by 9:00 a.m. the day of the abnormal weather.

### **ARTICLE 30 – TESTING**

- A. Where special inspection or testing is required by virtue of any state laws, instructions of the Designer, Specifications or codes, the Contractor shall give written notice a minimum of forty-eight (48) hours in advance to the designated official representatives of the Owner, of the time set for such inspection or test. Such special tests or inspections will be made in the presence of the official representatives of the Owner, and it shall be the Contractor's responsibility to serve ample notice of such tests. The Contractor shall furnish the official representatives of the Owner with all certificates of inspection or approval. Work performed without proper testing may be ordered for removal and replacement at no additional cost to the Owner.
- B. The Contractor shall employ and pay for the services of an independent testing firm to perform all inspections, tests, or approvals required by the Contract Documents including, but not limited to, mix designs, soil tests, compaction tests, concrete tests, foundation tests, piling testing and inspection, and all other required material tests. The Contractor shall provide the Owner with a schedule of values for all tests to be performed on the Project. The values presented shall be all-inclusive; no separate payment shall be made for labor, materials, travel, meals, lodging, etcetera. Prior to any testing being performed, the Contractor must receive written approval from the Owner approving the selected testing firm.
- C. Testing shall be performed by licensed, professional personnel according to the standards referenced in the technical specifications, or in the absence thereof, according to applicable ASTM standards or other applicable industry standards. On a daily basis, personnel performing the tests shall provide the Contractor and Owner a list of all tests performed including, at a minimum, the date, time, location, temperature, Project identifier, and tester's name.
- D. If a unit price line item for "Testing Allowance" is included in the proposal, the price will be adjusted in accordance with article "Unit Price Work." The established cost of Work for the unit price line item "Testing Allowance" shall be 105% of the required testing performed and billed by the independent testing firm that is documented by actual invoices submitted to the Designer from the Contractor.
- E. Payment shall not be made for failing tests, tests performed in the absence of the Owner's inspector (unless prior written authorization from the Owner's inspector has

been granted), tests unable to be verified by the daily test list, or any costs incurred due to poor scheduling.

## ARTICLE 31 – CONSTRUCTION SUPERVISION

- A. Throughout the progress of the Work, each Contractor shall keep at the job Site, a competent superintendent or supervisory staff satisfactory to the Designer. The superintendent shall not be changed without the consent of the Designer unless said superintendent ceases to be employed by the Contractor or ceases to be competent. The superintendent shall have authority to act on behalf of the Contractor, and instructions, directions or notices given to him shall be as binding as if given to the Contractor.
- B. The Contractor shall examine and study the Contract Documents and fully understand the Project design, and shall provide constant, competent, and efficient supervision to the Work. Should he discover any discrepancies of any sort in the Drawings or Specifications, he shall report them to the Designer without delay. He will not be held responsible for discrepancies in the Drawings and/or Specifications, but shall be held responsible to report them should they become known to him.
- C. All Contractors shall be required to cooperate and consult with each other during the construction of the Project. Prior to installation of Work, all Contractors shall jointly prepare coordination Drawings, showing locations of various ductworks, piping, motors, pumps, and other mechanical or electrical equipment, in relation to the structure, walls and ceilings. These Drawings shall be submitted to the Designer through the Project Expediter for information only. Each Contractor shall lay out and execute his Work to cause the least delay to other contractors. Each Contractor shall be financially responsible for any damage to other Contractor's Work and for undue delay caused to other contractors on the Project.
- D. The Contractor is required to attend monthly job Site progress conferences as directed by the Designer. Home office representatives may be required at these meetings. Contractor representatives shall have authority to act on behalf of the Contractor. These meetings shall be open to Subcontractors, material Suppliers and any others who can contribute toward maintaining required job progress. It shall be the principal purpose of these meetings, or conferences, to effect coordination, cooperation and assistance in every practical way toward the end of maintaining progress of the Project on schedule and to complete the Project within the specified Contract Time. Each Contractor shall be prepared to assess progress of the Work as required in his particular contract and to recommend remedial measures for correction of progress as may be appropriate. The Designer or his authorized representative shall be the coordinator of the conferences and shall preside as chairman.
- E. The Designer shall designate a Project Expediter on Projects involving two or more prime contracts and shall designate such in the Supplementary General Conditions. **For the purposes of a single prime contract, the single prime Contractor shall be designated as the Project Expediter.** The Project Expediter shall have the following responsibilities:

1. Prepare the Project construction schedule and shall allow all prime Contractors (multi-prime contract) and Subcontractors (single-prime contract) performing general, plumbing, HVAC, and electrical work equal input into the preparation of the initial construction schedule.
2. Maintain a Project progress schedule for all contractors.
3. Give adequate notice to all contractors to ensure efficient continuity of all phases of the Work.
4. Notify the Designer of any changes in the Project schedule.
5. Recommend to the Designer whether payment to a Contractor or Subcontractor should be approved.

## ARTICLE 32 – SCHEDULE

- A. It shall be the responsibility of the Project Expediter to cooperate with and obtain from all Prime Contractors and Subcontractors on the job, their respective work activities and integrate these activities into a Project construction schedule in form of a detailed bar chart or Critical Path Method (CPM), schedule. Each prime Contractor shall provide work activities within fourteen (14) days of request by the Project Expediter. A “work activity,” for scheduling purposes, shall be any component or contractual requirement of the Project requiring at least one (1) day, but not more than fourteen (14) days, to complete or fulfill. The Project construction schedule shall graphically show all salient features of the Work required to construct the Project from start to finish and within the allotted time established in the Contract. The time (in days) between the Contractor’s early completion and contractual completion dates is part of the Project total float time; and shall be used as such, unless amended by a Change Order. On a multi-prime Project, each prime Contractor shall review the proposed construction schedule and approve same in writing. The Project Expediter shall submit the proposed construction schedule to the Designer for comments. The complete Project construction schedule shall be of the type set forth in the Supplementary General Conditions or Subparagraph (a) or (b) below, as appropriate:
  1. For a Project with total contracts of \$500,000 or less, a bar chart schedule will satisfy the above requirement. The schedule shall indicate the estimated starting and completion dates for each major element of the Work, as well as **cost values** associated with each element.
  2. For a Project with total contracts over \$500,000, a Critical Path Method (CPM) schedule shall be utilized to control the planning and scheduling of the Work. The CPM schedule shall be the responsibility of the Project Expediter and shall be paid for by the Project Expediter.
- B. **Bar Chart Schedule:** Where a bar chart schedule is required, it shall be time-scaled in weekly increments, shall indicate the estimated starting and completion dates for each major element of the Work by trade and by area, level, or zone, and shall schedule dates for all salient features, including but not limited to the placing of orders for materials, submittal of Shop Drawings and other Submittals for approval, approval of Shop Drawings by Designers, the manufacture and delivery of material, the testing and the installation of materials, supplies and equipment, and all Work

activities to be performed by the Contractor. The Contractor shall allow sufficient time in his schedule for all required inspections, reviews (punch lists), and correction of punch list items. Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.

- C. **CPM Schedule:** Where a CPM schedule is required, it shall be in time-scaled precedence format using the Project Expediter's logic and time estimates. The CPM schedule shall be drawn or plotted with activities grouped or zoned by Work area or subcontract as opposed to a random (or scattered) format. The CPM schedule shall be time-scaled on a weekly basis and shall be drawn or plotted at a level of detail and logic which will schedule all salient features of the Work to be performed by the Contractor including but not limited to the placing of orders for materials, submittal of Shop Drawings and other Submittals for approval, approval of Shop Drawings by Designers, the manufacture and delivery of material, and the testing and the installation of materials, supplies and equipment. The Contractor shall allow sufficient time in his schedule for all required inspections, reviews (punch lists), and correction of punch list items. Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.
- D. The CPM schedule will identify and describe each activity, state the duration of each activity, the calendar dates for the early and late start and the early and late finish of each activity, and clearly highlight all activities on the critical path. "Total float" and "free float" shall be indicated for all activities. Float time shall be considered for the exclusive use or benefit of the Owner. Extensions to the Contract Time, when granted by Change Order, will be granted only when equitable time adjustment exceeds the Total Float in the activity or path of activities affected by the change. Extensions to the Contract Time shall only be granted for activities on the critical path. **The CPM schedule shall also show what part of the Contract Price is attributable to each activity on the schedule, the sum of which for all activities shall equal the total Contract Price.**
- E. **Early Completion of Project:** The Contractor may attempt to complete the Project prior to the Contract Completion Date. However, such planned early completion shall be for the Contractor's convenience only and shall not create any additional rights of the Contractor or obligations of the Owner under this Contract, nor shall it change the Time for Completion or the Contract Completion Date. The Contractor shall not be required to pay liquidated damages to the Owner because of its failure to complete by its planned earlier date. Likewise, the Owner shall not pay the Contractor any additional compensation for early completion nor will the Owner owe the Contractor any compensation should the Owner, its officers, employees, or agents cause the Contractor not to complete earlier than the date required by the Contract Documents.
- F. The proposed Project construction schedule shall be presented to the Designer no later than ten (10) days after the Project start date for Projects with a total Contract Price of \$500,000 or less and no later than thirty (30) days after the Project start date for Projects with a total Contract Price in excess of \$500,000. No Request for Payment will be processed until this schedule is **accepted** by the Owner.
- G. Acceptance of the schedule shall not impose on the Designer or Owner responsibility for the progress schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve Contractor from Contractor's responsibility thereof.

- H. The approved Project construction schedule shall be distributed to all contractors and displayed at the job Site by the Project Expediter.
- I. The several contractors shall be responsible for their work activities and shall notify the Project Expediter of any necessary changes or adjustments to their work. The Project Expediter shall maintain the Project construction schedule, making monthly adjustments, updates, corrections, etc., that are necessary to finish the Project within the Contract Time, keeping all contractors and the Designer fully informed. Copy of a bar chart schedule annotated to show the current progress shall be submitted by the Contractor(s) to the Designer, along with monthly Request for Payment. For Project requiring CPM schedule, the Contractor shall submit a monthly report of the status of all activities. The bar chart schedule or monthly status report shall show the actual Work completed to date in comparison with the original Work scheduled for all activities. If any activities of the Work of several contractors are behind schedule, the Contractor must indicate in writing, what measures will be taken to bring each such activity back on schedule and to ensure that the Contract Completion Date is not exceeded. A plan of action and recovery schedule shall be developed and submitted to the Designer by the Project Expediter, when (1) the Contractor's monthly report indicates delays, that are in the opinion of the Designer or the Owner, of sufficient magnitude that the Contractor's ability to complete the Work by the scheduled completion is brought into question; (2) the updated construction schedule is thirty (30) days behind the planned or baseline schedule and no legitimate time extensions are in process; and (3) the Contractor desires to make changes in the logic (sequencing of work) or the planned duration of future activities of the CPM schedule which, in the opinion of the Designer or the Owner, are of a major nature. The plan of action, when required shall be submitted to the Owner for review within two (2) business days of the Contractor receiving the Owner's written demand. The recovery schedule, when required, shall be submitted to the Owner within five (5) calendar days of the Contractor's receiving the Owner's written demand. Failure to provide an updated construction schedule or a recovery schedule may be grounds for rejection of payment requests or withholding of funds as set forth in Article "Payments Withheld."
- J. The Project Expediter shall notify each Contractor of such events or time frames that are critical to the progress of the job. Such notice shall be timely and reasonable. Should the progress be delayed due to the Work of any of the several contractors, it shall be the duty of the Project Expediter to immediately notify the Contractor(s) responsible for such delay, the Designer, the Owner and other prime Contractors. The Designer shall determine the Contractor(s) who caused the delays and notify the bonding company of the responsible Contractor(s) of the delays; and shall make a recommendation to the Owner regarding further action.
- K. Designation as Project Expediter entails an additional Project control responsibility and does not alter in any way the responsibility of the Contractor so designated, or the responsibility of the other contractors involved in the Project.

### **ARTICLE 33 – WORKING HOURS**

Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, and Contractor will not permit the performance of Work on Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to

the Designer. The regular working hours shall be established by the Owner. In lieu of a directive by the Owner, working hours shall be 7:30 a.m. until 6:00 p.m., Monday through Friday, excluding holidays.

#### **ARTICLE 34 – SEPARATE CONTRACTS AND CONTRACTOR RELATIONSHIPS**

- A. Effective from January 1, 2002, NCGS Chapter 143, Article 8, was amended, to allow public contracts to be bid in single-prime, dual (single-prime and separate-prime), construction manager at risk, and alternative contracting method as approved by the State Building Commission. The Owner reserves the right to prepare separate Specifications, receive separate bids, and award separate contracts for such other major items of Work as may be in the best interest of the Owner.
- B. All Contractors shall cooperate with each other in the execution of their Work, and shall plan their Work in such manner as to avoid conflicting schedules or delay of the Work. See Articles “Construction Supervision” and “Schedule.”
- C. If any part of Contractor’s Work depends upon the Work of another Contractor, defects which may affect that Work shall be reported to the Designer in order that prompt inspection may be made and the defects corrected. Commencement of Work by a Contractor where such condition exists will constitute acceptance of the other Contractor’s Work as being satisfactory in all respects to receive the Work commenced, except as to defects which may later develop. The Designer shall be the judge as to the quality of Work and shall settle all disputes on the matter between Contractors.
- D. Any mechanical or electrical work such as sleeves, inserts, chases, openings, penetrations, etc., which is located in the Work of the general Contractor shall be built in by the general Contractor. The respective mechanical and electrical contractors shall set all sleeves, inserts and other devices that are to be incorporated into the structure in cooperation and under the supervision of the general Contractor. The responsibility for the exact location of such items shall be that of the mechanical and/or Electrical Contractor.
- E. The Designer and the Owner shall have access to the Work at all times. The Contractor shall provide facilities for such access so the Designer may perform his functions under the Contract Documents.
- F. Should a Contractor cause damage to the Work or property of another Contractor, he shall be directly responsible, and upon notice, shall promptly settle the claim or otherwise resolve the dispute.

#### **ARTICLE 35 – SUBCONTRACTS AND SUBCONTRACTORS**

- A. Within thirty (30) days after award of the Contract, the Contractor shall submit to the Designer and to the Owner a list giving the names and addresses of Subcontractors and equipment and material Suppliers he proposes to use, together with the scope of their respective parts of the Work. The Contractor shall not employ any Subcontractor or other person or organization, either directly or indirectly, whether initially or as a substitute, against whom either the Designer or the Owner has an objection. The Designer shall act promptly in the approval of Subcontractors, and when approval of the list is given, no changes of Subcontractors will be permitted except for cause or reason considered justifiable by the Designer.

- B. The Prime Contractor shall not allow first-tier Subcontractors to sublet any portion of the sub-contracted Work without written approval from the Designer. Circumvention of this requirement by a first-tier Subcontractor using the device of “hiring” the employees and/or “renting” the equipment of a second-tier Subcontractor shall be a violation of the Contract and shall subject the Prime Contractor to penalties associated with violation of the Contract. The Designer may require the Prime Contractor to provide behavioral, financial, relationship, ownership, and other documentation to support claims that Work is indeed being performed by an approved, first-tier Subcontractor. Unless waived by the Designer, at least 75% of the equipment utilized by a first-tier Subcontractor to perform the Work shall be owned by the first-tier Subcontractor and at least 75% of the Subcontractor’s employees performing Work on the Project shall have been regular, continuous, full time employees of the company for at least six (6) months prior to performing Work on the Project.
- C. The Designer will furnish to any Subcontractor, upon request, evidence regarding amounts of money paid to the Contractor on account of the Subcontractor’s Work.
- D. The Prime Contractor will furnish to the Designer, upon request, evidence regarding amounts of money paid and due to Subcontractors for their Work.
- E. The Contractor is and remains fully responsible for his own acts or omissions as well as those of any Subcontractor or of any employee of either. The Contractor agrees that no contractual relationship exists between the Subcontractor and the Owner in regard to the Contract, and that the Subcontractor acts on this Work as an agent or employee of the Contractor.
- F. The Owner reserves the right to limit the amount of portions of Work to be subcontracted. Pipe installation using trenchless technology (Horizontal Directional Drill, Bore & Jack, etc.) must be performed by the Prime Contractor or first-tier Subcontractor using their own equipment and permanent, full-time employees.

## **ARTICLE 36 – CONTRACTOR AND SUBCONTRACTOR RELATIONSHIPS**

The Contractor agrees that the terms of these Contract Documents shall apply equally to each Subcontractor, regardless of tier, as to the Contractor, and the Contractor agrees to take such action as may be necessary to bind each Subcontractor to these terms. The Contractor further agrees to conform to the Code of Ethical Conduct as adopted by the Associated General Contractors of America, Inc., with respect to Contractor-Subcontractor relationships, and that payments to Subcontractors shall be made in accordance with the provisions of NCGS 143-134.1 titled *Interest on final payments due to prime Contractors: payments to Subcontractors*.

- A. The balance due prime Contractors shall be paid in full within forty-five (45) days after respective prime contracts of the Project have been accepted by the Owner, certified by the architect, Engineer or Designer to be completed in accordance with terms of the plans and Specifications, or occupied by the Owner and used for the purpose for which the Project was constructed, whichever occurs first. Provided, however, that whenever the architect or consulting Designer in charge of the Project determines that delay in completion of the Project in accordance with terms of the plans and Specifications is the fault of the Contractor, the Project may be occupied and used for the purposes for which it was constructed without payment of any

interest on amounts withheld past the forty -five (45) day limit. No payment shall be delayed because of the failure of another prime Contractor on such Project to complete his contract. Should final payment to any prime Contractor beyond the date such contracts have been certified to be completed by the Designer or architect, accepted by the Owner, or occupied by the Owner and used for the purposes for which the Project was constructed, be delayed by more than forty-five (45) days, said prime Contractor shall be paid interest, beginning on the 46th day, at the rate of one percent (1%) per month or fraction thereof unless a lower rate is agreed upon on such unpaid balance as may be due. In addition to the above final payment provisions, periodic payments due a prime Contractor during construction shall be paid in accordance with the payment provisions of the Contract Documents or said prime Contractor shall be paid interest on any such unpaid amount at the rate stipulated above for delayed final payments. Such interest shall begin on the date the payment is due and continue until the date on which payment is made. Such due date may be established by the terms of the Contract. Where a conditional acceptance of a Contract exists, and where the Owner is retaining a reasonable sum pending correction of such conditions, interest on such reasonable sum shall not apply.

- B. Within seven (7) days of receipt by the prime Contractor of each periodic or final payment, the prime Contractor shall pay the Subcontractor based on Work completed or service provided under the subcontract. Should any periodic or final payment to the Subcontractor be delayed by more than seven (7) days after receipt of periodic or final payment by the prime Contractor, the prime Contractor shall pay the Subcontractor interest, beginning on the eighth day, at the rate of one percent (1%) per month or fraction thereof on such unpaid balance as may be due.
- C. The percentage of retainage on payments made by the prime Contractor to the Subcontractor shall not exceed the percentage of retainage on payments made by the Owner to the prime Contractor. Any percentage of retainage on payments made by the prime Contractor to the Subcontractor that exceeds the percentage of retainage on payments made by the Owner to the prime Contractor shall be subject to interest to be paid by the prime Contractor to the Subcontractor at the rate of one percent (1%) per month or fraction thereof.
- D. Nothing in this section shall prevent the prime Contractor at the time of application and certification to the Owner from withholding application and certification to the Owner for payment to the Subcontractor for unsatisfactory job progress; defective construction not remedied; disputed Work; third-party claims filed or reasonable evidence that claim will be filed; failure of Subcontractor to make timely payments for labor, equipment and materials; damage to prime Contractor or another Subcontractor; reasonable evidence that subcontract cannot be completed for the unpaid balance of the subcontract sum; or a reasonable amount for retainage not to exceed the initial percentage retained by Owner.

## **ARTICLE 37 – DESIGNER’S STATUS**

- A. The Designer shall provide general administration of the performance of construction contracts, including liaison and necessary inspection of the Work to ensure compliance with plans and Specifications. He is the agent of the Owner only for the purpose of constructing this Work and to the extent stipulated in the Contract Documents. He has authority to stop Work or to order Work removed, or to order corrections of faulty Work where such action may be necessary to assure successful completion of the Work.



- B. The Designer, when employed in a construction inspection/administration role, is the impartial interpreter of the Contract Documents, and, as such, he shall exercise his powers under the Contract to enforce faithful performance by both the Owner and the Contractor. The Designer shall issue written clarifications or interpretations of the requirements of the Contract Documents with reasonable promptness. The Designer may authorize minor variations in the Work that are different from the requirements of the Contract Documents which do not involve an adjustment of Contract Price or Time of Completion as long as such variation is compatible with the design concept of the Project.
- C. The Designer will make periodic inspections of the Project at intervals appropriate to the stage of construction. He will inspect the progress, the quality and the quantity of the Work. The Designer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work.
- D. The Designer and the Owner shall have access to the Work whenever it is in preparation and progress. The Contractor shall provide facilities for such access so the Designer may perform his functions under the Contract Documents.
- E. Based on the Designer's inspections and evaluations of the Project, the Designer shall issue interpretations, directives and decisions as may be necessary to administer the Project. His decisions relating to artistic effect and technical matters shall be final, provided such decisions are within the limitations of the Contract.
- F. The Designer will determine the actual quantities and classifications of unit price Work performed by the Contractor.
- G. The Designer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

#### **ARTICLE 38 – CHANGES IN THE WORK**

- A. The Owner may have changes made in the Work covered by the Contract. These changes will not invalidate and will not relieve or release the Contractor from any guarantee given by him pertinent to the Contract provisions. These changes will not affect the validity of the guarantee bond and will not relieve the Surety or Sureties of said bond. All extra Work shall be executed under conditions of the original Contract.
- B. Except in an emergency endangering life or property, **NO CHANGE SHALL BE MADE BY THE CONTRACTOR EXCEPT UPON RECEIPT OF APPROVED CHANGE ORDER OR WRITTEN WORK CHANGE DIRECTIVE FROM THE DESIGNER, COUNTERSIGNED BY THE OWNER AUTHORIZING SUCH CHANGE. NO CLAIM FOR ADJUSTMENTS OF THE CONTRACT PRICE SHALL BE VALID UNLESS THIS PROCEDURE IS FOLLOWED.**

**A WORK CHANGE DIRECTIVE, TRANSMITTED BY FAX OR HAND DELIVERED, MAY BE USED WHERE THE CHANGE INVOLVED IMPACTS THE CRITICAL PATH OF THE WORK. A FORMAL CHANGE**

**ORDER SHALL BE ISSUED WITHIN THE TIME STATED ON THE WORK CHANGE DIRECTIVE.**

In the event of emergency endangering life or property, the Contractor may be directed to proceed on a time and material basis whereupon the Contractor shall proceed and keep accurately on such form as may be required, a correct account of costs together with all proper invoices, payrolls and supporting data. Upon completion of the Work the Change Order will be prepared as outlined under either Method "C 1." or Method "C 2." or both.

- C. In determining the values of changes, either additive or deductive, Contractors are restricted to the use of the following methods:
  - 1. Where the extra Work involved is covered by unit prices quoted in the proposal, the value of the change shall be computed by application of unit prices based on quantities, estimated or actual as agreed of the items involved. Unit prices shall include all direct and indirect present or future cost, all time and all overhead and profit for each unit.
  - 2. The contracting parties shall negotiate and agree upon the equitable value of the change prior to issuance of the Change Order, and the Change Order shall stipulate the corresponding lump sum adjustment to the Contract Price.
- D. Under Paragraph (B) and Methods (C 2.) above, the allowances for overhead and profit combined shall not exceed twenty percent (20%) of **net cost**. Under Method "C 1." no additional allowances shall be made for overhead and profit. In the case of deductible Change Orders, under Method (C 2.) and Paragraph (B) above, the Contractor shall include no less than five percent (5%) profit, but no allowances for overhead. Overhead shall include all conditions of the Contract, "Extended General Conditions", and all general requirements including, but not limited to, Project management, scheduling, home office expense, job Site overhead, layout, reproduction of Drawings, document processing and coordination (shop Drawings, Change Orders, RFI's, etc.), supervision, small tools, temporary facilities, safety provisions, as built Drawings, estimating, and general overhead.
- E. The term "net cost" as used herein shall mean the difference between all proper cost additions and deductions. The "cost" as used herein shall be limited to the following:
  - 1. The actual costs of materials and supplies incorporated or consumed as part of the Project.
  - 2. The actual costs of labor expended on the Project Site.
  - 3. The actual costs of labor burden, limited to the costs of social security (FICA) and Medicare/Medicaid taxes; unemployment insurance costs; health/dental/vision insurance premiums; paid employee leave for holidays, vacation, sick leave, and/or petty leave, not to exceed a total of thirty (30) days per year; retirement contributions; worker's compensation insurance premiums; and the costs of general liability insurance when premiums are computed based on payroll amounts. The total labor burden shall not exceed forty percent (40%) of the actual costs of labor.
  - 4. The actual costs of rental for equipment; machinery; temporary facilities; and tools, excluding hand tools, required for the Project.

5. The actual costs of premiums for bonds, insurance, permit fees, and sales or use taxes related to the Project.
  6. Overtime and extra pay for holidays and weekends may be a cost item only to the extent approved by the Owner.
- F. Should concealed conditions be encountered in the performance of the Work below grade, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the Contract Documents, the Contract sum and time for completion may be equitably adjusted by Change Order upon claim by either party made within thirty (30) days after the condition has been identified. The cost of such change shall be arrived at by one of the foregoing methods.

**ALL CHANGE ORDERS SHALL BE SUPPORTED BY A BREAKDOWN SHOWING METHOD OF ARRIVING AT NET COST AS DEFINED ABOVE.**

- G. The Contractor may solicit a change using the "Change Proposal" form or may submit a "Change Proposal" form when the Designer requests costs for potential changes in the Work. However, no Work is to be performed until a properly executed Change Order or Work Change Directive is provided to the Contractor. The Contractor shall provide the "Change Proposal" and supporting data in a form suitable to the Designer and Owner. The Designer shall verify correctness. Within fourteen (14) days after receipt of the "Change Proposal," the Designer shall respond, in writing, to the Contractor's proposal. If the Designer deems that the Proposal is in the best interest of the Owner, the Designer shall prepare a Change Order or Work Change Directive and forward to the Contractor for his signature. Within seven (7) days after receipt of the Change Order or Work Change Directive executed by the Contractor, the Designer shall certify the document by his signature, and forward the document and all supporting data to the Owner for the Owner's signature. The Owner's representative shall execute the document and, if necessary, forward to the County Commissioners for final approval. Upon approval by the Owner's representative and County Commissioners, one copy remains with the County Commissioners, and the remaining original is sent to the Designer for distribution to the Contractor(s). A copy is sent to the Surety. In case of emergency or extenuating circumstances, approval of changes may be obtained verbally by telephone or Work Change Directives approved by all parties, then shall be substantiated in writing as outlined under normal procedure.
- H. At the time of signing a Change Order, the Contractor shall be required to certify as follows:
- "I certify that my bonding company will be notified forthwith that my Contract has been changed by the amount of this Change Order, and that a copy of the approved Change Order will be mailed upon receipt by me to my Surety."
- I. A Change Order, when issued, shall be full compensation, or credit, for the Work included, omitted or substituted. It shall show on its face the adjustment in time for completion of the Project as a result of the change in the Work.
- J. If, during the progress of the Work, the Owner requests a Change Order and the Contractor's terms are unacceptable, the Owner may require the Contractor to perform such Work on a time and material basis in accordance with Paragraph (B)

above. Without prejudice, nothing in this paragraph shall preclude the Owner from performing or to have performed that portion of the Work requested in the Change Order.

- K. If a unit price line item for “Change Order Allowance” or similar is included in the proposal, the price will be adjusted in accordance with article “Unit Price Work.” The established cost of Work for the unit price line item “Change Order Allowance” shall be one hundred percent (100%) of approved Change Orders, either additive or deductive.

## **ARTICLE 39 – UNIT PRICE WORK**

- A. The Project is “lump sum” and payment of the lump sum bid price shall be full compensation for all Work indicated in the Contract Documents. Unit Price items included in the proposal shall be included as part of the lump sum bid. These items are indicated in the proposal and may have an associated quantity. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor’s overhead and profit for each separately identified item. When indicated, the estimated quantities of items of unit price Work are not guaranteed and are solely for the purpose of comparison of bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of unit price Work included in the lump sum bid that is performed by the Contractor will be made by the Designer. The Designer shall issue a Change Order, either additive or deductive, at the close of the Project for any variation between the actual quantity and the estimated quantities of the unit price Work indicated in the Contract Documents. No payment shall be made to the Contractor for re-stocking of materials.
- B. The quantities shown on the proposal form are for the base bid only unless the Contract Documents specifically indicate that the item(s), or any portion thereof, are part of an alternate bid element. It is the responsibility of the Contractor to apportion the cost of unit price items to the base bid and any alternates listed in the Proposal using information in the Contract Documents. In the event that the Owner selects an alternate that clearly increases or decreases the estimated quantity of a unit price item shown on the proposal form, after selection of the Contractor, the Contractor shall be provided an updated list of estimated unit price quantities reflective of the alternates chosen. This updated list shall be used in determining any variation between the actual quantities and the estimated quantities of the unit price Work. An estimated unit price quantity shall be updated only in the event that the Contract Documents clearly indicate that the unit price item was indeed part of the Owner-selected alternate. The cost for all unit price items shall be included within either the base bid or an alternate, as applicable.
- C. In situations where a particular unit price item overruns, or the Contractor expects such overrun, of an estimated quantity by more than twenty-five percent (25%), the Contractor shall notify the Designer in writing and shall not install the overrun item in excess of twenty-five percent (25%) until the Contractor has received written authorization from the Designer. The aforesaid notification from the Contractor shall include any requests for modification of the unit price due to an actual quantity overrun greater than twenty-five percent (25%). The Engineer may solicit a reduction in the unit price due to a sufficient increase in the actual quantity installed of a unit price item. A reduction, regardless of the amount, of the actual installed quantity of a unit price item shall not warrant a change in the unit price.

- D. The Contractor is responsible for maintaining all documentation pertaining to the actual quantities of unit price items. This will be remitted to the Designer upon request. No payment shall be made for the quantity of unit price items that cannot be verified.
- E. There will be no measurement for lump sum bid items by this Contract, as payment of the lump sum price shall include all equipment, labor, materials, and incidentals necessary to perform the Work required.
- F. Extensions to the Contract Time shall not entitle the Contractor to an increase to any unit price.

#### **ARTICLE 40 – ALLOWANCE ITEMS**

The Contract Price includes the allowance items indicated on the bid proposal. Allowances cover the costs for portions of the Work that cannot be specified with sufficient particularity at the time of bid. The Contractor shall provide product recommendations and associated costs to the Owner for allowance items, but shall not incorporate into the Work without consent from the Owner. The allowance items may be utilized and specified by the Owner in its sole and absolute discretion within a reasonable time prior to the date on which the Contractor shall be required to utilize such items. The amount shown for each allowance item shall include, and may be used by the Owner for, the cost of the material, equipment, or service for the allowance item. All other costs associated with installing an allowance item, including without limitation the cost of all labor, overhead, and profit, are otherwise included in the Contract Price and shall not be paid for with the amount allocated to each allowance item. The sole exception being additive Changes in the Work approved and designated by the Owner to be paid for out of a “Change Order Allowance”; the value of such Changes in the Work shall be determined according to the Article “Changes in the Work” section C. 2. The amount paid to the Contractor for an allowance item shall be adjusted based on the actual value attributable to the particular allowance item. The Designer shall issue a Change Order, either additive or deductive, at the close of the Project for any variation between the actual value of an allowance item and the estimated value of the allowance item shown on the Form of Proposal. If an allowance item is not utilized by the Owner, the Contract Price shall be reduced by the amount allocated to the item and a reasonable amount for the unused labor and overhead and unearned profit associated therewith. Allowance items designated on the bid proposal may or may not be indicated on the Project plans or Specifications.

#### **ARTICLE 41 – CLAIMS FOR EXTRA COST**

- A. Should the Contractor consider that as a result of any instructions given in any form by the Designer, he is entitled to extra cost above that stated in the Contract, he shall give written notice thereof to the Designer within seven (7) days without delay, and shall not proceed with the Work affected until further advised, except in emergency involving the safety of life or property, which condition is covered in Article “Changes in the Work,” Paragraph (B) and Articles “Protection of Work and Property” and “Safety.” No claims for extra compensation will be considered unless the claim is so made. The Designer shall render a written decision within seven (7) days of receipt of claim.
- B. THE CONTRACTOR SHALL NOT ACT ON INSTRUCTIONS RECEIVED BY HIM FROM PERSONS OTHER THAN THE DESIGNER, AND ANY CLAIMS FOR EXTRA COMPENSATION OR EXTENSION OF TIME ON**

**ACCOUNT OF SUCH INSTRUCTION WILL NOT BE HONORED.** The Designer will not be responsible for misunderstandings claimed by the Contractor of verbal instructions which have not been confirmed in writing, and in no case shall instructions be interpreted as permitting a departure from the Contract Documents unless such instruction is confirmed in writing and supported by a properly authorized Change Order.

- C. Should a claim for extra compensation by the Contractor be denied by the Designer or Owner, and cannot be resolved by the County Commissioners, the Contractor may request mediation in accordance with the procedures set forth below. If the Contractor is unable to resolve its claim as a result of mediation, the Contractor may institute a civil action for the sum he claims to be entitled to under the Contract by filing a verified complaint and the issuance of a summons in the Superior Court of Brunswick County. The procedure shall be the same as in all civil actions except that all issues shall be tried by a judge, without a jury.

## **ARTICLE 42 – DISPUTE RESOLUTION**

### **A. Initiating Mediated Settlement Conferences**

1. A party to a dispute arising out of the Contract and the construction process in which the amount in controversy is at least \$15,000 may submit a written request to the County for mediation of the dispute.
2. Prior to submission of a written request for mediation to the County, the party requesting mediation should give notice of any and all claims in accordance with their respective contracts, obtain decisions on the claims as required or allowed by their respective contracts, and attempt to resolve the dispute according to the terms and conditions in their respective contracts. The Mediator may adjourn any mediated settlement conference if the Mediator believes, in his or her sole discretion, that the parties have not satisfied all of the terms and conditions of their respective contracts and that doing so will enhance the prospects for a negotiated settlement.
3. Condition Precedent to Litigation. Before any party to a Contract may commence a civil action against the County seeking remedies for breach or non-performance of the Contract by the County, said party must first initiate the dispute resolution process as provided for herein and attend and participate in good faith in the mediated settlement conference.

### **B. Selection of a Mediator**

1. Unless otherwise agreed upon in writing, the parties shall mutually select an attorney certified to conduct superior court mediations by the North Carolina Dispute Resolution Commission. If the Mediator selected is not available or declines to participate for any reason, the parties shall select another person from the list.
2. Disqualification of Mediator. Any party may request replacement of the Mediator for good cause. Nothing in this provision shall preclude Mediators from disqualifying themselves.

C. The Mediated Settlement Conference

1. Where Conference is to be Held. The mediated settlement conference shall be held in Brunswick County, North Carolina. The Mediator shall be responsible for reserving a location, making arrangements for the conference, and giving timely notice of the time and location of the conference to all attorneys, unrepresented parties and other persons or entities required to attend.
2. When Conference is to be Held. The mediation shall be completed within sixty (60) days after selection of the Mediator unless all parties to the mediation agree to a different schedule.
3. Request to Accelerate or Extend Deadline for Completion. Any party or the Mediator may request the County to accelerate or extend the deadline for completion of the conference. Such request shall state the reasons the acceleration or extension is sought and shall be served by the moving party upon the other parties and the Mediator. Objections to the request must be promptly communicated to the County and to the Mediator. The County, with the concurrence of the designated Mediator, may grant the request by adjusting the time for completion of the conference.
4. Recesses. The Mediator may recess the mediation conference at any time and may set times for reconvening. If the Mediator determines the time and place where the conference is to reconvene before the conference is recessed, no further notice is required to persons present at the conference.
5. Project Delay. The mediated settlement conference that results from a construction contract dispute shall not be cause for the delay of the construction project.

D. Duties of Parties and other Participants in Formal Dispute Resolution Process

1. Attendance.
  - a. All parties to the dispute must designate an official representative to attend the mediation.
  - b. Attorneys representing parties may attend the mediation, but are not required to do so.
  - c. Sureties and insurance company representatives are required to physically attend the mediation unless the Mediator and all of the other parties to the mediation excuse their attendance or consent to their attendance by telephone or other electronic means.
  - d. The parties who attend a duly scheduled mediation conference shall have the right to recover their share of the Mediator's compensation from any party or parties who fail to attend the conference without good cause.
2. Finalizing Agreement. If an agreement is reached in the conference, the terms of the agreement shall be confirmed in writing and signed by all parties.
3. Payment of Mediation Fee: Mediation Fees shall be divided between the parties to the dispute, with at least one-third of the total cost to be paid by County.

4. Failure to Compensate Mediator. Any party's failure to compensate the Mediators in accordance with NCGS § 143-128(f1) shall subject that party to a withholding by the County of said amount of money from the party's payment or any other moneys owed by that party to the County.

E. Authority and Duties of the Mediator

1. Authority of Mediator.

- a. Control of Conference. The Mediator shall at all times be in control of the conference and the procedures to be followed.
- b. Private Consultation. The Mediator may communicate privately with any participant or counsel prior to and during the conference. The fact that private communications have occurred with a participant shall be disclosed to all other participants at the beginning of the conference.
- c. Scheduling the Conference. The Mediator shall make a good faith effort to schedule the conference at a time that is convenient with the participants, attorneys and Mediator. In the absence of agreement, the Mediator shall select the date for the conference.
- d. Determining good cause for a party's failure to appear at a scheduled mediation conference.

e. Duties of Mediator.

- i. The Mediator shall define and describe the following at the beginning of the conference:
  - ii. The process of mediation.
  - iii. The difference between mediation and other forms of conflict resolution.
  - iv. The costs of the mediated settlement conference.
  - v. That the mediated settlement conference is not a trial, the Mediator is not a judge, and the parties retain their legal rights if they do not reach settlement; however, the Mediator will advise all parties that failure to appear at mediation without good cause may result in imposition of sanctions and may be asserted as a bar to lawsuits by claimants who have failed to exhaust this administrative remedy.
  - vi. The circumstances under which the Mediator may meet and communicate privately with any of the parties or with any other person.
  - vii. Whether and under what conditions communications with the Mediator will be held in confidence during the conference.
  - viii. The inadmissibility of conduct and statements as provided by NCGS §7A-38.1(1).
  - ix. The duties and responsibilities of the Mediator and the participants.



- x. That any agreement reached will be reached by mutual consent.
- f. Disclosure. The Mediator has a duty to be impartial and to advise all participants of any possible bias, prejudice or partiality.
- g. Declaring Impasse. The Mediator may determine at any time during the mediation conference that an impasse exists and that the conference should end.
- h. Reporting Results of Conference. The Mediator shall submit a written report to the County and the other parties within ten (10) days of the conference stating whether or not the parties reached an agreement. The Mediator's report shall indicate the absence of any party from the mediated settlement conference without permission or good cause.
- i. Scheduling and Holding the Conference. It is the duty of the Mediator to schedule the conference and conduct it prior to the deadline of completion set by the rules. The Mediator shall strictly observe deadlines for completion of the conference unless said time limit is changed by agreement of the parties.

**F. Amendments**

The dispute resolution procedures may be amended by the County at any time. Amendments will not affect mediations where claims and/or requests for mediation have been filed at the time the amendment takes effect.

**F. Time Limits**

Any time limit may be waived or extended at the sole discretion of the County, if no Mediator has been selected, and at the discretion of the County with concurrence of the Mediator if a Mediator has been selected.

**ARTICLE 43 – MINOR CHANGES IN THE WORK**

The Designer will have the authority to order minor changes in the Work not involving an adjustment in the Contract sum or time of completion, and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and the Contractor.

**ARTICLE 44 – TIME OF COMPLETION, DELAYS, EXTENSION OF TIME**

The time of completion is stated in the Notice to Bidders and in the Form of Construction Contract. The Project Expediter, upon Notice of Award of Contract, shall prepare a construction schedule to complete the Project within the time of completion as required by the Article "Schedule."

- A. The Contractors shall commence Work to be performed under this agreement and the time of completion shall commence to run on the thirtieth day after the effective date of the Contract, or if a Notice to Proceed is given, on the date specified in a written Notice to Proceed. The Contractor shall fully complete all Work hereunder within

the time of completion stated. A Notice to Proceed may be given at any time within thirty (30) days after the effective date of the Contract.

- B. No Work shall be performed until the Owner receives and accepts fully executed Contracts, performance bonds, payment bonds, and certificates of insurance.
- C. For each calendar day in excess of the time of completion, the Contractor(s) shall pay the Owner the sum stated as liquidated damages (see Notice to Bidders) reasonably estimated in advance to cover the losses to be incurred by the Owner by reason of failure of said Contractor(s) to complete the Work within the time specified, such time being in the essence of this Contract and a material consideration thereof.
- D. The Designer shall be the judge as to the division of responsibility between the Contractor(s), based on the construction schedule, weekly reports and job records, and shall apportion the amount of liquidated damages to be paid by each of them, according to delay caused by any or all of them.
- E. If the Contractor is delayed in the progress of critical path activities by any act or negligence of the Owner or the Designer, or by any employee of either; by any separate Contractor employed by the Owner; by changes ordered in the Work; by labor disputes at the Project Site; by abnormal weather conditions not reasonably anticipated for the locality where the Work is performed; by unavoidable casualties; by any causes beyond the Contractor's control; or by any other causes which the Designer and Owner determine may justify the delay, then the Contract Time may be extended by Change Order for the time which the Designer and Owner may determine is reasonable. However, such delays **must** be on critical path activities that cause the anticipated Project construction time to exceed the Time of Completion. Extensions to the Contract Time, when granted by Change Order, will be granted only when equitable time adjustment exceeds the Total Float in the activity or path of activities affected by the change.
- F. Time extensions granted for a portion of the Work shall not obligate the Owner to grant time extensions for portions of the Work not affected by the delay. The Engineer may establish an extended Time of Completion for Work affected by delays while still maintaining the overall Time of Completion for the Work not affected by delays. Liquidated Damages may be assessed for any portion of the Work not completed within any Time of Completion term set by the Engineer, though the daily Liquidated Damage rate may not exceed that indicated within the Contract Documents.
- G. Time extensions will not be granted for rain, wind, snow or other natural phenomena of **normal intensity** for the locality where Work is performed. Based on National Oceanic and Atmospheric Administration (NOAA) National Weather Service records between 1971 and 2000 for weather stations in the Brunswick County area (Wilmington, NC and Myrtle Beach, SC) the average annual days for precipitation equal to or exceeding 0.1 inch is 75. This is further broken down by month 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>
7	6	6	5	6	7	9	8	6	4	5	6

For the purposes of determining time extensions based on weather, **normal intensity** weather conditions is defined on a monthly basis as noted in the chart above. For any given month, if the actual number of days in which precipitation exceeds 0.1 inch is greater than that listed in the chart; the Contractor may request a time extension for the difference. However, days in which the precipitation exceeds 0.1 inch but the Contractor is not mobilized to the Site or actively working on Site are excluded from the calculation. Actively working on-site is evidenced by onsite work operations the normally scheduled working day prior to and after the day of precipitation. Time extensions will not be given for days in which the precipitation is less than 0.1 inch. For the purpose of determining the extent of delay attributable to unusual weather phenomena, the Normal Intensity weather conditions shall be compared to NOAA National Weather Service data from the station nearest the Project. In the event that a Contract begins or ends in the middle of the month, the Normal Intensity days shall be prorated based on the number of Contract days within the partial month. Time extensions for weather delays do not entitle the Contractor to “extended overhead” recovery.

- H. Request for extension of time shall be made in writing within thirty (30) days following cause of delay. In case of continuing cause for delay, the Contractor shall notify the Designer of the delay within thirty (30) days of the beginning of the delay and only one claim is necessary.
- I. The Contractor shall notify his Surety in writing of extension of time granted.
- J. No claim shall be allowed on account of failure of the Designer to furnish Drawings or instructions until twenty (20) days after demand for such Drawings and/or instructions. See Article “Shop Drawings, Submittals, Samples, Data.”
- K. The Contractor shall carry on the Work and adhere to the schedule during all disputes or disagreements with the Owner or Designer. No Work shall be delayed or postponed pending resolution of any disputes or disagreements unless agreed to by both the Owner and Contractor in writing.
- L. In no event shall the Owner or Designer be liable to Contractor, any Subcontractor, any Supplier, or any other person or organization, or to any Surety for or employee or agent of any of them, for damages arising out of or resulting from delays within the control of the Contractor or delays beyond the control of both the Owner and Contractor, including fires, floods, epidemics, abnormal weather conditions, acts of God, or acts of neglect by utility owners or other contractors performing other Work.
- M. Time extensions granted to the Contractor shall cover all Work delays for Work items that may run concurrently. For example, if the Contractor is due a time extension for unusual weather phenomena and due a time extension for other delays to a critical path activity, the new Project completion date shall be based on the longer of the individually approved time extensions. The time extension granted for multiple delays shall **not** be additive. The only exception to this is where the Contractor can demonstrate to the satisfaction of the Engineer that the individual Work items cannot run concurrently.

#### **ARTICLE 45 – PARTIAL UTILIZATION/SUBSTANTIAL COMPLETION**

- A. The Owner may desire to occupy or utilize all or a portion of the Project when the Work is substantially complete on all or a portion of the Project.

- B. Prior to the final payment, the Owner may request the Contractor(s) in writing, through the Designer if applicable, to permit him to use a specified part of the Project which he believes he may use without significant interference with construction of the other parts of the Project. If the Contractor(s) agree, the Designer will schedule a substantial completion inspection, with the approval of the Owner, after which the Designer may issue a certificate of substantial completion on all or a portion of the Project. The certificate shall include the following documentation:
  - 1. Date of substantial completion.
  - 2. Portion of Project determined to be substantially complete.
  - 3. A tentative list of items to be completed or corrected before final payment.
- C. The Owner shall have the right to exclude the Contractor from any part of the Project which the Designer has so certified to be substantially complete, but the Owner will allow the Contractor reasonable access to complete or correct Work to bring it into compliance with the Contract.
- D. Occupancy by the Owner under this article will in no way relieve the Contractor from his contractual requirement to complete the Project within the specified time. The Contractor will not be relieved of liquidated damages because of use or occupancy by the Owner.

#### **ARTICLE 46 – FINAL INSPECTION, ACCEPTANCE, AND PROJECT CLOSEOUT**

- A. Upon written notification from the Contractor(s) that the Project is complete and ready for inspection, the Designer shall make a preliminary final inspection to verify that the Project is complete and ready for final inspection. Prior to final inspection, the Contractor(s) shall complete all items requiring corrective measures noted at the preliminary inspection. The Designer shall schedule a final inspection at a time and date acceptable to the Owner and Contractor(s).
- B. When contractors finish their Work prior to completion by other contractors, these Contracts shall be closed out through the final inspection, acceptance and final payment process on recommendation of the Designer and approval of the Owner.
- C. At the final inspection, the Designer shall, if job conditions warrant, record a list of items that are found to be incomplete or not in accordance with the Contract Documents. At the conclusion of the final inspection, the Designer and Owner shall make one of the following determinations:
  - 1. That the Project is completed and accepted. The “Date of Final Acceptance” is coincident with the date of the final inspection.
  - 2. That the Project is complete subject to the list of discrepancies (punch list). All punch list items must be completed within thirty (30) days of acceptance or the Owner may invoke the Article “Owner’s Right to Do Work.” The “Date of Final Acceptance” shall be no earlier than the date that the Project representative certifies completion of the punch list items.

3. That the Project is not complete. The Contractor must establish another date for a final inspection when Project is deemed incomplete.
- D. Within fourteen (14) days of acceptance as noted above or within fourteen (14) days after completion of punch list as noted above, the Designer shall certify the Work and issue applicable certificate(s) of compliance with the "Date of Final Acceptance" noted thereon.
- E. Any discrepancies listed or discovered after the date of final inspection and acceptance as noted above shall be handled in accordance with Article "Guarantee."
- F. The "Date of Final Acceptance" as indicated on the Certificate of Compliance will establish the following:
  1. The beginning of guarantees and warranties period.
  2. The date on which the Contractor's insurance coverage for public liability, property damage and builder's risk may be terminated.
  3. That no liquidated damages (if applicable) shall be assessed after this date.
  4. The termination date of utility cost to the Contractor.
- G. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents.
  1. Observations by Designer;
  2. Recommendation by Designer or payment by Owner of any progress or final payment;
  3. The issuance of a certificate of Substantial Completion or any payment related thereto by Owner;
  4. Use or occupancy of the Work or any part thereof by Owner;
  5. Any acceptance by Owner or any failure to do so;
  6. Any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Designer;
  7. Any inspection, test, or approval by others; or
  8. Any correction of defective Work by Owner.
- H. Acceptance of the Work, or any portion of the Work, by the Owner does not relieve the Contractor from acquiring acceptance of the Work from the North Carolina Department of Transportation or any other such regulatory agency having approval authority over any portion of the Project. Furthermore, acceptance of the Work or any portion of the Work by the North Carolina Department of Transportation or any other such regulatory agency having approval authority does not obligate the Owner to grant acceptance of the Work.

#### **ARTICLE 47 – CORRECTION OF WORK BEFORE FINAL PAYMENT**

- A. Any Work, materials, fabricated items or other parts of the Work which have been condemned or declared not in accordance with the Contract by the Designer shall be promptly removed from the Work Site by the Contractor, and shall be immediately replaced by new Work in accordance with the Contract at no additional cost to the Owner. Work or property of other contractors or the Owner, damaged or destroyed by virtue of such faulty Work, shall be made good at the expense of the Contractor whose Work is faulty.
- B. Correction of condemned Work described above shall commence within twenty-four (24) hours after receipt of notice from the Designer, and shall make satisfactory progress until completed.
- C. Should the Contractor fail to proceed with the required corrections, then the Owner may complete the Work in accordance with the provisions of Article “Owner’s Right to Do Work.”

#### **ARTICLE 48 – CORRECTION OF WORK AFTER FINAL PAYMENT**

See Article “Performance Bond and Payment Bond,” and Article “Guarantee.” Neither the final certificate, final payment, occupancy of the premises by the Owner, nor any provision of the Contract, nor any other act or instrument of the Owner, nor the Designer, shall relieve the Contractor from responsibility for negligence, or faulty material or workmanship, or failure to comply with the Drawings and Specifications. He shall correct or make good any defects due thereto and repair any damage resulting therefrom, which may appear during the guarantee period following final acceptance of the Work except as stated otherwise under Article “Guarantee.” The Owner will report any defects as they may appear to the Contractor and establish a time limit for completion of corrections by the Contractor. The Owner will be the judge as to the responsibility for correction of defects.

#### **ARTICLE 49 – ACCEPTANCE OF DEFECTIVE WORK**

If instead of requiring correction or removal and replacement of defective or faulty Work, Owner prefers to accept it, Owner may do so. Contractor shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) attributable to Owner’s evaluation of and determination to accept such defective Work and the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Designer’s recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

## **ARTICLE 50 – OWNER’S RIGHT TO DO WORK**

- A. If, during the progress of the Work or during the period of guarantee, the Contractor fails to prosecute the Work properly or to perform any provision of the Contract, the Owner, after fifteen (15) days’ written notice sent by certified mail, return receipt requested, to the Contractor from the Designer, may perform or have performed that portion of the Work. If the Work is deemed to be an emergency, the Owner may dispense with the fifteen (15) days’ written notice and proceed with the Work immediately. The cost of the Work may be deducted from any amounts due or to become due to the Contractor. Should the cost of such action of the Owner exceed the amount due or to become due the Contractor, then the Contractor or his Surety, or both, shall be liable for and shall pay to the Owner the amount of said excess. The Contractor shall not be allowed an extension of Time of Completion (or milestones) because of any delay in the performance of the Work attributable to the exercise by the Owner of Owner’s rights and remedies.
- B. In exercising the rights and remedies under this paragraph, Owner shall proceed expeditiously. In connection with such corrective and remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor’s services related thereto, take possession of Contractor’s tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner’s representatives, agents and employees, Owner’s other contractors, and Designer and Designer’s Consultants access to Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. The Owner may have other Work performed at the Site by Owner’s employees, contractors, or utility owners. Contractor shall afford each other Contractor who is a party to such other Work proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other Work and shall properly coordinate the Work with theirs.

## **ARTICLE 51 – TERMINATION BY OWNER AND REMEDIES**

- A. If the Contractor fails to begin the Work under the Contract within the time specified, or the progress of the Work is not maintained on schedule, or the Work is not completed within the time specified, or if the Contractor fails to perform the Work with sufficient workmen and equipment or with sufficient materials to ensure the prompt completion of said Work, or shall perform the Work unsuitably or shall discontinue the prosecution of the Work, or if the Contractor shall become insolvent or be declared bankrupt or commit any act of bankruptcy or insolvency, or allow any final judgment to stand against him unsatisfied for a period of forty-eight (48) hours, or shall make an assignment for the benefit of creditors, or disregards laws, regulations, or direction of the Designer, or for any other cause whatsoever shall not carry on the Work in an acceptable manner, the Owner may give notice in writing, sent by certified mail, return receipt requested, to the Contractor and his Surety of such delay, neglect or default, specifying the same, and if the Contractor within a period of fifteen (15) days after such notice shall not proceed in accordance therewith, then the Owner shall declare this Contract in default, and, thereupon, the Surety shall promptly take over the Work and complete the performance of this Contract in the manner and within the time frame specified. In the event the Surety shall fail to take over the Work to be done under this Contract within fifteen (15) days

after being so notified and notify the Owner in writing, sent by certified mail, return receipt requested, that he is taking the same over and stating that he will diligently pursue and complete the same, the Owner shall have full power and authority, without violating the Contract, to take the prosecution of the Work out of the hands of said Contractor, to appropriate or use any or all Contract materials and equipment on the grounds as may be suitable and acceptable and may enter into an agreement, either by public letting or negotiation, for the completion of said Contract according to the terms and provisions thereof or use such other methods as in his opinion shall be required for the completion of said Contract in an acceptable manner. All costs and charges incurred by the Owner, together with the costs of completing the Work under Contract, shall be deducted from any monies due or which may become due said Contractor and Surety. In case the expense so incurred by the Owner shall be less than the sum which would have been payable under the Contract, if it had been completed by said Contractor, then the said Contractor and Surety shall be entitled to receive the difference, but in case such expense shall exceed the sum which would have been payable under the Contract, then the Contractor and the Surety shall be liable and shall pay to the Owner the amount of said excess.

- B. Upon fifteen (15) days' written notice to Contractor and Designer, Owner may, without cause and without prejudice to any other right or remedy of Owner, elect to terminate the Contract. In such case, Contractor shall be paid (without duplication of any items):
  - 1. For completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
  - 2. For expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
  - 3. For reasonable expenses directly attributable to termination.
- C. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

## **ARTICLE 52 – CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT**

- A. Should the Work be stopped by order of a court having jurisdiction, or by order of any other public authority for a period of three (3) months, due to cause beyond the fault or control of the Contractor, or if the Owner, without cause, should fail or refuse to make payment based on a Request for Payment approved by the Designer within forty-five (45) days after receipt of same, then the Contractor, after fifteen (15) days' written notice sent by certified mail, return receipt requested, to the Owner and the Designer, may suspend operations on the Work or terminate the Contract.
- B. In the event that the Contract is terminated due to cause beyond the fault or control of the Contractor, the Owner shall be liable to the Contractor for the cost of all materials delivered and Work performed on this Contract as determined according to the Article "Changes in the Work". The Designer shall determine the correctness of such payment.



**ARTICLE 53 – REQUESTS FOR PAYMENT**

- A. Not later than the fifth day of the month, the Contractor shall submit to the Designer a Request for Payment for Work done during the previous month. The request shall be in the form “Request for Payment” in the Contract Documents and shall show substantially the value of Work done and materials delivered to the Site during the period since the last payment, and shall sum up the financial status of the Contract with the following information:
  - 1. Total of Contract including approved Change Orders.
  - 2. Value of Work completed to date and properly stored on-site materials.
  - 3. Less five percent (5%) retainage, provided however, that after fifty percent (50%) of the Contractor’s Work has been satisfactorily completed on schedule, with written consent of the Surety, the Owner shall not require any additional retainage. If the Owner determines the Contractor’s performance is unsatisfactory, the Owner may reinstate retainage for each subsequent payment. There shall be no retainage on contracts with a bid amount less than \$100,000.
  - 4. Less previous payments.
  - 5. Current amount due.
- B. The Contractor, upon request of the Designer, shall substantiate the request with invoices of vouchers or payrolls or other evidence.
- C. The Contractor shall submit a fully completed “Periodic Payment Itemized Tax Statement” and “Periodic Payment Tax Certification” form with each Request for Payment.
- D. Prior to submitting the first request, the Contractor shall prepare for the Designer a schedule showing a breakdown of the Contract Price into values of the various parts of the Work, so arranged as to facilitate payments to Subcontractors in accordance with Article “Contractor and Subcontractor Relationships.” The Contractor(s) shall list the value of each Subcontractor and Supplier, identifying each minority business Subcontractor and Supplier as listed in Affidavit C, if applicable.
- E. Payment for Mobilization in excess of 3% of the initial Contract value shall be made with the Final Payment.
- F. Twenty percent (20%) of the payment for installed underground piping may be withheld until the installed piping has passed all necessary testing requirements and the required vegetative cover has been established, or at the discretion of the Owner, seeding and mulching has been performed. A separate line item for “Testing and Vegetative Cover over Piping” may be shown on the schedule that reflects a cost of at least 25% of the underground piping cost.
- G. When payment is made on account of stored materials and equipment, such materials must be stored on the Owner’s property, and the requests for payments shall be accompanied by invoices or bills of sale or other evidence to establish the Owner’s title to such materials and equipment. Responsibility for such stored materials and equipment shall remain with the Contractor regardless of ownership title. Such

stored materials and equipment shall not be removed from the Owner's property. Should the space for storage on-site be limited, the Contractor, at his option, shall be permitted to store such materials and/or equipment in a suitable space off-site. Should the Contractor desire to include any such materials or equipment in his Request for Payment, they must be stored in the name of the Owner in a commercial warehouse approved by the Designer and the Owner and located as close to the Site as possible. The warehouse selected must be approved by the Contractor's bonding and insurance companies; the material to be paid for shall be assigned to the Owner and shall be inspected by the Designer. Upon approval by the Designer of the storage facilities and materials and equipment, payment therefore will be certified. Responsibility for such stored materials and equipment shall remain with the Contractor. Such stored materials and equipment shall not be moved except for transportation to the Project Site. Under certain conditions, the Designer may approve storage of materials at the point of manufacture, which conditions shall be approved by the Designer and the Owner prior to approval for the storage and shall include an agreement by the storing party which unconditionally gives the Owner absolute right to possession of the materials at any time. Bond, security and insurance protection shall continue to be the responsibility of the Contractor(s).

- H. Along with each Request for Payment, the Contractor shall submit evidence to the Designer showing that all record Drawings are up to date.
- I. Along with each Request for Payment, the Contractor shall submit either a statement indicating that no claims for extension of time due to weather is to be made during the billing period OR shall make claims for extension of time for the billing period in accordance with the article "Time of Completion, Delays, Extension of Time."

#### **ARTICLE 54 – APPROVAL OF PAYMENTS AND FINAL PAYMENT**

- A. Within ten (10) days from receipt of Request for Payment from the Contractor, the Designer shall issue and forward to the Owner the approved Request for Payment. This Request for Payment shall indicate the amount requested or as approved by the Designer. If the request is not approved by the Designer, he shall state in writing to the Contractor and the Owner his reasons for withholding payment. In the latter case, the Contractor may make the necessary corrections and resubmit the Request for Payment.
- B. No approval of a Request for Payment or payment made shall constitute an acceptance of the Work or any part thereof. The making and acceptance of final payment shall constitute a waiver of all claims by the Owner except:
  - 1. Claims arising from unsettled liens or claims against the Contractor.
  - 2. Faulty Work or materials appearing after final payment.
  - 3. Failure of the Contractor to perform the Work in accordance with Drawings and Specifications, such failure appearing after payment.
  - 4. As conditioned in the performance bond and payment bond.
- C. The making and acceptance of final payment shall constitute a waiver of all claims by the Contractor except those claims previously made and remaining unsettled (Article "Claims for Extra Cost").

- D. Prior to submitting final Request for Payment to the Designer for approval, the Contractor shall fully comply with all requirements specified in Article “Final Inspection, Acceptance, and Project Closeout.” These requirements include, but are not limited to the following:
  - 1. Submittal of Product and Operating Manuals, Warranties and Bonds, Guarantees, Maintenance Agreements, properly certified As-Built Drawings, Record Drawings, Certificates of Inspection or Approval from agencies having jurisdiction. (The Designer must approve the Manuals prior to delivery to the Owner).
  - 2. Transfer of required stock material and all keys in an organized manner.
  - 3. Record of Owner’s training.
  - 4. Resolution of any final inspection discrepancies.
- E. The Contractor shall forward to the Designer, the final Request for Payment along with the following documents:
  - 1. List of minority business Subcontractors and material Suppliers showing breakdown of contracts amount.
  - 2. Contractor’s Affidavit of Release of Liens.
  - 3. “Final Tax Certification” form with all fully completed “Periodic Payment Itemized Tax Statement” and “Periodic Payment Tax Certification” forms corresponding to each Request for Payment.
  - 4. Affidavit of Contractor’s payment to material Suppliers and Subcontractors. (See Article “Contractor’s Affidavit”).
  - 5. Consent of Surety to Final Payment.
  - 6. Certificates of state agencies required by state law.
  - 7. Record Drawings
  - 8. As-Built Drawings
- F. The Designer will not authorize final payment until the Work under Contract has been certified by Designer, certificates of compliance issued, and the Contractor has complied with the closeout requirements. The Designer shall forward the Contractor’s final Request for Payment to the Owner along with respective certificate(s) of compliance required by law.
- G. After the request for final payment by the Contractor, all quantities of materials installed on the Project shall be reviewed for accuracy and any errant or outdated quantity information supplied on previously submitted Pay Applications, or any other source, shall be rectified on the Final Pay Application to reflect the actual quantity of materials installed on the Project.

## **ARTICLE 55 – PAYMENTS WITHHELD**

- A. The Designer, with the approval of the Owner, may withhold payment for the following reasons:
  - 1. Faulty Work not corrected.
  - 2. The unpaid balance on the Contract is insufficient to complete the Work in the judgment of the Designer.
  - 3. To provide for sufficient Contract balance to cover liquidated damages that will be assessed.
  - 4. Missing or improperly completed documentation required by the Contract Documents.
- B. In addition to the reasons noted above, the Owner may authorize the withholding of payment for the following reasons:
  - 1. Claims filed against the Contractor or evidence that a claim will be filed.
  - 2. Evidence that Subcontractors have not been paid.
- C. When grounds for withholding payments have been removed, payment will be released. Delay of payment due the Contractor without cause will make Owner liable for payment of interest to the Contractor as provided in NCGS 143-134.1.

## **ARTICLE 56 – ACCESS TO PERSONS AND RECORDS**

The State Auditor and the using agency's internal auditors shall have access to persons and records as a result of all contracts or grants entered into by State agencies or political subdivisions in accordance with General Statute 147-64.7 and Session Law 2010-194, Section 21 (i.e., the State Auditors and internal auditors may audit the records of the Contractor during the term of the Contract to verify accounts and data affecting fees or performance).

## **ARTICLE 57 – TAXES**

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the location of the Project which are applicable during the performance of the Work. Specific guidelines include the following:
- B. Federal excise taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3442(3)).
- C. Federal transportation taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3475(b) as amended).
- D. North Carolina sales tax and use tax, as required by law, do apply to materials entering into state work and such costs shall be included in the bid proposal and Contract sum.

- E. Local option sales and use taxes, as required by law, do apply to materials entering into state work as applicable and such costs shall be included in the bid proposal and Contract sum.

**F. The Amount of County Sales and Use Tax Paid Per Contractor's Statements**

1. Contractors shall give the Owner a signed statement containing the information listed in NCGS 105-164.14(e).
2. The Contractor shall submit a certified statement setting forth the Project, date, the type of property and the cost of the property purchased from each vendor, the county in which the vendor made the sale and the amount of local sales and use taxes paid thereon. If the property was purchased out-of-state, the county in which the property was delivered shall be listed. Sales receipts shall be included with the statement. The Contractor is hereby notified that the certified statement may be subject to audit.
3. In the event the Contractors make several purchases from the same vendor, such certified statement must indicate the invoice numbers, the inclusive dates of the invoices, the total amount of the invoices, the counties, and the county sales and use taxes paid thereon.
4. Name of taxing county: The position of a sale is the retailer's place of business located within a taxing county where the vendor becomes contractually obligated to make the sale. Therefore, it is important that the county tax be reported for the county of sale rather than the county of use.
5. When property is purchased from out-of-state vendors and the county tax is charged, the county should be identified where delivery is made when reporting the county tax.
6. Such statement must also include the cost of any tangible personal property withdrawn from the Contractor's warehouse stock and the amount of county sales or use tax paid thereon by the Contractor.
7. Similar certified statements by his Subcontractors must be obtained by the general Contractor and furnished to the claimant.
8. Contractors are not to include any tax paid on supplies, tools and equipment which they use to perform their contracts and should include only those building materials, supplies, fixtures and equipment which actually become a part of or annexed to the Work.
9. Contractor shall provide a completed "Final Tax Certification" form, including copies of all Periodic Payment Tax Certifications, with the application for final payment.

**ARTICLE 58 – MINIMUM INSURANCE REQUIREMENTS**

The Work under this Contract shall not commence until the Contractor has obtained all required insurance and verifying certificates of insurance have been approved in writing by the Owner. The Contractor shall provide and maintain, during the life of the Contract,

comprehensive general liability insurance, including coverage for premises operations, independent contractors, completed operations, products and contractual exposures, as shall protect such contractors from claims arising out of any bodily injury, including accidental death, as well as from claims for property damages which may arise from operations under this Contract, whether such operations be by the Contractor or by any Subcontractor, or by anyone directly or indirectly employed by either of them. The Contractor shall purchase and maintain property insurance during the life of this Contract, upon the entire Work at the Site to the full insurable value thereof that shall include the interests of the Owner, the Contractor, the Subcontractors in the Work and shall insure against the perils of fire, extended coverage, and vandalism and malicious mischief. If the Owner is damaged by failure of the Contractor to purchase or maintain such insurance, then the Contractor shall bear all reasonable costs properly attributable thereto; the Contractor shall effect and maintain similar property insurance on portions of the Work stored off the Site when Request for Payment per articles so includes such portions. The Contractor shall ensure that all Subcontractors are insured to at least the same extent required of the Contractor. Unless modified by the "Notice to Bidders," the minimum insurance requirements are as outlined below.

**A. Contractor's Liability Insurance**

1. Contractor shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
  - a. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
  - b. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
  - c. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
  - d. claims for damages insured by reasonably available personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or (ii) by any other person for any other reason;
  - e. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
  - f. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle.
2. The policies of insurance so required by this paragraph to be purchased and maintained shall:

- a. with respect to insurance required by Paragraphs (A.1.c) through (A.1.f) inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) Owner, Designer, Designer's Consultants, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, and other consultants and Subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
- b. include at least the specific coverages and be written for not less than the limits of liability provided in the paragraph below Notice to Bidders, or required by Laws or Regulations, whichever is greater;
- c. include completed operations insurance;
- d. include contractual liability insurance covering Contractor's indemnity obligations;
- e. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least thirty (30) days" prior written notice has been given to by certified mail/return receipt requested to Owner and Contractor and to each other additional insured to whom a certificate of insurance has been issued;
- f. remain in effect at least until written Project acceptance and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work; and
- g. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least three (3) years after final payment.

## **B. Property Insurance**

- 1. Unless otherwise provided in the Notice to Bidders, Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof. This insurance shall:
  - a. include the interests of Owner, Contractor, Subcontractors, Designer, Designer's consultants, and any other individuals or entities identified in the Notice to Bidders and the officers, directors, partners, employees, agents, and other consultants and Subcontractors of each and any of them, each of whom is deemed to have an insurable interest;
  - b. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils or causes of loss as may be specifically required by the Notice to Bidders;

- c. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of Designers);
  - d. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in a Request for Payment recommended by Designer;
  - e. allow for partial utilization of the Work by Owner;
  - f. include testing and startup; and
  - g. be maintained in effect until final acceptance is made unless otherwise agreed to in writing by Owner, Contractor, and Designer with thirty (30) days' written notice to each other additional insured.
- 2. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained will contain a provision or endorsement that the coverage afforded will not be cancelled or materially changed or renewal refused until at least thirty (30) days prior to written notice has been given to Owner and Contractor and to each other additional insured.
  - 3. Owner shall not be responsible for purchasing and maintaining any property insurance to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.
  - 4. If Contractor requests in writing that other special insurance be included in the property insurance policies, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

### **C. Deductible**

Any deductible, if applicable to loss covered by insurance provided, is to be borne by the Contractor.

### **D. Proof of Carriage**

The Contractor shall furnish the Owner with satisfactory proof of carriage of the insurance required before written approval is granted by the Owner.

### **E. Limits of Liability**

#### *Worker's Compensation*

- 1. State: Statutory
- 2. Applicable Federal (e.g. Longshoreman's): Statutory
- 3. Employer's Liability: \$500,000



*Automobile Liability*

1. Bodily Injury:  
    \$1,000,000 Each Person  
    \$1,000,000 Each Accident  
    Property Damage:  
    \$1,000,000 Each Accident  
**or**
2. Combined Single Limit (Bodily Injury and Property Damage):  
    \$1,000,000 Each Accident

*Employer's Other Liability*

1. Gen. Aggregate (except Products- Completed Operations): \$2,000,000
2. Products- Completed Operations: \$2,000,000
3. Personal & Advertising Injury (per person/organization): \$1,000,000
4. Each Occurrence (Bodily Injury & Property Damages): \$1,000,000
5. Excess Liability:
  - a. General Aggregate: \$2,000,000
  - b. Each Occurrence: \$2,000,000
6. Property damage liability insurance will provide Explosion, Collapse, and Underground coverage where applicable.
7. Pollution Liability: \$1,000,000 per occurrence
8. Professional Liability: \$1,000,000 per occurrence

**F. Receipt and Application of Insurance Proceeds**

1. Any insured loss under the policies of insurance will be adjusted with Owner and made payable to Owner as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.
2. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within fifteen (15) days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If so such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

**G. Right of Recovery; Subrogation**

Contractor shall have no right of recovery or subrogation against County (including its officers, agents and employees), it being the intention of the parties that the insurance policies so affected shall protect both parties and be primary coverage for any and all losses covered by the aforementioned insurance.

## **ARTICLE 59 – PERFORMANCE BOND AND PAYMENT BOND**

- A. Each Contractor shall furnish a performance bond and payment bond executed by a Surety company authorized to do business in North Carolina. The bonds shall be at least equal to the full Contract amount. Bonds shall be executed in the form bound with these Specifications. The bonds shall be delivered with the executed Contract. These bonds shall remain in effect at least through the warranty period, but in no case less than one year after the date of Owner acceptance of the Project.
- B. All bonds shall be countersigned by an authorized agent of the bonding company who is licensed to do business in North Carolina and shall include a certified copy of such agent's authority to act.
- C. If the Surety on any Bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located, Contractor shall within twenty (20) days thereafter substitute another Bond and Surety.
- D. An additional performance guarantee with the North Carolina Department of Transportation may be required for Work performed in the right-of-way. In this event, the Contractor, within ten (10) days of receipt of the "Notice of Award," shall supply the Owner with a copy of the executed performance guarantee and evidence of acceptance by the NCDOT. The Contractor shall perform all Work within the right-of-way in accordance with the "Policies and Procedures for Accommodating Utilities on Highway Rights of Way" and the provisions of the Encroachment Agreement. Any necessary guarantees and agreements between the Contractor and NCDOT must be in place prior to the Contractor performing any construction activities within the NCDOT right-of-way. Failure of the Contractor to receive concurrence from the NCDOT allowing the Contractor to Work within the right of way shall not be grounds for extension of the Contract Time.
- E. The Owner reserves the right to not release the Performance Bond until the NCDOT has approved the portion of the completed Work within the NCDOT right-of-way stipulated in the Project encroachment agreement.

## **ARTICLE 60 – CONTRACTOR'S AFFIDAVIT**

The final payment of retained amount due the Contractor on account of the Contract shall not become due until the Contractor has furnished to the Owner through the Designer an affidavit signed, sworn and notarized to the effect that all payments for materials, services or subcontracted Work in connection with his Contract have been satisfied, and that no claims or liens exist against the Contractor in connection with this Contract. In the event that the Contractor cannot obtain similar affidavits from Subcontractors to protect the Contractor and the Owner from possible liens or claims against the Subcontractor, the Contractor shall state in his affidavit that no claims or liens exist against any Subcontractor to the best of his (the Contractor's) knowledge, and if any appear afterward, the Contractor shall save the Owner harmless.

## **ARTICLE 61 – ASSIGNMENTS**

The Contractor shall not assign any portion of this Contract nor subcontract in its entirety. Except as may be required under terms of the performance bond or payment bond, no funds or sums of money due or become due the Contractor under the Contract may be assigned.

## **ARTICLE 62 – CLEANING UP**

- A. The Contractors shall keep the Project, buildings, and surrounding area reasonably free from rubbish at all times, and shall remove debris from the Site on a timely basis or when directed to do so by the Designer or Project Expediter. The Project Expediter shall provide an on-site refuse container(s) for the use of all Contractors. Each Contractor shall remove their rubbish and debris from the building on a daily basis. Disposal of waste material, rubbish, and other debris shall conform to applicable Laws and Regulations. The Project Expediter shall broom clean the building as required to minimize dust and dirt accumulation.
- B. The Project Expediter shall provide and maintain suitable all-weather access to buildings.
- C. Before final inspection and acceptance of buildings, each Contractor shall clean his portion of the Work, including glass, hardware, fixtures, masonry, tile and marble (using no acid), clean and wax all floors as specified, and completely prepare the building for use by the Owner, with no cleaning required by the Owner.
- D. Prior to substantial completion of the Work, Contractor shall clean the Site and make it ready for utilization by Owner. At the completion of the Work, Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- E. All material including construction debris, etc., which is not to be used at the Project Site must be legally disposed of off the Project Site at the Contractor's expense. Survey stakes are not considered debris and shall be removed only at the direction of the Designer.
- F. All Contractors are responsible for maintaining streets, parking lots, walks and grounds connecting to the Project area which shall be protected from deposits of mud, sand, stone, litter or debris of any form. All mud collected on vehicle wheels must be cleaned off by spraying each tire and the underside of vehicle before leaving the construction Site. Should any mud or debris from the construction Project collect on the streets, this shall be removed immediately.

## **ARTICLE 63 – GUARANTEE**

- A. The Contractor warrants and guarantees to Owner, Designer, and Designer's consultants that all Work shall be in accordance with the Contract Documents and will not be defective.
- B. All warranties and guarantees shall expressly run to the benefit of the Owner.

- C. The Contractor shall unconditionally guarantee materials and workmanship against patent defects arising from faulty materials, faulty workmanship or negligence for a period of twelve (12) months following the date of final acceptance of the Work and shall replace such defective materials or workmanship without cost to the Owner.
- D. Where items of equipment or material carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material. The Contractor shall replace such defective equipment or materials, without cost to the Owner, within the manufacturer's warranty period.
- E. All warranties shall be construed under and in accordance with the State of North Carolina.
- F. All materials and equipment incorporated into the Work shall be good quality and new, unless specified otherwise.
- G. Additionally, the Owner may bring an action for latent defects caused by the negligence of the Contractor which is hidden or not readily apparent to the Owner at the time final acceptance in accordance with applicable law.
- H. Additional guarantees for roof, equipment, materials, and supplies may be stipulated in the Specifications sections governing such roof, equipment, materials, or supplies.
- I. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instruction of the applicable Supplier or manufacturer.
- J. If required by the Designer, the Contractor shall provide satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- K. Any defective materials or workmanship replaced or repaired during the initial warranty period shall extend the warranty period for a period of twelve (12) months following Owner acceptance of the replacement material or workmanship.

## **ARTICLE 64 – INDEMNIFICATION**

- A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, Designer, Designer's Consultants, and the officers, directors, partners, employees, agents, and other consultants and Subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage:
  - 1. is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom; and

2. is caused in whole or in part by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts of them may be liable, regardless of whether or not caused in part by any negligence or omission of an individual or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such individual or entity.
- B. In any and all claims against Owner or Designer or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work of anyone for whose acts any of them may be liable, the indemnification obligation above shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability acts, or other employee benefit acts.
- C. This Section shall survive any expiration or termination of the Contract.

#### **ARTICLE 65 – CONTRACTOR EVALUATION**

The Contractor's overall Work performance on the Project shall be fairly evaluated for determining qualifications to bid on future County capital improvement Projects. In addition to final evaluation, interim evaluation may be prepared during the progress of the Project. Evaluations shall be performed by the Owner and Designer. The Owner may request the Contractor's comments to evaluate the Designer.

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## **BRUNSWICK COUNTY, NORTH CAROLINA**



### **SUPPLEMENTARY GENERAL CONDITIONS SECTION 007300**

The Supplementary General Conditions contain changes and additions to the "General Conditions of the Contract."

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#### **SECTION 007300 - SUPPLEMENTARY GENERAL CONDITIONS**

#### **PART I - AMENDMENTS TO GENERAL CONDITIONS**

These Supplementary General Conditions amend or supplement the OWNER's "General Conditions of the Contract", May 2019 Version) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

## ARTICLE 2 – TERMINOLOGY AND INTENT OF DOCUMENTS

### SGC-2B.

The phrase “Instructions to Bidders,” occurs twice in this paragraph. Delete the second occurrence.

## ARTICLE 5 – SITE DOCUMENTATION

### SGC-5.

At the end of Article 5, insert the following: “See Specification Section 013233 for further details on Site Documentation.”

## ARTICLE 8 – COPIES OF DESIGN DRAWINGS AND SPECIFICATIONS

### SGC-8A.

Delete Paragraph 8A of the General Conditions in its entirety. Replace with “General Contractor and single-prime Contractor – Up to three (3) sets of general Contractor drawings and specifications, and one electronic copy.”

### SGC-8B.

Delete Paragraph 8B of the General Conditions in its entirety. Replace with “Each other Contractor – Up to three (3) sets of the appropriate drawings and specifications, and one electronic copy.”

## ARTICLE 10 – SHOP DRAWINGS, SUBMITTALS, SAMPLES, DATA

### SGC-10B.

Delete “A minimum of three (3) copies of each submittal shall be submitted to the Designer to retain and the Contractor shall supply, at the request of the Designer, additional copies as needed.” Replace with “An electronic copy of each submittal shall be submitted to the Designer to retain.”

### SGC-10F.

Delete Paragraph 10F in its entirety. Replace with “The Owner may assess the Contractor the cost of shop drawing review for shop drawing submittals in excess of two for any one item.”

## ARTICLE 12 – RECORD DRAWINGS AND SPECIFICATIONS AT THE JOB SITE

### SGC-12.

Delete the 3<sup>rd</sup> sentence and insert the following therefor: “These materials shall be annotated to show changes made during construction including but not limited to, adjustments to elevations, dimensions, locations, and materials incorporated into the completed Work.”



## ARTICLE 20 – SUBSURFACE AND PHYSICAL CONDITIONS

SGC-20D.

Delete Paragraph D3 in its entirety. Replace with “Reserved”.

## ARTICLE 23 – UTILITIES, STRUCTURES, SIGNS

SGC-23A.

Delete Paragraph 23A in its entirety. Replace with “The Project Expediter shall provide necessary and adequate facilities for water, electricity, gas, oil, sewer, and other utility services, which may be necessary and required for completion of the project. Any permanent meters installed shall be listed in the Project Expediter’s name until his work is fully accepted by the Owner. The Project Expediter shall pay all utilities costs. The Project Expediter may recover actual costs of metered utilities from the responsible party should delays occur in project completion.”

SGC-23J.

Delete Paragraph 23J in its entirety. Replace with “The Project Expediter shall furnish all materials, equipment, services, and incidentals in accordance with Specification Section 015000, Temporary Facilities and Controls.”

## ARTICLE 29 – INSPECTION OF THE WORK

SGC-29E.

Delete Paragraph 29E in its entirety. Replace with “If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner or Designer may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner or Designer to stop the Work shall not give rise to any duty on the part of Owner or Designer to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.”

## ARTICLE 32 – SCHEDULE

SGC-32K.

After Paragraph 32K, add the following new Paragraph 32L:

“L. Project Expediter shall also comply with the additional scheduling requirements of Specification Section 013200, Construction Progress Documentation.”

## ARTICLE 33 – WORKING HOURS

SGC-33.

At the end of Article 33, insert the following: “Owner observes the following holidays: New Year’s Day, Martin Luther King Jr. Day, Good Friday, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the day after Thanksgiving, Christmas Eve, and Christmas Day.”

## ARTICLE 37 – DESIGNER’S STATUS

SGC-37.

Delete Article 37 in its entirety. Replace with the following:

### “A. Owner’s Representative

Designer will be Owner’s representative during the construction period. The duties and responsibilities and the limitations of authority of Designer as Owner’s representative during construction are set forth in the Contract.

### B. Visits to Site

1. Designer will make visits to the Site at intervals appropriate to the various stages of construction as Designer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor’s executed Work. Based on information obtained during such visits and observations, Designer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Designer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Designer’s efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Designer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
2. Designer’s visits and observations are subject to all the limitations on Designer’s authority and responsibility set forth in Paragraph 37H. Particularly, but without limitation, during or as a result of Designer’s visits or observations of Contractor’s Work, Designer will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

### C. Project Representative

If Owner and Designer have agreed that Designer will furnish a Resident Project Representative (RPR) to represent Designer at the Site and assist Designer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary General Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 37H. If Owner designates another representative or agent to represent Owner at the Site who is not Designer’s consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary General Conditions.

The Resident Project Representative will be Designer's representative at the Site, will act as directly by and under the supervision of Designer, and will confer with Designer regarding RPR's actions.

1. General: RPR's dealings in matters pertaining to the Work in general shall be with Designer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner only with the knowledge of and under the direction of Designer.
2. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Designer concerning acceptability.
3. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.
4. Liaison:
  - a. Serve as Designer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
  - b. Assist Designer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.
  - c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.
5. Interpretation of Contract Documents: Report to Designer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Designer.
6. Shop Drawings and Samples:
  - a. Record date of receipt of Samples and Contractor-approved Shop Drawings.
  - b. Receive Samples which are furnished at the Site by Contractor and notify Designer of availability of Samples for examination.
  - c. Advise Designer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Designer.
7. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to Designer. Transmit to Contractor in writing decisions as issued by Designer.
8. Review of Work and Rejection of Defective Work:

- a. Conduct on-Site observations of Contractor's work in progress to assist Designer in determining if the Work is in general proceeding in accordance with the Contract Documents.
- b. Report to Designer whenever RPR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Designer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

9. Inspections, Tests, and System Start-ups:

- a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.
- b. Observe, record, and report to Designer appropriate details relative to the test procedures and systems start-ups.

10. Records:

- a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Designer.
- b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.
- c. Maintain records for use in preparing Project documentation.

11. Reports:

- a. Furnish to Designer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.
- b. Draft and recommend to Designer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.
- c. Immediately notify Designer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

12. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Designer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.
13. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Designer for review and forwarding to Owner prior to payment for that part of the Work.
14. Completion:
  - a. Participate in Designer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.
  - b. Participate in Designer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.
  - c. Observe whether all items on the final list have been completed or corrected and make recommendations to Designer concerning acceptance and issuance of the notice of acceptability of the work.

D. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
2. Exceed limitations of Designer's authority as set forth in the Contract Documents.
3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Designer.
7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
8. Authorize Owner to occupy the Project in whole or in part.

#### E. Rejecting Defective Work

Designer has the authority to reject Work in accordance with Paragraph 29E.

#### F. Shop Drawings, Change Orders and Payments

1. Designer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Article 10.
2. Designer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 37J below.
3. Designer's authority as to Change Orders is set forth in Articles 38, 39, 40, 41 and 43.
4. Designer's authority as to Applications for Payment is set forth in Articles 52, 53 and 54.

#### G. Determinations for Unit Price Work

Designer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Article 39.

#### H. Decisions on Requirements of Contract Documents and Acceptability of Work

Designer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Designer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

#### I. Limitations on Designer's Authority and Responsibilities

1. Neither Designer's authority or responsibility under this Article 37 or under any other provision of the Contract, nor any decision made by Designer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Designer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Designer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
2. Designer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Designer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
3. Designer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

4. Designer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and any other documentation required to be delivered by Article 53 will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
5. The limitations upon authority and responsibility set forth in this Paragraph 37H shall also apply to the Resident Project Representative, if any.

#### J. Compliance with Safety Program

While at the Site, Designer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Designer has been informed.

#### K. Delegation of Professional Design Services

1. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
2. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Designer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Designer.
3. Owner and Designer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Designer have specified to Contractor all performance and design criteria that such services must satisfy.
4. Pursuant to this paragraph, Designer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Designer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose of determining if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Approval of Shop Drawings for equipment requiring Efficiency Guarantee Bonds will be withheld until the receipt of such Bonds.

5. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Designer.”

## ARTICLE 38 – CHANGES IN THE WORK

SGC-38B.

Delete the words “FAX OR” in the second paragraph.

## ARTICLE 46 – FINAL INSPECTION, ACCEPTANCE, AND PROJECT CLOSEOUT

SGC-46F.

Add the following to paragraph 1. “Some guarantees and warranties will commence sooner than the Date of Final Acceptance if early use (Partial Utilization) of a portion of the Project is taken, as defined in paragraph B Article 45.”

## ARTICLE 58 – MINIMUM INSURANCE REQUIREMENTS

SGC-58A.

In paragraph A.2.a, delete the phrase “Paragraphs (A.1.c) through (A.1.f) inclusive”. Replace with the phrase “Paragraphs (A.1.a) through (A.1.f) inclusive”.

At the end of paragraph A.2, insert the following new subparagraph:

- “h. All insurers waive all rights of subrogation against Owner and Designer, their officers, directors, partners, employees and other consultants and subcontractors.”

In paragraph A.2.e, delete the phrase “Owner and Contractor”. Replace with “Owner, Designer, and Contractor”.

SGC-58B.

At the end of paragraph B.1.a, delete the phrase “each of whom is deemed to have an insurable interest;”. Replace with “each of whom is deemed to have an insurable interest and shall be named as additional insureds;”.

SGC-58E.

Delete line items 2 and 3 under *Worker’s Compensation*. Replace with:

- |  |              |                      |
|--|--------------|----------------------|
| “2. Employer’s Liability                                   | \$500,000    | Each Occurrence      |
|  | \$500,000    | Disease per Employee |
| 3. U.S. Longshoremen’s and Harbor<br>Workers’ Compensation | \$1,000,000  |                      |
| 4. Admiralty Jurisdiction, Coverage/Program II             | \$1,000,000” |                      |



Delete line item 5 under *Employer's Other Liability*. Replace with:

"5. Excess Liability	\$5,000,000 Per Occurrence
	\$5,000,000 General Aggregate"

Delete line items 7 and 8 under *Employer's Other Liability*. Replace with:

"7. Contractor's Pollution Liability	\$2,000,000 Each Occurrence
	\$2,000,000 General Aggregate
8. Contractor's Professional Liability	\$1,000,000 Each Claim
	\$2,000,000 Annual Aggregate"

#### ARTICLE 63 – GUARANTEE

SGC-63D.

Add the following sentence to the end of paragraph D. "For parts of the Project providing early use by the Owner, warranties for equipment being used will commence on the date of Substantial Completion provided for the Partial Utilization, as defined in paragraph B of Article 45."

END OF SECTION 007300

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**Division 01**  
**General Requirements**



## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work performed by Owner.
4. Work under Owner's separate contracts.
5. Owner's product purchase contracts.
6. Contractor's use of site and premises.
7. Coordination with occupants.
8. Work restrictions.
9. Specification and Drawing conventions.

- B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 017300 "Execution" for coordination of Owner-installed products.

#### 1.3 DEFINITIONS

- A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

#### 1.4 PROJECT INFORMATION

- A. Project Identification: Northwest Water Treatment Plant, Concentrate Discharge Pipeline.

1. Project Location: Clearwell Drive, Butler Road, Mount Misery Road, and Hooper Road, all in Leland, NC 28451.

- B. Owner: Brunswick County, Public Utilities Operation Center, 250 Greywater Drive, Supply, NC 28462.

1. Owner's Representative: Bob Tweedy, PE (910-253-2680)

- C. Engineer: CDM Smith, 5400 Glenwood Ave, Suite 400, Raleigh, NC 27612.
  - 1. Engineer's Representative: Michael Pollard, PE (919-325-3507).
- D. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.
  - 1. See Section 013100 "Project Management and Coordination." for requirements for using web-based Project software.

#### 1.5 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
  - 1. Furnish and install an 18-inch PVC concentrate pipeline, over 4.5 miles, from the existing Northwest Water Treatment Plant to the discharge at the Caper Fear River.
- B. Type of Contract:
  - 1. Project will be constructed under a single prime contract.

#### 1.6 WORK PERFORMED BY OWNER

- A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. Concurrent Work: The following construction operations will be occurring at or adjacent to the Project site. Those operations will be conducted simultaneously and have connections to Work under this Contract.
  - 1. Northwest Water Treatment Plant operations and maintenance by the County.
  - 2. Delivery and supply of water plant materials required for operations.
  - 3. Residuals final dewatering and hauling by a contract operator at the water plant.

#### 1.7 WORK UNDER OWNER'S SEPARATE CONTRACTS

- A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.
- B. Concurrent Work: Owner will award a separate contract for the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.
  - 1. Northwest Water Treatment Plant Expansion and Upgrades.
  - 2. New raw water connection by the Lower Cape Fear Water and Sewer Authority

## 1.8 CONTRACTOR'S USE OF SITE

- A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project. The Contractor is limited to using the temporary construction access for transporting all necessary to perform the Work.
- B. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair and pay for all damages caused by construction operations.

## 1.9 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy Project site and existing buildings during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
  - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
  - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
  - 1. Engineer will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.

2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

#### 1.10 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
  1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to between 7:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.
- C. On-Site Work Day restrictions: Do not perform work resulting in utility shutdowns or resulting in noisy activity on-site during work black-out days.
- D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:
  1. Notify Engineer and Owner not less than 7 days in advance of proposed utility interruptions.
  2. Obtain Engineer's or Owner's written permission before proceeding with utility interruptions.
- E. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.
  1. Notify Engineer and Owner not less than 7 days in advance of proposed disruptive operations.
  2. Obtain Engineer's or Owner's written permission before proceeding with disruptive operations.
- F. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.
- G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- H. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
  1. Maintain list of approved screened personnel with Owner's representative.



## 1.11 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
  3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
  4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
  3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION (NOT USED)

END OF SECTION 011000

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## SECTION 012500 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 007200 "General Conditions" for requirements for substitution requests prior to award of Contract.
  - 2. Section 012100 "Allowances" for products selected under an allowance.
  - 3. Section 012300 "Alternates" for products selected under an alternate.
  - 4. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

#### 1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

#### 1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication, or installation method cannot be provided, if applicable.

- b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
  - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
  - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of Engineers and owners.
  - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
2. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation. Engineer will notify Contractor of acceptance or rejection of proposed substitution.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## 1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

## 1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Substitution request is fully documented and properly submitted.
  - c. Requested substitution will not adversely affect Contractor's construction schedule.
  - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - e. Requested substitution is compatible with other portions of the Work.
  - f. Requested substitution has been coordinated with other portions of the Work.
  - g. Requested substitution provides specified warranty.
  - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012500

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## SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
  - 2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

#### 1.3 MINOR CHANGES IN THE WORK

- A. Engineer will issue through Field Orders authorizing minor changes in the Work, not involving adjustment to the Contract Price or the Contract Time, on form included in Project Manual.

#### 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Price or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Requests For Proposal (RFP) issued by Engineer are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request after receipt of RFP, submit a quotation estimating adjustments to the Contract Price and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and

finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- e. Quotation Form: Use forms provided by Owner. .
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Engineer
- 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Price and the Contract Time.
  - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - 4. Include costs of labor and supervision directly attributable to the change.
  - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  - 6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
  - 7. Proposal Request Form: Use form provided by Owner.

## 1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012901 "Measurement and Payment" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Price to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012901 "Measurement and Payment" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

## 1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Change Order Request, Engineer will issue a Change Order for signatures of Owner and Contractor on form included in Project Manual.

## 1.7 WORK CHANGE DIRECTIVE

- A. Work Change Directive: Engineer may issue a Work Change Directive on form included in Project Manual. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Price or the Contract Time.



- B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012600

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## SECTION 012900 - PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 012600 "Contract Modifications Procedures" for administrative procedures for handling changes to the Contract.
  - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

#### 1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

#### 1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
  - 2. Submit the schedule of values to Engineer at earliest possible date, but no later than 5 days before the date scheduled for submittal of initial Applications for Payment.
  - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
  - 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
  - 5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract, as described in Section 011000 "Summary."

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:
  - a. Project name and location.
  - b. Owner's name.
  - c. Owner's Project number.
  - d. Name of Engineer.
  - e. Engineer's Project number.
  - f. Contractor's name and address.
  - g. Date of submittal.
2. Arrange schedule of values consistent with format of EJCDC Document C-620.
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
  - a. Related Specification Section or division.
  - b. Description of the Work.
  - c. Name of subcontractor.
  - d. Name of manufacturer or fabricator.
  - e. Name of supplier.
  - f. Change Orders (numbers) that affect value.
  - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
    - 1) Labor.
    - 2) Materials.
    - 3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
8. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
9. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
11. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
12. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

## 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Engineer by the 15<sup>th</sup> day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
  - 1. Submit draft copy of Application for Payment 5 days prior to due date for review by Engineer.
- D. Application for Payment Forms: Use EJCDC Document C-620 as form for Applications for Payment.
  - 1. Other Application for Payment forms proposed by the Contractor may be acceptable to Engineer and Owner. Submit forms for approval with initial submittal of schedule of values.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.
  - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
  - 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed.
  - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment.
  - 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 indicating 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.
- G. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
  - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  - 2. When an application shows completion of an item, submit conditional final or full waivers.
  - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  - 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  - 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- I. Maintain an updated set of drawings to be used as record drawings in accordance with Section 017839. As a prerequisite for monthly progress payments, exhibit the updated record drawings for review by Owner and Engineer for completeness and accuracy.
- J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
  - 1. List of subcontractors.
  - 2. Schedule of values.
  - 3. Contractor's construction schedule.
  - 4. Combined Contractor's construction schedule incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
  - 5. Products list (preliminary if not final).
  - 6. Sustainable design action plans, including preliminary project materials cost data.
  - 7. Schedule of unit prices.
  - 8. Submittal schedule.
  - 9. List of Contractor's staff assignments.
  - 10. List of Contractor's principal consultants.
  - 11. Copies of building permits.
  - 12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  - 13. Initial progress report.
  - 14. Report of preconstruction conference.

- K. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
    - a. Complete administrative actions, submittals, and Work proceeding this application, as described in Section 017700 "Closeout Procedures."
  2. Include initial submittal of closeout record drawings in accordance with Section 017839.
  3. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Certification of completion of final punch list items.
  3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  4. Final submittal of closeout record drawings in accordance with Section 017839.
  5. Updated final statement, accounting for final changes to the Contract Sum.
  6. AIA Document G706.
  7. AIA Document G706A.
  8. AIA Document G707.
  9. Evidence that claims have been settled.
  10. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  11. Final liquidated damages settlement statement.
  12. Proof that taxes, fees, and similar obligations are paid.
  13. Waivers and releases.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012900

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## SECTION 012901 - MEASUREMENT AND PAYMENT

### PART 1 GENERAL

#### 1.01 SCOPE

- A. This Section includes details for the measurement and payment of the various elements of the Work; with provisions applicable to lump sum prices, unit prices, alternatives and allowances, if applicable.
- B. In the case of conflict between this Section and the measurement methods specified in the individual technical Sections, the measurement methods in the technical specifications shall govern.
- C. The Contractor shall receive no payment for any portion of the work until it is installed. The only exception to this is payment for stored materials on site if the Contract provides for the payment of stored materials. Partial payment may be requested for items partially installed.

#### 1.02 RELATED WORK

- A. Payment Procedures are included in Section 012900.
- B. Form of Proposal is included in Section 004213.
- C. General Conditions are included in Section 007200.
- D. Supplemental General Conditions are included in Section 007300

#### 1.03 LUMP SUM ITEMS

- A. Lump Sum measurement will be for the entire item, unit of work, structure, or combination thereof, as specified and as indicated in the Form of Proposal. Measurement and payment for all bid items indicated as Lump Sums shall include the cost of all labor, materials and equipment necessary to furnish, install, clean, test, and place each bid item into operation; including permitting, general conditions, overhead and profit.
- B. Progress payments will be based on the Schedule of Values prepared by the Contractor and approved by the Engineer and Owner before acceptance of the first Application for Payment.
- C. In order for the Contractor to request progress payments against Lump Sum items, Contractor shall provide a disaggregation or breakdown in sufficient and measurable detail that is acceptable to the Engineer.
- D. Measurement
  - 1. Measurement shall be based on the estimated percent complete of each item of the Schedule of Values, as determined by the Engineer.

E. Payment

1. Payment will be made at the lump sum price proportional to the completion percentages approved by the Engineer.

1.04 UNIT PRICE ITEMS

- A. Quantity and measurement estimates stated in the Form of Proposal are estimates for bidding purposes only. Actual payments shall be based on actual quantities installed, in-place, as measured and/or verified by the Engineer.
- B. Unless otherwise provided in the General Conditions, the bid unit prices shall be in effect throughout the contract duration, regardless of variances between the estimated quantities and the actual installed quantities.
- C. The Contractor shall make no claim, nor receive any compensation, for anticipated profits, loss of profit, damages, or any extra payment due to any difference between the amounts of work actually completed, or materials or equipment furnished, and the estimated quantities.
- D. Unless otherwise approved by the Owner, any unit quantities exceeded may not be invoiced until the estimated quantity is increased by contract change order.
- E. Contractor shall assist Engineer by providing necessary equipment, workers, and survey personnel as required to measure quantities.
- F. Measured quantities shall be rounded to the nearest whole integer, unless the value of the unit price exceeds \$100, in which case measured quantities shall be rounded to the nearest half unit.
- G. Measurement
  1. Measurement for progress payment shall be made by, or approved by, the Engineer based on the estimated effective quantity installed. The effective quantity installed represents the actual units or quantities installed, adjusted for incomplete elements or components.
  2. Unless otherwise provided in the Form of Proposal, unit price items are all-inclusive of all related work, direct and indirect, to provide a complete and functional item. For example, underground pipe installation would include trenching, shoring, dewatering, bedding, installation, backfill, testing, flushing, disinfection, and commissioning; including all labor, materials and equipment necessary to furnish, install, clean, test, and place into operation; including permitting, general conditions, overhead and profit.
  3. The final measurement shall be based on actual quantities, jointly measured by Contractor and Engineer, complete, fully, tested and placed into service.
- H. Payment
  1. Progress payments shall be in accordance with the contract documents based on estimated effective quantities installed, paid at the bid unit price.
  2. The final payment shall be based on actual quantities, fully installed, tested and placed into service, paid at the bid unit price.

## 1.05 ALLOWANCE ITEMS

### A. DEFINITIONS

1. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

### B. SELECTION AND PURCHASE

1. At the earliest practical date after award of the Contract, advise Engineer of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.
2. At Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
3. Purchase products and systems selected by Engineer from the designated supplier.

### C. ACTION SUBMITTALS

1. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

### D. INFORMATIONAL SUBMITTALS

1. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
2. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
3. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

### E. CHANGE ORDER ALLOWANCES

1. Use the change order allowance only as directed by Engineer for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
2. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the change order allowance are included in the allowance and are not already part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

### F. ADJUSTMENT OF ALLOWANCES

1. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, required maintenance materials, and similar margins.
  - a. Include installation costs in purchase amount only where indicated as part of the allowance.

- b. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
  - c. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
  - d. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
2. At Project closeout, credit unused amounts of allowances remaining to the Owner by Change Order

## 1.61 ALTERNATES

- A. Definition: An amount proposed by bidders and stated on the Form of Proposal for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

B. Procedures

1. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
2. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
3. Execute accepted alternates under the same conditions as other work of the Contract.

## PART 2 PRODUCTS – (NOT USED)

## PART 3 EXECUTION

### 3.01 SCHEDULE OF ALLOWANCES ITEMS

A. Change Order Allowance (BID ITEM NO. 1)

1. Measurement and Payment
  - a. The Contractor will be reimbursed for costs of work defined in an approved Change Order.
  - b. Payment will be made at the change order price proportional to the completion percentages approved by the Engineer.

B. Materials Testing Allowance (BID ITEM NO. 2)

1. Measurement and Payment
  - a. The Contractor will be reimbursed for costs of work defined for Materials Testing.

2. Payment

- a. Payment will be made at the testing price proportional to the completion percentages approved by the Engineer.

3.02 SCHEDULE OF UNIT PRICE ITEMS

A. AC Pavement Replacement (BID ITEM NO. 3)

1. Measurement

- a. Measurement shall be for the volume of material defined by the technical specifications as being required for replacement of existing Asphalt Concrete. For the defined volume, the unit price shall include all work to remove and dispose of existing asphalt concrete (AC) and furnish and install new AC.
- b. Measurement for progress payment shall be made by, or approved by, the Engineer based on the estimated effective quantity installed. The effective quantity installed represents the actual units or quantities installed, adjusted for incomplete elements or components.
- c. Unless otherwise provided for in the Form of Proposal unit price items are all-inclusive of all related work, direct and indirect, to provide a complete and functional item. For this bid item it includes, but is not limited to saw cutting, removal of existing pavement and base course, traffic control, milling, tack coat, AC base course, AC surface course, adjusting utilities to proper grade, sealcoating, replacement of reflective markers and restriping per NCDOT requirements, inspection fees and other measures necessary to receive written approval from NCDOT and successful project completion including permitting, general conditions, overhead and profit.
- d. The final measurement shall be based on actual quantities, jointly measured by Contractor and Engineer, complete, fully, tested and placed into service.

2. Payment

- a. Progress payments shall be in accordance with the contract documents based on estimated effective quantities installed, paid at the bid unit price.
- b. The final payment shall be based on actual quantities, fully installed, tested and placed into service, paid at the bid unit price.

B. Concrete Driveway Replacements (BID ITEM NO. 4)

1. Measurement

- a. Measurement for progress payment shall be made by, or approved by, the Engineer based on the estimated effective quantity installed. The effective quantity installed represents the actual units or quantities installed, adjusted for incomplete elements or components.
- b. Unless otherwise provided for in the Form of Proposal unit price items are all-inclusive of all related work, direct and indirect, to provide a complete and functional item. For this bid item it includes, but is not limited to saw cutting, removal of existing concrete driveways and base course to the limits defined on the plans, traffic control, doweling into existing concrete, new concrete, expansion joints, construction/contraction joints, base course, reinforcing steel, and other measures necessary to furnish, install, clean, test and place into operation including permitting, general conditions, overhead and profit.
- c. The final measurement shall be based on actual quantities, jointly measured by Contractor and Engineer, complete, fully, tested and placed into service.

2. Payment

- a. Progress payments shall be in accordance with the contract documents based on estimated effective quantities installed, paid at the bid unit price.
- b. The final payment shall be based on actual quantities, fully installed, tested and placed into service, paid at the bid unit price.

C. 15" RCP Culvert Replacements (BID ITEM NO. 5)

1. Measurement

- a. Measurement for progress payment shall be made by, or approved by, the Engineer based on the estimated effective quantity installed. The effective quantity installed represents the actual units or quantities installed, adjusted for incomplete elements or components.
- b. Unless otherwise provided for in the Form of Proposal unit price items are all-inclusive of all related work, direct and indirect, to provide a complete and functional item. For this bid item, this includes, but is not limited to, all labor, materials, equipment and incidentals necessary for removal of existing culverts and installation of aggregate base, 15" RCP culverts, grading necessary for positive drainage and other measures necessary to furnish, install, clean, test and place into operation including permitting, general conditions, overhead and profit.
- c. The final measurement shall be based on actual quantities, jointly measured by Contractor and Engineer, complete, fully, tested and placed into service.

2. Payment

- a. Progress payments shall be in accordance with the contract documents based on estimated effective quantities installed, paid at the bid unit price.
- b. The final payment shall be based on actual quantities, fully installed, tested and placed into service, paid at the bid unit price.

D. 18" RCP Culvert Replacements (BID ITEM NO. 6)

1. Measurement

- a. Measurement for progress payment shall be made by, or approved by, the Engineer based on the estimated effective quantity installed. The effective quantity installed represents the actual units or quantities installed, adjusted for incomplete elements or components.
- b. Unless otherwise provided for in the Form of Proposal unit price items are all-inclusive of all related work, direct and indirect, to provide a complete and functional item. For this bid item, this includes, but is not limited to, all labor, materials, equipment and incidentals necessary for removal of existing culverts and installation of aggregate base, 18" RCP culverts, grading necessary for positive drainage and other measures necessary to furnish, install, clean, test and place into operation including permitting, general conditions, overhead and profit.
- c. The final measurement shall be based on actual quantities, jointly measured by Contractor and Engineer, complete, fully, tested and placed into service.

2. Payment

- a. Progress payments shall be in accordance with the contract documents based on estimated effective quantities installed, paid at the bid unit price.
- b. The final payment shall be based on actual quantities, fully installed, tested and placed into service, paid at the bid unit price.

E. 30" RCP Culvert Replacements (BID ITEM NO. 7)

1. Measurement

- a. Measurement for progress payment shall be made by, or approved by, the Engineer based on the estimated effective quantity installed. The effective quantity installed represents the actual units or quantities installed, adjusted for incomplete elements or components.
- b. Unless otherwise provided for in the Form of Proposal unit price items are all-inclusive of all related work, direct and indirect, to provide a complete and functional item. For this bid item, this includes, but is not limited to, all labor, materials, equipment and incidentals necessary for removal of existing culverts and installation of aggregate base, 30" RCP culverts, grading necessary for positive drainage and other measures necessary to furnish, install, clean, test and place into operation including permitting, general conditions, overhead and profit.
- c. The final measurement shall be based on actual quantities, jointly measured by Contractor and Engineer, complete, fully, tested and placed into service.

2. Payment

- a. Progress payments shall be in accordance with the contract documents based on estimated effective quantities installed, paid at the bid unit price.
- b. The final payment shall be based on actual quantities, fully installed, tested and placed into service, paid at the bid unit price.

F. Remove and Replace Unsuitable Pipe Subgrade Material (BID ITEM NO. 8)

1. Measurement

- a. Measurement shall be for the volume of material defined by the technical specifications as being unsuitable bedding below any new pipeline. For the defined volume, the unit price shall include all Work to remove and dispose the existing material and furnish and install suitable materials.
- b. Measurement for progress payment shall be made by, or approved by, the Engineer based on the estimated effective quantity installed. The effective quantity installed represents the actual units or quantities installed, adjusted for incomplete elements or components.
- c. Unless otherwise provided for in the Form of Proposal unit price items are all-inclusive of all related work, direct and indirect, to provide a complete and functional item. For example, underground pipe installation would include trenching, shoring, dewatering, bedding, installation, backfill, testing, flushing, disinfection, and commissioning; including all labor, materials and equipment necessary to furnish, install, clean, test, and place into operation; including permitting, general conditions, overhead and profit.
- d. The final measurement shall be based on actual quantities, jointly measured by Contractor and Engineer, complete, fully, tested and placed into service.

2. Payment

- a. Progress payments shall be in accordance with the contract documents based on estimated effective quantities installed, paid at the bid unit price.
- b. The final payment shall be based on actual quantities, fully installed, tested and placed into service, paid at the bid unit price.

END OF SECTION 012901

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## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on the Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. RFIs.
  - 4. Digital project management procedures.
  - 5. Web-based Project management software package.
  - 6. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

#### 1.3 DEFINITIONS

- A. RFI: Request for Information. Request from Owner and , Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.

3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 10 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and in prominent location in each built facility. Keep list current at all times.

## 1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
  2. Preparation of the schedule of values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.

## 1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    - f. Indicate required installation sequences.
    - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
  2. Plenum Space: Indicate subframing for support of ceiling, raised access floor, and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
  3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
  4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
  6. Mechanical and Plumbing Work: Show the following:

- a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    - c. Fire-rated enclosures around ductwork.
  7. Electrical Work: Show the following:
    - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    - c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
    - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
  8. Fire-Protection System: Show the following:
    - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
  9. Review: Engineer will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Engineer will so inform Contractor, who shall make suitable modifications and resubmit.
  10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
- C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
  2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
  3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
  4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
  5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
  6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
  7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.

## 1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  - 1. Engineer will return without response those RFIs submitted to Engineer by other entities controlled by Contractor.
  - 2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - 1. Project name.
  - 2. Owner name.
  - 3. Owner's Project number.
  - 4. Name of Engineer and Construction Manager.
  - 5. Engineer's Project number.
  - 6. Date.
  - 7. Name of Contractor.
  - 8. RFI number, numbered sequentially.
  - 9. RFI subject.
  - 10. Specification Section number and title and related paragraphs, as appropriate.
  - 11. Drawing number and detail references, as appropriate.
  - 12. Field dimensions and conditions, as appropriate.
  - 13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  - 14. Contractor's signature.
  - 15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Form bound in Project Manual.
  - 1. Attachments shall be electronic files in PDF format.
- D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow seven days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.
  - 1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Engineer's actions on submittals.

- g. Incomplete RFIs or inaccurately prepared RFIs.
- 2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt by Engineer of additional information.
- 3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Change Procedures."
  - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer and Construction Manager in writing within 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
  - 1. Project name.
  - 2. Name and address of Contractor.
  - 3. Name and address of Engineer and Construction Manager.
  - 4. RFI description.
  - 5. Date the RFI was submitted.
  - 6. Date Engineer's and Construction Manager's response was received.
  - 7. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  - 8. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within seven days if Contractor disagrees with response.
- G. Web-Based Project Management Software Package: Provide, administer, and use web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion. General Contractor shall be responsible for the full cost for the project team including costs for Owner, Engineer, Contractor, subcontractors and suppliers.
  - 1. Web-based Project management software includes, at a minimum, the following features:
    - a. Compilation of Project data, including Contractor, subcontractors, Engineer, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    - c. Document workflow planning, allowing customization of workflow between project entities.
    - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    - e. Track status of each Project communication in real time, and log time and date when responses are provided.
    - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.

- g. Processing and tracking of payment applications.
    - h. Processing and tracking of contract modifications.
    - i. Creating and distributing meeting minutes.
    - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
    - k. Management of construction progress photographs.
    - l. Mobile device compatibility, including smartphones and tablets.
  2. Provide up to ten Project management software user licenses for use by Owner, Owner's Commissioning Authority, Engineer, and Engineer's consultants. Provide eight hours of software training at Engineer's office for web-based Project software users.
  3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Engineer. Provide data in locked format to prevent further changes.
  4. Provide one of the following Project management software packages under their current published licensing agreements:
    - a. Autodesk; Constructware.
    - b. Corecon Technologies, Inc.
    - c. Meridian Systems; Prolog.
    - d. Newforma, Inc.
    - e. Procore Technologies, Inc.
    - f. Viewpoint, Inc.; Viewpoint for Projects.
- H. PDF Document Preparation: Where PDFs are required to be submitted to Engineer, prepare as follows:
  1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
  3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

## 1.8 PROJECT MEETINGS

- A. General: Engineer will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within three days of the meeting.
- B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days after execution of the Agreement.
  1. Attendees: Authorized representatives of Owner Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned

- parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Responsibilities and personnel assignments.
    - b. Tentative construction schedule.
    - c. Phasing.
    - d. Critical work sequencing and long lead items.
    - e. Designation of key personnel and their duties.
    - f. Lines of communications.
    - g. Use of web-based Project software.
    - h. Procedures for processing field decisions and Change Orders.
    - i. Procedures for RFIs.
    - j. Procedures for testing and inspecting.
    - k. Procedures for processing Applications for Payment.
    - l. Distribution of the Contract Documents.
    - m. Submittal procedures.
    - n. Sustainable design requirements.
    - o. Preparation of Record Documents.
    - p. Use of the premises.
    - q. Work restrictions.
    - r. Working hours.
    - s. Owner's occupancy requirements.
    - t. Responsibility for temporary facilities and controls.
    - u. Procedures for moisture and mold control.
    - v. Procedures for disruptions and shutdowns.
    - w. Construction waste management and recycling.
    - x. Parking availability.
    - y. Office, work, and storage areas.
    - z. Equipment deliveries and priorities.
    - aa. First aid.
    - bb. Security.
    - cc. Progress cleaning.
    - dd. List of major subcontractors and suppliers.
  3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer, of scheduled meeting dates.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.



- f. Deliveries.
  - g. Submittals.
  - h. Review of mockups.
  - i. Possible conflicts.
  - j. Compatibility requirements.
  - k. Time schedules.
  - l. Weather limitations.
  - m. Manufacturer's written instructions.
  - n. Warranty requirements.
  - o. Compatibility of materials.
  - p. Acceptability of substrates.
  - q. Temporary facilities and controls.
  - r. Space and access limitations.
  - s. Regulations of authorities having jurisdiction.
  - t. Testing and inspecting requirements.
  - u. Installation procedures.
  - v. Coordination with other work.
  - w. Required performance results.
  - x. Protection of adjacent work.
  - y. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Engineer will schedule and conduct a project closeout conference, at a time convenient to Owner and Engineer, but no later than 90 days prior to the scheduled date of Substantial Completion.
- 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  - 2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    - a. Preparation of Record Documents.
    - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    - c. Procedures for completing and archiving web-based Project software site data files.
    - d. Submittal of written warranties.
    - e. Requirements for completing sustainable design documentation.
    - f. Requirements for preparing operations and maintenance data.
    - g. Requirements for delivery of material samples, attic stock, and spare parts.
    - h. Requirements for demonstration and training.
    - i. Preparation of Contractor's punch list.

- j. Procedures for processing Applications for Payment at Substantial Completion and for final payment including final change order.
  - k. Submittal procedures.
  - l. Coordination of separate contracts.
  - m. Owner's partial occupancy requirements including certificate of occupancy and closeout of permits.
  - n. Installation of Owner's furniture, fixtures, and equipment.
  - o. Responsibility for removing temporary facilities and controls.
  - p. Final cleaning.
  - 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Engineer will conduct progress meetings at regular intervals, to be agreed upon by all parties involved at the beginning of the project.
- 1. Coordinate dates of meetings with preparation of payment requests.
  - 2. Attendees: In addition to representatives of Owner, and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Resolution of BIM component conflicts.
      - 4) Status of submittals.
      - 5) Status of sustainable design documentation.
      - 6) Deliveries.
      - 7) Off-site fabrication.
      - 8) Access.
      - 9) Site use.
      - 10) Temporary facilities and controls.
      - 11) Progress cleaning.
      - 12) Quality and work standards.
      - 13) Status of correction of deficient items.
      - 14) Field observations.
      - 15) Status of RFIs.
      - 16) Status of Proposal Requests.
      - 17) Pending changes.
      - 18) Status of Change Orders.
      - 19) Pending claims and disputes.
      - 20) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
  - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting. Where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Engineer will conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
  1. Attendees: In addition to representatives of Owner, and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    - c. Review present and future needs of each contractor present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Resolution of BIM component conflicts.
      - 4) Status of submittals.
      - 5) Deliveries.
      - 6) Off-site fabrication.
      - 7) Access.
      - 8) Site use.
      - 9) Temporary facilities and controls.
      - 10) Work hours.
      - 11) Hazards and risks.
      - 12) Progress cleaning.
      - 13) Quality and work standards.
      - 14) Status of RFIs.
      - 15) Proposal Requests.
      - 16) Change Orders.
      - 17) Pending changes.
  3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 013100

## SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Startup construction schedule.
  - 2. Contractor's Construction Schedule.
  - 3. Construction schedule updating reports.
  - 4. Daily construction reports.
  - 5. Material location reports.
  - 6. Site condition reports.
  - 7. Unusual event reports.
- B. Related Requirements:
  - 1. Section 014000 "Quality Requirements" for schedule of tests and inspections.
  - 2. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

#### 1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. Working electronic copy of schedule file.
  - 2. PDF file.
  - 3. Two paper copies, of sufficient size to display entire period or schedule, as required.
- B. Startup construction schedule.
  - 1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
  - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, latest allowable start date, latest allowable finish date, status (where critical) and total float and free float in calendar days.
  - 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.

2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
  3. Total Float Report: List of activities sorted in ascending order of total float.
  4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at monthly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Unusual Event Reports: Submit at time of unusual event.
- K. Qualification Data: For scheduling consultant.

## 1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Engineer's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
1. Review software limitations and content and format for reports.
  2. Verify availability of qualified personnel needed to develop and update schedule.
  3. Discuss constraints, including phasing, interim milestones and partial Owner occupancy.
  4. Review delivery dates for Owner-furnished products.
  5. Review schedule for work of Owner's separate contracts.
  6. Review submittal requirements and procedures.
  7. Review time required for review of submittals and resubmittals.
  8. Review requirements for tests and inspections by independent testing and inspecting agencies.
  9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
  10. Review and finalize list of construction activities to be included in schedule.
  11. Review procedures for updating schedule.
  12. Submit at this conference a preliminary network defining the planned operation during the first 60 calendar days after the Notice to Proceed.

## 1.6 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.
  - 2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

## 1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Program Description
  - 1. 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.
  - 2. 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.
- B. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
  - 1. Use Scheduling component of Project management software package specified in Section 013100 "Project Management and Coordination," for current Windows operating system.
- C. Qualifications
  - 1. The Contractor shall have the capability of preparing and utilizing the specified CPM schedule or engage the services of a specialized scheduling professional to do so. Within seven days of the award of contract, provide a résumé or qualifications statement for the individual within the Contractor's organization, or the outside consultant, who is being proposed as the responsible party for development and maintenance of the CPM schedule. The résumé or qualifications statement shall demonstrate that the proposed responsible party has successfully developed and maintained CPM schedules for at least three construction projects of the same size or greater than this project. The proposed responsible party for the CPM schedule is subject to approval by the Engineer, Engineer and Owner. If the proposed responsible party for the CPM schedule is not approved by the Engineer, Engineer and/or Owner, Contractor shall resubmit a more-appropriate candidate for approval.
- D. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.



- E. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Engineer.
  2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
    - a. Securing of approvals and permits required for performance of the Work.
    - b. Temporary facilities.
    - c. Construction of mock-ups, prototypes and samples.
    - d. Owner interfaces and furnishing of items.
    - e. Interfaces with Separate Contracts.
    - f. Regulatory agency approvals.
    - g. Punch list.
  3. Procurement Activities: Include procurement process activities for the long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
  5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
  6. Commissioning Time: Include no fewer than 15 days for commissioning.
  7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's and Engineer's administrative procedures necessary for certification of Substantial Completion.
  8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.
- F. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  6. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use-of-premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.
    - f. Sample testing.
    - g. Deliveries.
    - h. Installation.
    - i. Tests and inspections.
    - j. Adjusting.
    - k. Curing.
    - l. Building flush-out.
    - m. Startup and placement into final use and operation.
    - n. Commissioning.
  8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    - a. Structural completion.
    - b. Temporary enclosure and space conditioning.
    - c. Permanent space enclosure.
    - d. Completion of mechanical installation.
    - e. Completion of electrical installation.
    - f. Substantial Completion.
- G. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion, and the following interim milestones:
1. Installation, testing and startup of four (4) reverse osmosis skids.
- H. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- I. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
  2. Unanswered Requests for Information.
  3. Rejected or unreturned submittals.
  4. Notations on returned submittals.
  5. Pending modifications affecting the Work and the Contract Time.
- J. Acceptability
1. Submit the CPM schedule submittals, as specified, and resubmit as needed, until they are in compliance with Contract requirements.

2. The Engineer's review of the Contractor's construction schedule submittals will only be for conformance with the Contract requirements – including but not limited to contract time and work sequences specified in the contract documents. The Engineer's review of the schedule shall not include the Contractor's means and methods of construction or safety. The Engineer's concurrence, acceptance, or approval of the Contractor's schedule submittals will not relieve the Contractor from responsibility for complying with the Contract Scope, Contract Time or any other contract requirement. Any indication of concurrence, acceptance, or approval of the Contractor's schedule will only indicate a general conformance with the Contract Requirements.
  3. Engineer's review of the Contractor's construction schedule submittals shall not relieve the Contractor from responsibility for any deviations from the Contract Documents unless the Contractor has in writing called Engineer's attention to such deviations at the time of submission and Engineer has given written concurrence to the specific deviations, nor shall any concurrence by the Engineer relieve Contractor from responsibility for errors and omissions in the submittals. Concurrence of the CPM Activity Network by the Engineer is advisory only and shall not relieve the Contractor of responsibility for accomplishing the Work within the Contract completion date(s).
  4. Concurrence, acceptance, or approval of the Contractor's CPM schedule by the Engineer in no way makes the Engineer an insurer of the CPM schedule's success, nor liable for time or cost overruns resulting therefrom.
  5. Failure to include any element of work required for the performance of this Contract will not excuse the Contractor from completing all Work required within the Contract completion date(s), notwithstanding the review of the network by the Engineer.
  6. CPM schedules that contain activities with negative float, or which extend beyond the contract completion date, will not be acceptable.
  7. Except where earlier completions are specified, CPM schedules which show completion of all work prior to the contract completion date may be indicated; however, in no event shall they constitute a basis for claim for delay by the Contractor.
- K. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate Final Completion percentage for each activity. Activities shall not be considered to be complete until they are in fact 100 percent complete.
  4. Submit a narrative report based on the CPM schedule evaluation, in a format agreed upon by the Contractor and the Engineer. The report shall include a description of the progress during the previous period in terms of completed activities, an explanation of each activity which is showing a delay, a description of problem areas, current and anticipated delaying factors and their estimated impact on performance of other activities and completion dates and an explanation of corrective action taken or proposed.
- L. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working

hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

- M. The contract completion time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any contract completion date, the Contractor shall furnish such justification and supporting evidence as the Engineer may deem necessary to determine whether the Contractor is entitled to an extension of time under the provisions of this Contract. The Engineer will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof. If the Engineer finds that the Contractor is entitled to any extension of any contract completion date, the Engineer's determination as to the total number of days extension shall be based upon the currently approved CPM schedule and on all data relevant to the extension. Such data shall be included in the next updating of the schedule. Actual delays in activities which, according to the CPM schedule, do not affect any contract completion date shown by the critical path in the network will not be the basis for a change therein.
- N. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  - 1. Post copies in Project meeting rooms and temporary field offices.
  - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

## 1.8 STARTUP CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within seven days of date established for the Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

## 1.9 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed.
  - 1. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
  - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

## 1.10 CPM SCHEDULE REQUIREMENTS

- A. Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
  - 1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
    - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
  - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
  - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
  - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals.
    - b. Mobilization and demobilization.
    - c. Purchase of materials.
    - d. Delivery.
    - e. Fabrication.
    - f. Utility interruptions.
    - g. Installation.
    - h. Work by Owner that may affect or be affected by Contractor's activities.
    - i. Testing and inspection.
    - j. Commissioning.
    - k. Punch list and Final Completion.
    - l. Activities occurring following Final Completion.
    - m. Maintenance of existing facilities.
    - n. Contract milestones.
  - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.

3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
  4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
  5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Engineer's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
    - a. Each activity cost shall reflect an appropriate value subject to approval by Engineer.
    - b. Total cost assigned to activities shall equal the total Contract Sum.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
  2. Description of activity.
  3. Main events of activity.
  4. Immediate preceding and succeeding activities.
  5. Early and late start dates.
  6. Early and late finish dates.
  7. Activity duration in workdays.
  8. Total float or slack time.
  9. Average size of workforce.
  10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the critical path.
  6. Changes in total float or slack time.
  7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.

2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
  - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
  - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

#### 1.11 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. Equipment at Project site.
  5. Material deliveries.
  6. High and low temperatures and general weather conditions, including presence of rain or snow.
  7. Testing and inspection.
  8. Accidents.
  9. Meetings and significant decisions.
  10. Unusual events.
  11. Stoppages, delays, shortages, and losses.
  12. Meter readings and similar recordings.
  13. Emergency procedures.
  14. Orders and requests of authorities having jurisdiction.
  15. Change Orders received and implemented.
  16. Work Change Directives received and implemented.
  17. Services connected and disconnected.
  18. Equipment or system tests and startups.
  19. Partial completions and occupancies.
  20. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
  2. Material stored prior to previous report and since removed from storage and installed.
  3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for

Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

- D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
1. Submit unusual event reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 013200



## SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Aerial and preconstruction photographs.
  - 2. Concealed Work photographs.
  - 3. Periodic construction photographs.
  - 4. Final Completion construction photographs.
  - 5. Preconstruction video recordings.
  - 6. Periodic construction video recordings.
  - 7. Construction webcam.
- B. Related Requirements:
  - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
  - 2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
  - 3. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.
  - 4. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
  - 1. Submit photos on CD-ROM or thumb-drive or by uploading to web-based Project management site. Include copy of key plan indicating each photograph's location and direction.
  - 2. Identification: Provide the following information with each image description in web-based Project management site:
    - a. Name of Project.
    - b. Name and contact information for photographer.

- c. Name of Engineer.
  - d. Name of Contractor.
  - e. Date photograph was taken.
  - f. Description of location, vantage point, and direction.
  - g. Unique sequential identifier keyed to accompanying key plan.
- C. Printed Photographs: Submit two sets of prints of each photographic view within seven days of taking photographs.
  - 1. Format: 8-by-10-inch smooth-surface matte prints on single-weight, paper; enclosed back to back in clear plastic sleeves punched for three-ring binder. Include copy of key plan indicating each photograph's location and direction. Provide one binder for each set of prints.
  - 2. Identification: On back of each print, label with the following information:
    - a. Name of Project.
    - b. Name and contact information for photographer.
    - c. Name of Engineer.
    - d. Name of Contractor.
    - e. Date photograph was taken if not date stamped by camera.
    - 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.
- D. Video Recordings: Submit video recordings within seven days of recording.
  - 1. Submit video recordings on CD-ROM or thumb drive or by uploading to web-based Project management site. Include copy of key plan indicating each video's location and direction.
  - 2. Identification: With each submittal, provide the following information on web-based Project management site:
    - a. Name of Project.
    - b. Name and address of photographer.
    - c. Name of Engineer.
    - 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.
  - 3. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy duty, three-ring vinyl covered binders. Provide label on front and spine. Include a cover sheet with label information. Include name of Project and date of video recording on each page.

#### 1.4 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

## 1.5 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode with vibration-reduction technology. Provide supplemental lighting in low light levels or backlit conditions.
- C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- D. Metadata: Record accurate date and time and GPS location data from camera.
- E. File Names: Name media files with date, Project area and sequential numbering suffix.
- F. Usage Rights
  - 1. Obtain and transfer copyright usage rights from photographer and videographer to Owner for unlimited reproduction of photographic and videographic documentation.

## 1.6 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs with maximum depth of field and in focus.
  - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Preconstruction Photographs: Before commencement of the Work take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Engineer.
  - 1. Flag construction limits before taking construction photographs.
  - 2. Take (min) 50 photographs to show existing conditions adjacent to property before starting the Work.
  - 3. Take 50 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
  - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
  - 1. Underground utilities.
  - 2. Underslab services.

3. Piping.
  4. Electrical conduit.
  5. Waterproofing and weather-resistant barriers.
- E. Periodic Construction Photographs: Take 20 photographs weekly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Additional Photographs: Engineer may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
1. Three days' notice will be given, where feasible.
  2. In emergency situations, take additional photographs within 24 hours of request.
  3. Circumstances that could require additional photographs include, but are not limited to, the following:
    - a. Special events planned at Project site.
    - b. Immediate follow-up when on-site events result in construction damage or losses.
    - c. Photographs shall be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
    - d. Substantial Completion of a major phase or component of the Work.
    - e. Extra record photographs at time of final acceptance.
    - f. Owner's request for special publicity photographs.

#### 1.7 CONSTRUCTION VIDEO RECORDINGS

- A. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Engineer.
1. Flag construction limits before recording construction video recordings.
  2. Show existing conditions 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 construction.
  4. Show protection efforts by Contractor.

#### PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION (NOT USED)

END OF SECTION 013233

## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Submittal schedule requirements.
  - 2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

- 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
  - 2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
  - 3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 4. Section 013233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
  - 5. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
  - 6. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
  - 7. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 8. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 9. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

#### 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with

requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

- C. Mass Submittals: Six or more submittals or items in one day or 20 or more submittals or items in one week.

#### 1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  - 3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
  - 4. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal Category: Action; informational.
    - d. Name of subcontractor.
    - e. Description of the Work covered.
    - f. Scheduled date for Engineer's final release or approval.
    - g. Scheduled dates for purchasing.
    - h. Scheduled date of fabrication.
    - i. Scheduled dates for installation.
    - j. Activity or event number.

#### 1.5 SUBMITTAL FORMATS

- A. Numbering System: Utilize the following example submittal identification numbering system to identify submittals and as file names for PDF submissions:
  - 1. First Identifier - Alphabet Character: D, S, M or I which represents Shop Drawing (including working drawings and product data), Sample, Manual (Operating & Maintenance) or Informational, respectively.
  - 2. Second Identifier - Next 6 or 8 Digits: Applicable Specification Section Number. Do not mix submittals from different specification sections into a single submittal.
  - 3. Third Identifier - Next Three Digits: Sequential number of each separate item or drawing submitted under each Specification Section, in chronological order submitted, starting at 001.

4. Fourth Identifier - Last Alphabet Character: 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. EXAMPLE: D-033000.13-008-B.
    - a. D = Shop Drawing.
    - b. 03 30 00.13 = Section; use only 6 digits for sections that do not include 8 digits.
    - c. 008 = the eighth different submittal under this Section.
    - d. B = the second submission (first resubmission) of that particular shop drawing.
- B. Submittal Information: Include the following information in each submittal:
1. Project name.
  2. Date.
  3. Name of Engineer.
  4. Name of Contractor.
  5. Name of firm or entity that prepared submittal.
  6. Names of subcontractor, manufacturer, and supplier.
  7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
  8. Category and type of submittal.
  9. Submittal purpose and description.
  10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
  11. Drawing number and detail references, as appropriate.
  12. Indication of full or partial submittal.
  13. Location(s) where product is to be installed, as appropriate.
  14. Other necessary identification.
  15. Remarks.
  16. Signature of transmitter.
- C. Options: Identify options requiring selection by Engineer.
- D. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- E. Paper Submittals:
1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
  2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
  3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Engineer will return one copy.
  4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Engineer will not return copies.
  5. Additional Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

6. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using Contractor's transmittal form.
- F. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
- G. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

## 1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  1. Email: Prepare submittals as PDF package and transmit to Engineer by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Engineer.
    - a. Engineer will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
  2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
  3. Paper: Prepare submittals in paper form and deliver to Engineer.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
  4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  1. Initial Review: Allow 30 days for initial review of each submittal (and 45 days for multi-discipline reviews). Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.



4. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
  5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Engineer and to Engineer's consultants, allow 30 days for review of each submittal. Submittal will be returned to Engineer before being returned to Contractor.
    - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Engineer.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
  4. 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.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

## 1.7 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams that show factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.

- d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Engineer's digital data drawing files is otherwise permitted.
  1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
    - a. Three opaque copies of each submittal. Engineer will retain two copies; remainder will be returned.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
  1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    - a. Project name and submittal number.
    - b. Generic description of Sample.
    - c. Product name and name of manufacturer.
    - d. Sample source.
    - e. Number and title of applicable Specification Section.
    - f. Specification paragraph number and generic name of each item.
  3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
  4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
  5. Paper Transmittal: Include paper transmittal, including complete submittal information indicated.
  6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.
  8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    - a. Number of Samples: Submit three sets of Samples. Engineer will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
      - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  2. Manufacturer and product name, and model number if applicable.
  3. Number and name of room or space.
  4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
  2. Insert definition of Contractor certificates here if required by individual Specification Sections. See the Evaluations.

3. Contractor's Certification: Each shop drawing, working drawing, product data, and sample shall have affixed to it the following Certification Statement:
  - a. "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."
4. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
5. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
6. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
7. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
8. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - a. Name of evaluation organization.
  - b. Date of evaluation.
  - c. Time period when report is in effect.
  - d. Product and manufacturers' names.
  - e. Description of product.
  - f. Test procedures and results.
  - g. Limitations of use.

## 1.8 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Engineer.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## 1.9 PROPOSED PRODUCT LIST

- A. Within 30 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, indicate manufacturer, trade name, model or catalog designation, and reference standards.

## 1.10 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Contractor Responsible for:
  - 1. Determination and verification of materials including manufacturer's catalog numbers.
  - 2. Determination and verification of field measurements and field construction criteria.
  - 3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.
  - 4. Determination of accuracy and completeness of dimensions and quantities.
  - 5. Confirmation and coordination of dimensions and field conditions at Site.
  - 6. Construction means, techniques, sequences, and procedures.
  - 7. Safety precautions.
  - 8. Coordination and performance of Work of all trades.
  - 9. Other requirements enumerated in Contract Documents.
- C. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement

certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.

#### 1.11 ENGINEER'S REVIEW

- A. Do not make mass submittals to Engineer. If mass submittals are received, Engineer's review time stated above will be extended as necessary to perform proper review. Engineer will review mass submittals based on priority determined by Engineer after consultation with Owner.
- B. Action Submittals: Engineer will review each submittal, indicate corrections or revisions required, and return.
  1. PDF Submittals: Engineer will indicate, via markup on each submittal, the appropriate action.
  2. Paper Submittals: Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
  3. Submittals by Web-Based Project Management Software: Engineer will indicate, on Project management software website, the appropriate action.
- C. Informational Submittals: Engineer will review each submittal and will not return it or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Engineer will return without review submittals received from sources other than Contractor.
- G. Submittals not required by the Contract Documents will be returned by Engineer without action.
- H. Shop drawings will be returned to the Contractor with one of the following codes.
  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.
  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.
  3. "APPROVED AS NOTED/RESUBMIT" - This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the package. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. The resubmittal is to address all comments, omissions and non-conforming items that were noted. An additional box is checked to indicate whether the resubmission is for the complete

package, or for parts of the package. If no box is checked, a complete resubmittal shall be provided. Review code may designate if a partial or full submittal is required. If full submittal is required, a complete resubmittal package addressing all comments shall be provided. If a partial submittal is designated, resubmittal shall only include information pertaining to those items noted in review comments requiring clarification and any portions of submittal impacted as a result of the response. Resubmittal is to be received by the Engineer within 30 calendar days of the date of the Engineer's transmittal requiring the resubmittal.

4. "REJECTED" - 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.
5. "RECEIPT ACKNOWLEDGED (Not subject to Engineer's Approval)" - This code is assigned to acknowledge receipt of a submittal that is not subject to the Engineer's approval. This code is generally used with submittals involving the Contractor's means and methods of construction work plans, and health and safety plans.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 013300

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## SECTION 013526 - GOVERNMENTAL SAFETY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes:
  - 1. Preparing and implementing a Health and Safety (H&S) Plan to establish in detail the protocols necessary for protecting workers from potential hazards during the work specified in the Contract Documents.

#### 1.3 DEFINITIONS

- A. CIH is a certified industrial hygienist.
- B. SSHO is the site safety & health officer. The Contractor shall provide a responsible individual, competent through experience and training, to be able to identify hazards associated with the Contractor's Work and has overall responsibility for the safety and health performance of contractor's activities, including lower tier subcontractors. The person shall be present on-site during all contractor activities and shall ensure that the requirements of the Project Specific Safety and Health Plan are fully implemented. This person shall also:
  - 1. Attend pre-work conferences and site safety and health orientations and briefings. The Contractor is expected to supplement the site orientation with information related to the Contractor's scope of work.
  - 2. Document weekly tool box safety meetings for the Contractor's employee's onsite.
  - 3. Submit weekly safety and health inspection reports of the construction site as it relates to the Contractor's scope of work. Record hazards identified, and corrective actions taken. The weekly inspection report shall be provided to the Engineer.
  - 4. Report all job-related accidents/illness related to the Contractor's employees and lower tier subcontractors as soon as practical to the Engineer and perform site accident and incident investigations associated with the Contractor's scope of work and fully cooperate with any other accident or incident investigations which may be required.
  - 5. Maintain safety and health statistical information and provide monthly reports to the Engineer. Reports shall include, employee hours worked, the number of first aid cases, the number of medical treatment cases, the number of restricted and lost workday cases as defined by the US Occupational Health and Safety Administration. These reports shall include statistical information related to all of the Contractor's activities and the activities of lower tier subcontractors.

6. Provide Engineer with the immediate notification of any regulatory inspection and a copy of all resulting citations or notice of deficiencies.

#### 1.4 ACTION SUBMITTALS

- A. Qualifications of the CIH and the SSHO.
- B. Prior to commencing work at the jobsite, Contractors must file with the Engineer all required documents, such as: A copy of the *Contractor's Project Specific Safety and Health Plan* and copies of employee training certificates, insurance certificates, construction permits, blasting permits, crane certifications and operator licenses, Steam Boiler Certifications, Elevator Certifications and any approved "OSHA Variances," or other approvals as required to safely and legally perform the Contractor's Scope of Work. The *Contractor's Project Specific Safety and Health Plan* shall as a minimum include the following:
  1. Letter of corporate commitment to Safety and Health signed by CEO or President of the contractor's organization.
  2. Brief description of the contractor's scope of work.
  3. Project safety and health organization, responsibilities and accountability procedures.
  4. Project safety and health goals and objectives.
  5. Project hazard communication and safety training.
  6. Activity hazard analyses covering activities within the contractor's scope of work describing the steps of each principle activity, the hazards associated with each activity and procedures to be used to eliminate or control the hazards.
  7. Personal protective equipment. (Note: Minimum site PPE requirements shall include hard hats, safety glasses with side shields and sturdy work boots.)
  8. Specialized medical surveillance and/or air monitoring procedures, if required.
  9. Safe work procedures. These may be incorporated by reference to the Contractor's Corporate Safety and Health Program.
  10. Safety inspections and audits.
  11. Project emergency response and preparedness procedures including provisions for providing first aid and notification of emergency services.
  12. The Contractor (and any of its subcontractors), must submit, a Hazardous Waste Management Plan that addresses the handling, labeling, transpiration and disposal of hazardous waste. The Contractor shall be held solely responsible for compliance with the provisions of all applicable regulations associated with hazardous waste generated as a consequence of the Contractor's activities.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Listed below are general conditions related to Safety and Health which the Contractor is required to comply with.
  1. Should a specific interpretation be required concerning special and/or unusual safety, fire protection, or environmental concerns not covered by, the National Fire Protection Association Codes, and current OSHA/EPA or other local regulations the contractor shall contact the Engineer's Safety and Health Representative or Corporate Safety and Health Office for guidance.

2. The practices, procedures, and requirements set forth in this Appendix shall apply equally to all Contractors, and it is mandatory that each Contractor inform and enforce the provisions of this Appendix in all contracts with its Subcontractors.
3. The Engineer shall have the right to direct the removal from the jobsite any Contractor or Contractor personnel for violation of safety, health, fire protection, or environmental rules and regulations.
4. Fighting or horseplay is strictly prohibited and shall be considered grounds for removal from the project.
5. The illegal use, possession, purchase, sale or diversion of a drug or controlled substance is prohibited. The use or possession of alcoholic beverages at the jobsite is prohibited.
6. The Engineer shall have the right to direct the removal from the jobsite any defective tools and equipment, the use of which may create a hazardous situation.
7. The Engineer reserves the right to delete, modify, or supplement these procedures at any time without prior notice, but in such event, will notify all contractors affected by such change in procedures.
8. The Engineer reserves the right to evaluate the Contractor's, and any of its subcontractor's, overall safety performance, compliance with these procedures, and any established supplements, at intervals the Engineer deems appropriate.
9. Prior to starting work in any jobsite area, each Contractor must first obtain permission and instructions from the Engineer, or designee

#### 1.6 TRAINING

- A. Certify that all Contractor personnel assigned for the purpose of performing or supervising work in accordance with the provisions of the H&S plan have received appropriate safety training in accordance with 29 CFR 1926.65. Training shall consist of a minimum of 40 hours of health and safety training and 8 hours refresher training annually. In addition, Contractor's supervisory personnel shall have a minimum of 8 hours additional specialized training for managing hazardous waste operations.
- B. Additionally, the Contractor shall be responsible for, and shall guarantee that, only personnel successfully completing the required training are permitted to enter designated areas of the site where worker protection is required.

#### 1.7 MEDICAL SURVEILLANCE

- A. Certify that the services of an occupational physician will be provided and utilized to provide the minimum medical examinations and surveillance specified herein for all workers performing or supervising work in accordance with the provisions of the H&S plan.
- B. The entire medical surveillance program shall meet the requirements of OSHA standard 29 CFR 1926.65(f) including the provision requiring the Contractor to obtain a physician's written medical opinion based on site specific information furnished by the Contractor.
- C. Maintain all medical surveillance records in accordance with 29 CFR 1926.65 and make these records available to the Engineer or other regulatory agencies as required.

## 1.8 DESCRIPTION OF REQUIREMENTS

- A. This Section describes the minimum health and safety requirements for this project. Develop a detailed H&S Plan using this Section as a basis and delineating additional details and requirements as deemed necessary. The H&S plan shall establish in detail the protocols necessary for protecting workers from potential hazards encountered during demolition activities.
- B. Utilize the services of a certified industrial hygienist (CIH) by the American Board of Industrial Hygienists (ABIH) to develop and implement the H&S plan, including any on-site air monitoring program, conducting initial site-specific training and provide continued support for all health and safety activities as needed, including the upgrading or downgrading of the level of personnel protection.
- C. The H&S Plan shall include but not necessarily be limited to, the following components as required by OSHA 29 CFR 1926.65(b)4 and 1926.65(l)(2):
  - 1. Site Description and Evaluation.
  - 2. Names of key personnel and alternate responsible for site safety and health (responsibilities and chain of command).
  - 3. Safety and health hazard assessment and risk analysis for each site task and operator (Accident Prevention Plan).
  - 4. Education and Training.
  - 5. Personnel Protective Equipment.
  - 6. Medical Surveillance.
  - 7. Air Monitoring (Environmental).
  - 8. Standard Operating Procedures, Engineering Controls and Work Practices.
  - 9. Site Control Measures (Work Zones, Communications and Security).
  - 10. Personnel Hygiene and Decontamination.
  - 11. Equipment Decontamination.
  - 12. Logs, Reports and Record Keeping.
  - 13. Heat/Cold Stress Monitoring.
  - 14. Pre-emergency planning.
  - 15. Personnel roles, lines of authority, training and communication.
  - 16. Emergency recognition and prevention.
  - 17. Safe distances and places of refuge.
  - 18. Site security and control.
  - 19. Evacuation routes and procedures.
  - 20. Decontamination.
  - 21. Emergency Medical treatment and first aid.
  - 22. Emergency alerting and response procedures.
  - 23. Critique of response and follow-up.
  - 24. Personnel Protection Equipment and emergency equipment.

## 1.9 REGULATORY REQUIREMENTS

- A. The Contractor is responsible for awareness, knowledge and full compliance with all applicable rules, regulations, laws and practices applicable to the Contractor's Scope of Work, including lower tier subcontractors, prescribed by the site owner, and any other government or agency governing the safety and health of employees, other site personnel, the general public and

protection of the environment. Within the United States and its Territories these include, but are not limited to regulations promulgated by the following:

1. Occupational Safety and Health Administration (OSHA)
2. Environmental Protection Agency (EPA)
3. Department of Transportation (DOT)
4. Department of Energy, Nuclear Regulatory Commission (NRC)
5. Mine Safety and Health Administration (MSHA)

B. Additional rules required by the Engineer include:

1. Each Contractor has the responsibility for instructing its employees in safe practices for the operation of tools and equipment and for the maintenance of safe conditions.
2. Contractors shall furnish for their employees' personal safety equipment such as, ANSI Z89.1 approved hard hats, ANSI Z87.1 approved eye protection with fixed side shields, ear protection, foot protection, NIOSH approved respiratory protection, fall protection and other equipment as required for safe performance of their particular work assignment. All personnel on the job site shall be required at a minimum to wear hard hats, safety glasses with side shields and proper and sturdy footwear.
3. Danger tags and locks shall be utilized to prevent personal injury and equipment damage in accordance with project electrical and mechanical tagging procedures.
4. Scaffolding and other structures utilized for elevated work platforms shall have the required decking, handrails, mid-rails, toe boards, proper access, and nets or screens.
5. Catwalks shall conform to a two-plank width minimum and, if elevated, shall have handrails and toe boards.
6. Areas in which "overhead" work is to be performed shall be blocked, decked, barricaded, netted, posted, or evacuated as instructed by project supervision.
7. Pits, trenches, and other excavations shall be shored/shielded or sloped to the proper angle of repose, barricaded, and provided with proper access.
8. When not in use, blades of bulldozers and buckets of front-end loaders shall be lowered to the ground. Also, beds of dump trucks shall be lowered when traveling or not in use. Project parking and traffic regulations shall be complied with.
9. Crane booms shall be lowered at the end of single shifts or secured against movement by attaching the hoist line to a fixed structure.
10. Specific air sampling shall be performed to determine the presence of toxic materials or dusts, flammable atmosphere and adequate oxygen content, in accordance with project procedures. Respirators, safety harnesses, lifelines, standby personnel, and permits shall be used when appropriate.
11. Personnel involved in activities which require the use of an Air Purifying Respirator (APR) shall not have facial hair which interferes with the respirator's face seal.
12. The Contractor shall provide to the Engineer a copy of MSDSs for all hazardous materials prior to their use at the site.
13. Back-up alarms shall be provided on all construction vehicles and equipment and shall alarm continuously while the vehicle or equipment is in reverse motion. For equipment not equipped with a back-up alarm, a spotter shall be used.
14. All portable generators shall have frames externally grounded or other means to ensure there is no potential for circuit to frame conductivity.
15. All electrical services used in conjunction with field activities shall be equipped with Ground Fault Circuit Interrupters (GFCI).

16. Compliance with the following fire prevention measures is mandatory:
  - a. Smoking is permitted only in specific areas as designated in project rules and procedures.
  - b. Open fires are prohibited. Temporary gas-fired heaters shall not be used in enclosed areas. Only UL and NFPA approved petroleum and/or electrically fired heating devices will be authorized for use.
  - c. Hot work permits shall be required for all flame and spark producing work tasks.
  - d. Debris, scrap, and refuse shall be segregated and controlled in metal containers and removed at appropriate intervals. Any potential fire hazard shall be controlled.
  - e. Each Contractor is responsible for maintaining and cleaning their work area. All walkways shall be kept clean and free of obstructions. Broken/spilled, scrap or other waste materials shall be placed in appropriate containers or waste areas as soon as practical after they are generated.
  - f. Flammable liquids shall be kept in UL approved safety containers and properly labeled as to contents.
  - g. Flammable and combustible materials shall be stored in designated locations that meet Federal, State and local regulations.
  - h. All equipment such as cranes, trucks, bulldozers, graders, loaders and backhoes shall be equipped with proper fire extinguishers.
  - i. The use of heavy equipment with internal combustion engines is prohibited within enclosed areas.
17. Only the number of persons provided with proper seats shall ride in a vehicle. No one shall ride on running boards, stand on moving equipment or ride on a vehicle other than in a proper seated position.
18. The swing radius of all heavy equipment such as cranes, back hoes, etc. shall be clearly barricaded.
19. The contractor shall provide 100% fall protection for fall exposures greater than 6 ft in accordance with project procedures.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION (NOT USED)

END OF SECTION 013526

## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

#### 1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced." unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
  - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to

verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.
  2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as indicated in-place portion of permanent construction, consisting of multiple products, assemblies, and subassemblies, with cutaways enabling inspection of concealed portions of the Work.
    - a. Include each system, assembly, component, and part of the exterior wall and roof to be constructed for the Project. Colors of components shall be those selected by the Engineer for use in the Project.
  3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting.
  4. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
  5. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."
- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Engineer.



#### 1.4 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.
- B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

#### 1.5 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Engineer regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Engineer for clarification before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

#### 1.6 ACTION SUBMITTALS

- A. Mockup Shop Drawings: For integrated exterior mockups.
  - 1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
  - 2. Indicate manufacturer and model number of individual components.
  - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

#### 1.7 DELEGATED DESIGN

- A. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1. Delegated-Designer: Professionals currently registered in State in which project work occurs.

## 1.8 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
  1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
  2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  1. Specification Section number and title.
  2. Entity responsible for performing tests and inspections.
  3. Description of test and inspection.
  4. Identification of applicable standards.
  5. Identification of test and inspection methods.
  6. Number of tests and inspections required.
  7. Time schedule or time span for tests and inspections.
  8. Requirements for obtaining samples.
  9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

## 1.9 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's

quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
  - 1. Project quality-control manager shall not have other Project responsibilities.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
  - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
  - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
  - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include Work Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

#### 1.10 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, telephone number, and email address of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample--taking and testing and inspection.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement of whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
  2. Statement that equipment complies with requirements.
  3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  4. Statement of whether conditions, products, and installation will affect warranty.
  5. Other required items indicated in individual Specification Sections.

#### 1.11 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- D. **Installer Qualifications:** A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. **Specialists:** Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged in the activities indicated.
  - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. **Testing and Inspecting Agency Qualifications:** An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. **Manufacturer's Technical Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect, demonstrate, repair and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. **Preconstruction Testing:** Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following: Contractor responsibilities include the following:
  - 1. Provide test specimens representative of proposed products and construction.
  - 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
  - 3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
  - 4. First subparagraph below attempts to ensure that tested assemblies will be representative of actual construction. This requirement may complicate testing and add cost.
  - 5. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
  - 6. Build laboratory mockups at testing facility, using personnel, products, and methods of construction indicated for the completed Work.
  - 7. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.

8. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups of size indicated.
  2. Build mockups in location indicated or, if not indicated, as directed by Engineer.
  3. Notify Engineer seven days in advance of dates and times when mockups will be constructed.
  4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
  5. Demonstrate the proposed range of aesthetic effects and workmanship.
  6. Obtain Engineer's approval of mockups before starting corresponding Work, fabrication, or construction.
    - a. Allow seven days for initial review and each re-review of each mockup.
  7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
  8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  10. Demolish and remove mockups when directed unless otherwise indicated.
- L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.
1. Coordinate construction of the mockup to allow observation of air barrier installation, flashings, air barrier integration with fenestration systems, and other portions of the building air/moisture barrier and drainage assemblies, prior to installation of veneer, cladding elements, and other components that will obscure the work.
- M. Room Mockups: Construct room mockups according to approved Shop Drawings, incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Engineer to evaluate quality of the Work. Comply with requirements in "Mockups" Paragraph.
- N. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.
- 1.12 QUALITY CONTROL
- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
  2. Payment for these services will be made from testing and inspection allowances specified in Section 012100 "Allowances," as authorized by Change Orders.
  3. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  2. Engage a qualified testing agency to perform quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
  4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Engineer, Commissioning Authority and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

- F. **Manufacturer's Technical Services:** Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. **Contractor's Associated Requirements and Services:** Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
  - 4. Facilities for storage and field curing of test samples.
  - 5. Delivery of samples to testing agencies.
  - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  - 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. **Schedule of Tests and Inspections:** Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payments.
  - 1. **Schedule Contents:** Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
  - 2. **Distribution:** Distribute schedule to Owner, Engineer and testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

#### 1.13 SPECIAL TESTS AND INSPECTIONS

- A. **Special Tests and Inspections:** Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
  - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
  - 2. Notifying Engineer and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.



3. Submitting a certified written report of each test, inspection, and similar quality-control service to Engineer with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
  1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Engineer.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's and authorities' having jurisdiction reference during normal working hours.
  1. Submit log at Project closeout as part of Project Record Documents.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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## SECTION 014200 – REFERENCES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.  
"Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- B. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- C. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- D. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- E. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- F. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- G. "Provide": Furnish and install, complete and ready for the intended use.
- H. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

#### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

#### 1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the **United States.**" The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.
  - 1. AABC - Associated Air Balance Council; [www.aabc.com](http://www.aabc.com).
  - 2. AAMA - American Architectural Manufacturers Association; [www.aamanet.org](http://www.aamanet.org).
  - 3. AAPFCO - Association of American Plant Food Control Officials; [www.aapfco.org](http://www.aapfco.org).
  - 4. AASHTO - American Association of State Highway and Transportation Officials; [www.transportation.org](http://www.transportation.org).
  - 5. AATCC - American Association of Textile Chemists and Colorists; [www.aatcc.org](http://www.aatcc.org).
  - 6. ABMA - American Bearing Manufacturers Association; [www.americanbearings.org](http://www.americanbearings.org).
  - 7. ABMA - American Boiler Manufacturers Association; [www.abma.com](http://www.abma.com).
  - 8. ACI - American Concrete Institute; (Formerly: ACI International); [www.concrete.org](http://www.concrete.org)
  - 9. ACPA - American Concrete Pipe Association; [www.concrete-pipe.org](http://www.concrete-pipe.org).
  - 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); [www.aeic.org](http://www.aeic.org).
  - 11. AF&PA - American Forest & Paper Association; [www.afandpa.org](http://www.afandpa.org).
  - 12. AGA - American Gas Association; [www.aga.org](http://www.aga.org).
  - 13. AHAM - Association of Home Appliance Manufacturers; [www.aham.org](http://www.aham.org).
  - 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); [www.ahrinet.org](http://www.ahrinet.org).
  - 15. AI - Asphalt Institute; [www.asphaltinstitute.org](http://www.asphaltinstitute.org).
  - 16. AIA - American Institute of Architects (The); [www.aia.org](http://www.aia.org).
  - 17. AISC - American Institute of Steel Construction; [www.aisc.org](http://www.aisc.org).
  - 18. AISI - American Iron and Steel Institute; [www.steel.org](http://www.steel.org).
  - 19. AITC - American Institute of Timber Construction; [www.aitc-glulam.org](http://www.aitc-glulam.org).
  - 20. AMCA - Air Movement and Control Association International, Inc.; [www.amca.org](http://www.amca.org).
  - 21. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  - 22. AOSA - Association of Official Seed Analysts, Inc.; [www.aosaseed.com](http://www.aosaseed.com).
  - 23. APA - APA - The Engineered Wood Association; [www.apawood.org](http://www.apawood.org).
  - 24. APA - Architectural Precast Association; [www.archprecast.org](http://www.archprecast.org).

25. API - American Petroleum Institute; [www.api.org](http://www.api.org).
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; [www.asphaltroofing.org](http://www.asphaltroofing.org).
29. ASCE - American Society of Civil Engineers; [www.asce.org](http://www.asce.org).
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; [www.ashrae.org](http://www.ashrae.org).
32. ASME - ASME International; (American Society of Mechanical Engineers); [www.asme.org](http://www.asme.org).
33. ASSE - American Society of Safety Engineers (The); [www.asse.org](http://www.asse.org).
34. ASSE - American Society of Sanitary Engineering; [www.asse-plumbing.org](http://www.asse-plumbing.org).
35. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
36. ATIS - Alliance for Telecommunications Industry Solutions; [www.atis.org](http://www.atis.org).
37. AWEA - American Wind Energy Association; [www.awea.org](http://www.awea.org).
38. AWI - Architectural Woodwork Institute; [www.awinet.org](http://www.awinet.org).
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; [www.awmac.com](http://www.awmac.com).
40. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).
41. AWS - American Welding Society; [www.aws.org](http://www.aws.org).
42. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).
43. BHMA - Builders Hardware Manufacturers Association; [www.buildershardware.com](http://www.buildershardware.com).
44. BIA - Brick Industry Association (The); [www.gobrick.com](http://www.gobrick.com).
45. BICSI - BICSI, Inc.; [www.bicsi.org](http://www.bicsi.org).
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); [www.bifma.org](http://www.bifma.org).
47. BISSC - Baking Industry Sanitation Standards Committee; [www.bissc.org](http://www.bissc.org).
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); [www.bissc.org](http://www.bissc.org).
49. CDA - Copper Development Association; [www.copper.org](http://www.copper.org).
50. CE - Conformite Europeenne ; <http://ec.europa.eu/growth/single-market/ce-marking/>
51. CEA - Canadian Electricity Association; [www.electricity.ca](http://www.electricity.ca).
52. CEA - Consumer Electronics Association; [www.ce.org](http://www.ce.org).
53. CFFA - Chemical Fabrics and Film Association, Inc.; [www.chemicalfabricsandfilm.com](http://www.chemicalfabricsandfilm.com).
54. CFSEI - Cold-Formed Steel Engineers Institute; [www.cfsei.org](http://www.cfsei.org).
55. CGA - Compressed Gas Association; [www.cganet.com](http://www.cganet.com).
56. CIMA - Cellulose Insulation Manufacturers Association; [www.cellulose.org](http://www.cellulose.org).
57. CISCA - Ceilings & Interior Systems Construction Association; [www.cisca.org](http://www.cisca.org).
58. CISPI - Cast Iron Soil Pipe Institute; [www.cispi.org](http://www.cispi.org).
59. CLFMI - Chain Link Fence Manufacturers Institute; [www.chainlinkinfo.org](http://www.chainlinkinfo.org).
60. CPA - Composite Panel Association; [www.pbmdf.com](http://www.pbmdf.com).
61. CRI - Carpet and Rug Institute (The); [www.carpet-rug.org](http://www.carpet-rug.org).
62. CRRC - Cool Roof Rating Council; [www.coolroofs.org](http://www.coolroofs.org).
63. CRSI - Concrete Reinforcing Steel Institute; [www.crsi.org](http://www.crsi.org).
64. CSA - CSA Group; [www.csagroup.com](http://www.csagroup.com).
65. CSA - CSA International; [www.csa-international.org](http://www.csa-international.org).
66. CSI - Construction Specifications Institute (The); [www.csinet.org](http://www.csinet.org).
67. CSSB - Cedar Shake & Shingle Bureau; [www.cedarbureau.org](http://www.cedarbureau.org).
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.cti.org](http://www.cti.org).
69. CWC - Composite Wood Council; (See CPA).

70. DASMA - Door and Access Systems Manufacturers Association; [www.dasma.com](http://www.dasma.com).
71. DHI - Door and Hardware Institute; [www.dhi.org](http://www.dhi.org).
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; [www.eciaonline.org](http://www.eciaonline.org).
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; [www.eima.com](http://www.eima.com).
77. EJMA - Expansion Joint Manufacturers Association, Inc.; [www.ejma.org](http://www.ejma.org).
78. ESD - ESD Association; (Electrostatic Discharge Association); [www.esda.org](http://www.esda.org).
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); [www.intertek.com](http://www.intertek.com).
81. EVO - Efficiency Valuation Organization; [www.evo-world.org](http://www.evo-world.org).
82. FCI - Fluid Controls Institute; [www.fluidcontrolsintstitute.org](http://www.fluidcontrolsintstitute.org).
83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); [www.fiba.com](http://www.fiba.com).
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); [www.fivb.org](http://www.fivb.org).
85. FM Approvals - FM Approvals LLC; [www.fmglobal.com](http://www.fmglobal.com).
86. FM Global - FM Global; (Formerly: FMG - FM Global); [www.fmglobal.com](http://www.fmglobal.com).
87. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; [www.floridarroof.com](http://www.floridarroof.com).
88. FSA - Fluid Sealing Association; [www.fluidsealing.com](http://www.fluidsealing.com).
89. FSC - Forest Stewardship Council U.S.; [www.fscus.org](http://www.fscus.org).
90. GA - Gypsum Association; [www.gypsum.org](http://www.gypsum.org).
91. GANA - Glass Association of North America; [www.glasswebsite.com](http://www.glasswebsite.com).
92. GS - Green Seal; [www.greenseal.org](http://www.greenseal.org).
93. HI - Hydraulic Institute; [www.pumps.org](http://www.pumps.org).
94. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
95. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
96. HPVA - Hardwood Plywood & Veneer Association; [www.hpva.org](http://www.hpva.org).
97. HPW - H. P. White Laboratory, Inc.; [www.hpwhite.com](http://www.hpwhite.com).
98. IAPSC - International Association of Professional Security Consultants; [www.iapsc.org](http://www.iapsc.org).
99. IAS - International Accreditation Service; [www.iasonline.org](http://www.iasonline.org).
100. ICBO - International Conference of Building Officials; (See ICC).
101. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
102. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
103. ICPA - International Cast Polymer Alliance; [www.icpa-hq.org](http://www.icpa-hq.org).
104. ICRI - International Concrete Repair Institute, Inc.; [www.icri.org](http://www.icri.org).
105. IEC - International Electrotechnical Commission; [www.iec.ch](http://www.iec.ch).
106. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
107. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); [www.ies.org](http://www.ies.org).
108. IESNA - Illuminating Engineering Society of North America; (See IES).
109. IEST - Institute of Environmental Sciences and Technology; [www.iest.org](http://www.iest.org).
110. IGMA - Insulating Glass Manufacturers Alliance; [www.igmaonline.org](http://www.igmaonline.org).
111. IGSHPA - International Ground Source Heat Pump Association; [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu).
112. ILI - Indiana Limestone Institute of America, Inc.; [www.ili.ai.com](http://www.ili.ai.com).
113. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); [www.intertek.com](http://www.intertek.com).

114. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); [www.isa.org](http://www.isa.org).
115. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
116. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); [www.isfanow.org](http://www.isfanow.org).
117. ISO - International Organization for Standardization; [www.iso.org](http://www.iso.org).
118. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
119. ITU - International Telecommunication Union; [www.itu.int/home](http://www.itu.int/home).
120. KCMA - Kitchen Cabinet Manufacturers Association; [www.kcma.org](http://www.kcma.org).
121. LMA - Laminating Materials Association; (See CPA).
122. LPI - Lightning Protection Institute; [www.lightning.org](http://www.lightning.org).
123. MBMA - Metal Building Manufacturers Association; [www.mbma.com](http://www.mbma.com).
124. MCA - Metal Construction Association; [www.metalconstruction.org](http://www.metalconstruction.org).
125. MFMA - Maple Flooring Manufacturers Association, Inc.; [www.maplefloor.org](http://www.maplefloor.org).
126. MFMA - Metal Framing Manufacturers Association, Inc.; [www.metalframingmfg.org](http://www.metalframingmfg.org).
127. MHIA - Material Handling Industry of America; [www.mhia.org](http://www.mhia.org).
128. MIA - Marble Institute of America; [www.marble-institute.com](http://www.marble-institute.com).
129. MMPA - Moulding & Millwork Producers Association; [www.wmmpa.com](http://www.wmmpa.com).
130. MPI - Master Painters Institute; [www.paintinfo.com](http://www.paintinfo.com).
131. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; [www.mss-hq.org](http://www.mss-hq.org).
132. NAAMM - National Association of Architectural Metal Manufacturers; [www.naamm.org](http://www.naamm.org).
133. NACE - NACE International; (National Association of Corrosion Engineers International); [www.nace.org](http://www.nace.org).
134. NADCA - National Air Duct Cleaners Association; [www.nadca.com](http://www.nadca.com).
135. NAIMA - North American Insulation Manufacturers Association; [www.naima.org](http://www.naima.org).
136. NBGQA - National Building Granite Quarries Association, Inc.; [www.nbgqa.com](http://www.nbgqa.com).
137. NBI - New Buildings Institute; [www.newbuildings.org](http://www.newbuildings.org).
138. NCAA - National Collegiate Athletic Association (The); [www.ncaa.org](http://www.ncaa.org).
139. NCMA - National Concrete Masonry Association; [www.ncma.org](http://www.ncma.org).
140. NEBB - National Environmental Balancing Bureau; [www.nebb.org](http://www.nebb.org).
141. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
142. NeLMA - Northeastern Lumber Manufacturers Association; [www.nelma.org](http://www.nelma.org).
143. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
144. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
145. NFHS - National Federation of State High School Associations; [www.nfhs.org](http://www.nfhs.org).
146. NFPA - National Fire Protection Association; [www.nfpa.org](http://www.nfpa.org).
147. NFPA - NFPA International; (See NFPA).
148. NFRC - National Fenestration Rating Council; [www.nfrc.org](http://www.nfrc.org).
149. NHLA - National Hardwood Lumber Association; [www.nhla.com](http://www.nhla.com).
150. NLGA - National Lumber Grades Authority; [www.nlga.org](http://www.nlga.org).
151. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
152. NOMMA - National Ornamental & Miscellaneous Metals Association; [www.nomma.org](http://www.nomma.org).
153. NRCA - National Roofing Contractors Association; [www.nrca.net](http://www.nrca.net).
154. NRMCA - National Ready Mixed Concrete Association; [www.nrmca.org](http://www.nrmca.org).
155. NSF - NSF International; [www.nsf.org](http://www.nsf.org).
156. NSPE - National Society of Professional Engineers; [www.nspe.org](http://www.nspe.org).
157. NSSGA - National Stone, Sand & Gravel Association; [www.nssga.org](http://www.nssga.org).
158. NTMA - National Terrazzo & Mosaic Association, Inc. (The); [www.ntma.com](http://www.ntma.com).
159. NWFA - National Wood Flooring Association; [www.nwfa.org](http://www.nwfa.org).



160. PCI - Precast/Prestressed Concrete Institute; [www.pci.org](http://www.pci.org).
161. PDI - Plumbing & Drainage Institute; [www.pdionline.org](http://www.pdionline.org).
162. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); [www.plasa.org](http://www.plasa.org).
163. RCSC - Research Council on Structural Connections; [www.boltcouncil.org](http://www.boltcouncil.org).
164. RFCI - Resilient Floor Covering Institute; [www.rfci.com](http://www.rfci.com).
165. RIS - Redwood Inspection Service; [www.redwoodinspection.com](http://www.redwoodinspection.com).
166. SAE - SAE International; [www.sae.org](http://www.sae.org).
167. SCTE - Society of Cable Telecommunications Engineers; [www.scte.org](http://www.scte.org).
168. SDI - Steel Deck Institute; [www.sdi.org](http://www.sdi.org).
169. SDI - Steel Door Institute; [www.steeldoor.org](http://www.steeldoor.org).
170. SEFA - Scientific Equipment and Furniture Association (The); [www.sefalabs.com](http://www.sefalabs.com).
171. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
172. SIA - Security Industry Association; [www.siaonline.org](http://www.siaonline.org).
173. SJI - Steel Joist Institute; [www.steeljoist.org](http://www.steeljoist.org).
174. SMA - Screen Manufacturers Association; [www.smainfo.org](http://www.smainfo.org).
175. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; [www.smacna.org](http://www.smacna.org).
176. SMPTE - Society of Motion Picture and Television Engineers; [www.smpte.org](http://www.smpte.org).
177. SPFA - Spray Polyurethane Foam Alliance; [www.sprayfoam.org](http://www.sprayfoam.org).
178. SPIB - Southern Pine Inspection Bureau; [www.spib.org](http://www.spib.org).
179. SPRI - Single Ply Roofing Industry; [www.spri.org](http://www.spri.org).
180. SRCC - Solar Rating & Certification Corporation; [www.solar-rating.org](http://www.solar-rating.org).
181. SSINA - Specialty Steel Industry of North America; [www.ssina.com](http://www.ssina.com).
182. SSPC - SSPC: The Society for Protective Coatings; [www.sspc.org](http://www.sspc.org).
183. STI - Steel Tank Institute; [www.steeltank.com](http://www.steeltank.com).
184. SWI - Steel Window Institute; [www.steelwindows.com](http://www.steelwindows.com).
185. SWPA - Submersible Wastewater Pump Association; [www.swpa.org](http://www.swpa.org).
186. TCA - Tilt-Up Concrete Association; [www.tilt-up.org](http://www.tilt-up.org).
187. TCNA - Tile Council of North America, Inc.; [www.tileusa.com](http://www.tileusa.com).
188. TEMA - Tubular Exchanger Manufacturers Association, Inc.; [www.tema.org](http://www.tema.org).
189. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); [www.tiaonline.org](http://www.tiaonline.org).
190. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
191. TMS - The Masonry Society; [www.masonrysociety.org](http://www.masonrysociety.org).
192. TPI - Truss Plate Institute; [www.tpinst.org](http://www.tpinst.org).
193. TPI - Turfgrass Producers International; [www.turfgrasssod.org](http://www.turfgrasssod.org).
194. TRI - Tile Roofing Institute; [www.tilerroofing.org](http://www.tilerroofing.org).
195. UL - Underwriters Laboratories Inc.; <http://www.ul.com>.
196. UNI - Uni-Bell PVC Pipe Association ; [www.uni-bell.org](http://www.uni-bell.org).
197. USAV - USA Volleyball; [www.usavolleyball.org](http://www.usavolleyball.org).
198. USGBC - U.S. Green Building Council; [www.usgbc.org](http://www.usgbc.org).
199. USITT - United States Institute for Theatre Technology, Inc.; [www.usitt.org](http://www.usitt.org).
200. WA - Wallcoverings Association; [www.wallcoverings.org](http://www.wallcoverings.org).
201. WASTEC - Waste Equipment Technology Association; [www.wastec.org](http://www.wastec.org).
202. WCLIB - West Coast Lumber Inspection Bureau; [www.wclib.org](http://www.wclib.org).
203. WCMA - Window Covering Manufacturers Association; [www.wcmanet.org](http://www.wcmanet.org).
204. WDMA - Window & Door Manufacturers Association; [www.wdma.com](http://www.wdma.com).



205. WI - Woodwork Institute; [www.wicnet.org](http://www.wicnet.org).
206. WSRCA - Western States Roofing Contractors Association; [www.wsrca.com](http://www.wsrca.com).
207. WWPA - Western Wood Products Association; [www.wwpa.org](http://www.wwpa.org).

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut für Normung e.V.; [www.din.de](http://www.din.de).
2. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
3. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
4. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; [www.usace.army.mil](http://www.usace.army.mil).
2. CPSC - Consumer Product Safety Commission; [www.cpsc.gov](http://www.cpsc.gov).
3. DOC - Department of Commerce; National Institute of Standards and Technology; [www.nist.gov](http://www.nist.gov).
4. DOD - Department of Defense; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
5. DOE - Department of Energy; [www.energy.gov](http://www.energy.gov).
6. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
7. FAA - Federal Aviation Administration; [www.faa.gov](http://www.faa.gov).
8. FG - Federal Government Publications; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
9. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
10. HUD - Department of Housing and Urban Development; [www.hud.gov](http://www.hud.gov).
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; [www.eetd.lbl.gov](http://www.eetd.lbl.gov).
12. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
13. SD - Department of State; [www.state.gov](http://www.state.gov).
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; [www.trb.org](http://www.trb.org).
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
16. USDA - Department of Agriculture; Rural Utilities Service; [www.usda.gov](http://www.usda.gov).
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; [www.ojp.usdoj.gov](http://www.ojp.usdoj.gov).
18. USP - U.S. Pharmacopeial Convention; [www.usp.org](http://www.usp.org).
19. USPS - United States Postal Service; [www.usps.com](http://www.usps.com).

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).

2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
  3. DSCC - Defense Supply Center Columbus; (See FS).
  4. FED-STD - Federal Standard; (See FS).
  5. FS - Federal Specification; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
    - a. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
    - b. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
    - c. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org](http://www.wbdg.org).
  6. MILSPEC - Military Specification and Standards; (See DOD).
  7. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
  8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; [www.bearhfti.ca.gov](http://www.bearhfti.ca.gov).
  2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; [www.calregs.com](http://www.calregs.com).
  3. CDHS; California Department of Health Services; (See CDPH).
  4. CDPH; California Department of Public Health; Indoor Air Quality Program; [www.cal-iaq.org](http://www.cal-iaq.org).
  5. CPUC; California Public Utilities Commission; [www.cpuc.ca.gov](http://www.cpuc.ca.gov).
  6. SCAQMD; South Coast Air Quality Management District; [www.aqmd.gov](http://www.aqmd.gov).
  7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; [www.txforestservation.tamu.edu](http://www.txforestservation.tamu.edu).

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION (NOT USED)

END OF SECTION 014200

## SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

#### 1.3 USE CHARGES

- A. Installation and removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Engineer, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Use of the Owner's existing toilets will not be permitted during construction. Contractor to provide temporary sanitation during construction.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.
- E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use with metering. Provide connections and extensions of services and metering as required for construction operations.
- F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use with metering. Provide connections and extensions of services and metering as required for construction operations.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
  - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
  - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
  - 3. Indicate methods to be used to avoid trapping water in finished work.
- F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
  - 1. Locations of dust-control partitions at each phase of work.
  - 2. HVAC system isolation schematic drawing.
  - 3. Location of proposed air-filtration system discharge.
  - 4. Waste-handling procedures.
  - 5. Other dust-control measures.
- G. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
  - 1. Methods used to meet the goals and requirements of the Owner.
  - 2. Concrete cutting method(s) to be used.
  - 3. Location of construction devices on the site.
  - 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.

5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.
6. Indicate locations of sensitive equipment areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.

## 1.5 QUALITY ASSURANCE

- A. Temporary facilities shall comply with all applicable state and local ordinances, codes and regulations.
- B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- D. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines.

## 1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top rails, with galvanized barbed-wire top strand.
- B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete bases for supporting posts.
- C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Engineer from manufacturer's standard colors.
- D. Wood Enclosure Fence: Plywood, 8 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

- E. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.
- F. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.
- G. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

## 2.2 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Engineer's Field Office: Of sufficient size, trailers of a minimum 12-ft by 50-ft, to accommodate needs of Owner, Engineer and to accommodate Project meetings specified in other Division 01 Sections for duration of project. Keep office clean and orderly. Furnish and equip trailer as follows:
  - 1. Field office trailer shall have at least one office, one conference room, one bathroom, one closet, and two exterior doors.
  - 2. The bathroom shall include toilet, sink and faucet, and faucet, medicine cabinet, and exhaust fan.
  - 3. The conference room shall include built-in plan table.
  - 4. The Engineer's field office shall be weather-tight construction with floor, walls, and ceiling completely insulated. Each room shall have at least one operating window. Each window shall have a venetian blind and full insect screen. Furnish two sets of keys for each exterior door. Provide fully insulated skirting on all sides of the field office trailer. Provide steps, platforms, handrails, and boot scrapers for each exterior door.
  - 5. Field office trailer shall be Mobile Mini, ModSpace, Williams Scotsman, or equal. Converted storage or box containers will not be acceptable.
  - 6. Furnishings:
    - a. Provide the following furnishings for the Engineer's temporary field office for the duration of the project. All furnishings shall be new – or in very good condition – subject to approval of the Engineer.
      - 1) Three 60-in by 30-in desks with file drawer and 5 drawers, all lockable, with upholstered swivel type chair with arms for each desk.
      - 2) One 30-in by 84-in conference table.
      - 3) Eight armless side chairs (stacking type).
      - 4) Two 54-in by 30-in folding tables.
      - 5) Six file cabinets, 4 drawer, legal size, Hon No. HN-315C, or equal.
      - 6) Four wastebaskets.
      - 7) One rolling plan storage rack, 10-stick capacity.
      - 8) One lockable storage cabinet, 72-in high, 36-in wide, and 18-in deep.
      - 9) Three steel bookcase units, 4 shelves high, Hon No. HN-S48 ABC, or equal.
      - 10) One digital telephone answering machine.
      - 11) 24 painted steel coat hangers.

- 12) One electric bottled water dispenser with hot and cold outlets and refrigerator unit. Adequate water bottles shall be provided (and paid for by the Contractor) until Final Completion.
- 13) One wall-mounted first aid kit, McMaster-Carr 9501T1 or equal.
- 14) Two smoke detectors, with batteries.
- 15) Two dry erase boards, aluminum frame, 36-in by 60-in, markers and eraser, Quartet Model No. TS-S 535 or equal.
- 16) One 1000-watt minimum 1.4-cuft microwave oven.
- 17) One 6-cf refrigerator.
- 18) Commercial duty cross-cut shredder with basket, designed for 3 to 5 users, Fellowes Powershred SB-125i, or equal.
- 19) One first aid kit, OSHA (1910.151.b) and ANSI (Z308.1-2003) compliant, suitable for ten people.

7. Equipment:

- a. Contractor shall provide the following equipment for the Engineer's temporary field office for the duration of the project. All equipment shall be new.
  - 1) A multifunction Photocopier, printer, facsimile and scanner.
- b. With 50-sheet auto-feeder, capable of copying and printing
- c. Letter-sized, legal-sized, and 11x17-inch documents.
- d. Contractor to provide paper and ink cartridges, as required, for the duration of the project.
  - 1) Answering machine with digital recorder.
  - 2) Digital Camera: provide one new digital camera for the Engineer's use for the project duration. Camera shall be a major brand name (e.g., Minolta, Cannon, Olympic, Pentax, etc. – subject to the Engineer's approval) and shall have an automatic date function, 3 Mega pixel or greater, 3x optical zoom or better, and at least one GB of memory (on board or supplemental memory card). The camera shall come complete with carrying case, storage card, rechargeable batteries, battery charger, flash memory reader, USB cables and all necessary software. After completion of project the camera will become the property of the Contractor.
  - 3) Four 8-outlet surge protectors with six-foot cord and minimum 1800-joule energy rating or greater; as manufactured by Belkin, or equal.
  - 4) One 12-cup coffeemaker with timer, by Krups, or equal.

8. Services:

- a. Provide the following services for the duration of the project. Services shall include all costs for installation, use, maintenance, and removal of all products, services and equipment billed by each provider for each service specified herein.
- b. Field office shall have complete and fully functional electrical, plumbing, and HVAC systems. Provide at least two smoke detectors hard-wired into the electrical system. Perform all scheduled and unscheduled maintenance for all systems and as directed by the Engineer.
- c. Electrical System: Provide connection to temporary electric service. Comply with the electrical requirements of the furnished office trailer. Provide main circuit panel, sufficient GFCI outlets and lighting in each room, exterior lights at each exterior door, and proper grounding of entire electrical system.

- d. Plumbing system: Connect to existing potable water supply. Provide hot water heater and hot and cold water to each fixture. Connect waste pipes to a waste holding tank or provide separate temporary portable toilets with wash stations. Heat trace and insulate exterior piping to prevent freezing. Where potable water service is not available, Contractor shall provide bottle water service with water chiller/dispenser.
- e. HVAC System: Provide central heating and air conditioning system with programmable thermostat. System shall be capable of maintaining an interior temperature of 70°F when the exterior temperature is 0°F and an interior temperature of 75°F when the exterior temperature is 100°F.
- f. Bottled water service: Provide bottled water service complete with dispenser with hot and cold water taps and regular bottle and cup replenishment as directed by the Engineer.
- g. Janitorial service: Provide janitorial services (at least weekly) that include dusting, sweeping, vacuuming, mopping, disinfection, and trash removal.
- h. Sanitary service: Provide regular pumping of waste holding tank, if applicable, as needed.
- i. Communications:
  - 1) Install two telephone lines in the Engineer's field office for the Engineer's exclusive use:
    - a) one voice grade line with caller ID and call-waiting features.
    - b) a second line for a dedicated fax line.
  - 2) Provide, for the Engineer's use, four two-way radios with a minimum range of two miles, with chargers.
- j. Internet Access:
  - 1) Provide a high-speed DSL data line or T1 cable line with internet access for the duration of the project.
  - 2) Provide one air card for the Engineer's use for the duration of the project (through Final Completion], with unlimited data plans.
- k. Pay all costs for installation, maintenance, and removal of the telephone and internet service and instruments, including cellular phone service. The monthly cost of all calls made and received by the Engineer, including toll and long-distance calls, shall be paid for by the Contractor for the duration of the project.
- 9. Supplies: Provide the following supplies for the duration of the project: copy paper, toner, toilet paper, paper towels, soap, light bulbs, and other consumables as required by the Engineer.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
  - 1. Store combustible materials apart from building.

## 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.



- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.
  - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

## PART 3 - EXECUTION

### 3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
  - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

### 3.2 INSTALLATION, GENERAL

- A. Locate facilities where shown on the Drawings or where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work. Engineer's trailer shall be set up and ready for occupancy within 30 days of the Notice to Proceed.
  - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use within 30 days of the Notice to Proceed and prior to Commencement of Work at the site. Do not remove until approved by Engineer or are replaced by authorized use of completed permanent facilities.

### 3.3 ENGINEER'S OFFICE

- A. Engineer's trailers shall be set up and ready for occupancy within 30 days of the Notice to Proceed and prior to commencement of Work at the site. All systems, furnishings, equipment, and services specified herein shall be furnished, installed, and completely operational for the field office to be considered established.

1. Provide regular office cleaning services for the duration of the project.
2. Provide supplies including, but not limited to restroom supplies (toilet tissue paper, paper towel, and soap), as well as light bulbs, air conditioner filters, etc.
3. Provide office supplies for printers and fax machines, etc.
4. Supply all fuel for heating and pay all utility bills.

B. Install field office plumb and level.

C. Engineer's trailer shall be removed, and the site shall be cleaned up and restored before Final Completion of the project.

### 3.4 CONTRACTOR'S FIELD OFFICE

A. Provide a temporary field office(s) for the Contractor's use for the duration of the project. An authorized representative of the Contractor shall be present at all times while the Work is in progress. Instructions received at the Contractors field office from the Engineer shall be considered delivered to the Contractor.

B. Locate field office(s) in accordance with approved shop drawings and as directed by the Owner.

C. Establish and occupy field office within 30 days of the Notice to Proceed, unless otherwise approved by the Engineer or Owner.

### 3.5 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service, if approved by Owner.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Do not Connect temporary sewers to the existing septic system. Provide temporary sanitation during construction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: If approved, connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Final Completion, restore these facilities to condition existing before initial use.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Use of Owner's existing or new toilet facilities will not be permitted.

- F. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
  - 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
  - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
    - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    - b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
  - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
  - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- H. The Contractor shall furnish temporary light and power, including 220 Volt service for welding, complete with wiring, lamps and similar equipment as required to adequately light all work areas and with sufficient power capacity to meet the project needs. Make all necessary arrangements with the local electric company for temporary electric service and pay all expenses in connection therewith.
- I. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- J. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
  - 1. Install electric power service underground unless otherwise indicated.
  - 2. Connect temporary service to Owner's existing power source, as directed by Owner.
- K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- L. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one land-based telephone line(s) for each field office.
  - 1. At each telephone, post a list of important telephone numbers.
    - a. Police and fire departments.

- b. Ambulance service.
  - c. Contractor's home office.
  - d. Contractor's emergency after-hours telephone number.
  - e. Engineer's office.
  - f. Engineers' offices.
  - g. Owner's office.
  - h. Principal subcontractors' field and home offices.
- M. Electronic Communication Service: Provide secure WIFI wireless connection to internet with provisions for access by Engineer and Owner.
- N. Project Computer: Provide a desktop computer in the primary field office adequate for use by Engineer and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
  - 1. Processor: Intel Core i5 or i7.
  - 2. Memory: 164 gigabyte.
  - 3. Disk Storage: 1 -terabyte hard-disk drive and combination DVD-RW/CD-RW drive.
  - 4. Display: 24-inch LCD monitor with 256-Mb dedicated video RAM.
  - 5. Full-size keyboard and mouse.
  - 6. Network Connectivity: Gigabit.
  - 7. Operating System: Microsoft Windows 10 Professional.
  - 8. Productivity Software:
    - a. Microsoft Office Professional, 2013 or higher, including Word, Excel, and Outlook.
    - b. Adobe Reader DC.
    - c. WinZip 10 or higher.
  - 9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
  - 10. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 10 Mbps upload and 15 Mbps download speeds at each computer.
  - 11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
  - 12. Backup: External hard drive, minimum 2 terabytes, with automated backup software providing daily backups.

### 3.6 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
  - 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
  - 2. Utilize designated area within existing building for temporary field offices.
  - 3. Maintain support facilities until Engineer schedules Final Completion inspection. Remove just before Final Completion.

- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.
  - 1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
  - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
  - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas accordance with Section 312000 "Earthwork."
  - 3. Recondition base after temporary use, including removing contaminated material, regrading, proof rolling, compacting, and testing.
  - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
  - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Provide temporary offsite parking areas for construction personnel.
- F. Storage and Staging: Use designated areas of Project site for storage and staging needs.
- G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
  - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
  - 2. Remove snow and ice as required to minimize accumulations.
- H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
  - 1. Identification Signs: Provide Project identification signs as indicated on Drawings. Signs shall be constructed of A-A Ext – APA grade plywood, 1-in thick. Posts and braces shall be of pressure treated lumber.
  - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    - a. Provide temporary, directional signs for construction personnel and visitors.
  - 3. Maintain and touch up signs, so they are legible at all times.

- I. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
  - J. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
  - K. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
    - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
  - L. Temporary Elevator Use: Use of elevators is not permitted.
  - M. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
    - 1. Do not load elevators beyond their rated weight capacity.
    - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work, so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
  - N. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
  - O. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
    - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas, so no evidence remains of correction work.
  - P. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.
- 3.7 SECURITY AND PROTECTION FACILITIES INSTALLATION
- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
    - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."
- D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings or requirements of EPA Construction General Permit, or authorities having jurisdiction, whichever is more stringent.
  - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
  - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
  - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
  - 4. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.
- E. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- F. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."
- G. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- H. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- I. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
  - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
  - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

- J. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- K. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- L. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- M. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.
  - 1. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
  - 2. Paint and maintain appearance of walkway for duration of the Work.
- N. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- O. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
  - 1. Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
  - 2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
    - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
  - 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
  - 4. Insulate partitions to control noise transmission to occupied areas.
  - 5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
  - 6. Protect air-handling equipment.
  - 7. Provide walk-off mats at each entrance through temporary partition.



- P. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
  2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
  3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
  4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
- Q. Weather protection shall comply with M.G.L. Chapter 149 Section 44G.

### 3.8 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
  2. Protect stored and installed material from flowing or standing water.
  3. Keep porous and organic materials from coming into prolonged contact with concrete.
  4. Remove standing water from decks.
  5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  2. Keep interior spaces reasonably clean and protected from water damage.
  3. Periodically collect and remove waste containing cellulose or other organic matter.
  4. Discard or replace water-damaged material.
  5. Do not install material that is wet.
  6. Discard and replace stored or installed material that begins to grow mold.
  7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.

3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
  - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
  - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Engineer.
  - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

### 3.9 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  2. Clear snow and ice from all drives, walks and stairs to maintain safe vehicle and pedestrian access to the site and facilities as directed by the Engineer.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Final Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Final Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
  3. Just prior to Final Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

## SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Requirements:
  - 1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
  - 2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

#### 1.3 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.
- B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape or the average of the smallest and largest diameters at a height 54 inches above the ground line for trees with caliper of 8 inches or greater as measured at a height of 12 inches above the ground.
- C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 12 times the tree's caliper size and with a minimum radius of 96 inches unless otherwise indicated.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

- a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
- b. Arborist's responsibilities.
- c. Quality-control program.
- d. Coordination of Work and equipment movement with the locations of protection zones.
- e. Trenching by hand or with air spade within protection zones.
- f. Field quality control.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
  2. Detail fabrication and assembly of protection-zone fencing and signage.
  3. Indicate extent of trenching by hand or with air spade within protection zones.
- C. Samples: For each type of the following:
  1. Organic Mulch: 1-quart volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
  2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.
  3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.
- D. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
  1. Species and size of tree.
  2. Location on site plan. Include unique identifier for each.
  3. Reason for pruning.
  4. Description of pruning to be performed.
  5. Description of maintenance following pruning.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For arborist and tree service firm.
- B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

- D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
  - 1. Use sufficiently detailed photographs or video recordings.
  - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- E. Quality-control program.

## 1.7 QUALITY ASSURANCE

- A. Arborist Qualifications: Licensed arborist in jurisdiction where Project is located.
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

## 1.8 FIELD CONDITIONS

- A. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Moving or parking vehicles or equipment.
  - 3. Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Backfill Soil: Planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
  - 1. Mixture: Well-blended mix of two parts stockpiled soil to one part planting soil.
  - 2. Planting Soil: Planting soil as specified in Section 329119 "Landscape Grading".
- B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
  - 1. Type: Shredded hardwood or Ground or shredded bark.
  - 2. Size Range: 3 inches maximum, 1/2 inch minimum.
  - 3. Color: Natural.
- C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements:
  - 1. Chain-Link Protection-Zone Fencing: Galvanized-steel or Polymer-coated steel fencing fabricated from minimum 2-inch opening, 0.148-inch-diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch-OD line posts, and 2-7/8-inch-OD corner and pull posts; with 0.177-inch-diameter top tension wire and 0.177-inch-diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
    - a. Height: 72 inches.
    - b. Polymer-Coating Color: Dark green or Olive green.
  - 2. Plywood Protection-Zone Fencing: Plywood framed with four 2-by-4-inch rails, with 4-by-4-inch preservative-treated wood posts spaced not more than 96 inches apart.
    - a. Height: 72 inches.
    - b. Plywood and Lumber: Comply with requirements in Section 061053 "Miscellaneous Rough Carpentry."
  - 3. Wood Protection-Zone Fencing: Constructed of two 2-by-4-inch horizontal rails, with 4-by-4-inch preservative-treated wood posts spaced not more than 96 inches apart, and lower rail set halfway between top rail and ground.
    - a. Height: 48 inches.
    - b. Lumber: Comply with requirements in Section 061053 "Miscellaneous Rough Carpentry."
  - 4. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.
    - a. Height: 48 inches.
    - b. Color: High-visibility orange, nonfading.

5. Gates: Single-swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.
- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
  1. Size and Text: As shown on Drawings.
  2. Lettering: 3-inch-high minimum, black characters on white background.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

### 3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
  1. Apply 4-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

### 3.3 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
  1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.

2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Engineer.
  3. Access Gates: Install where indicated; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Engineer. Install one sign spaced approximately every 35 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Maintain protection-zone fencing and signage in good condition as acceptable to Engineer and remove when construction operations are complete and equipment has been removed from the site.
1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
  2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

### 3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earthwork" unless otherwise indicated.
- B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.



### 3.5 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:
  - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
  - 2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
  - 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
  - 4. Cover exposed roots with burlap and water regularly.
  - 5. Backfill as soon as possible according to requirements in Section 312000 "Earthwork."
- B. Root Pruning at Edge of Protection Zone: Prune tree roots 6 inches outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

### 3.6 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.
  - 1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
  - 2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
  - 3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
    - a. Type of Pruning: Cleaning, raising and thinning where indicated.
    - b. Specialty Pruning: Structural, restoration, espalier and utility where indicated.
- B. Unless otherwise directed by arborist and acceptable to Engineer, do not cut tree leaders.
- C. Cut branches with sharp pruning instruments; do not break or chop.
- D. Do not paint or apply sealants to wounds.
- E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.
- F. Chip removed branches and stockpile in areas approved by Engineer.

### 3.7 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
  - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

### 3.8 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

### 3.9 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Engineer.
  - 1. Submit details of proposed pruning and repairs.
  - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
  - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Engineer.
- B. Trees: Remove and replace trees indicated to remain that are more than 66 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Engineer determines are incapable of restoring to normal growth pattern.
  - 1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 4 inches or smaller in caliper size.
  - 2. Large Trees: Provide two new tree(s) of 4-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.
    - a. Species: As selected by Engineer.
  - 3. Plant and maintain new trees as specified in Section 329300 "Plants."
- C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 4-inch uniform thickness to remain.

- D. Soil Aeration: Where directed by Engineer, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch-diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

### 3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 015639

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## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
  - 2. Section 012500 "Substitution Procedures" for requests for substitutions.
  - 3. Section 014200 "References" for applicable industry standards for products specified.
  - 4. Section 017710 "Closeout Procedures" for submitting warranties.

#### 1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycle contract materials are considered new products, unless indicated otherwise.
  - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
  1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
  2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

#### 1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
  1. Resolution of Compatibility Disputes between Multiple Contractors:
    - a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
    - b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
  - a. Name of product and manufacturer.
  - b. Model and serial number.
  - c. Capacity.
  - d. Speed.
  - e. Ratings.
3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

## 1.5 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.
- C. Storage:
  1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
  2. Store products to allow for inspection and measurement of quantity or counting of units.
  3. Store materials in a manner that will not endanger Project structure.
  4. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection for wind.
  5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
  1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
  3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Engineer will make selection.



5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
  - a. Submit additional documentation required by Engineer through Construction Manager in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Engineer, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
  - a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product that complies with requirements.
  - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
  - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer that complies with requirements.
  - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
  - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Engineer's sample," provide a product that complies with requirements and matches Engineer's sample. Engineer's decision will be final on whether a proposed product matches.
  1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Engineer from manufacturer's full range" or similar phrase, select a product that complies with requirements. Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.
  1. Select products for which sustainable design documentation submittals are available from manufacturer.

## 2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance the following requirements:
  1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects, with project names and addresses and names and addresses of Engineers and owners, if requested.
  5. Samples, if requested.

- B. Engineer's Action on Comparable Products Submittal: If necessary, Engineer will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
  - 1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
  - 2. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the Engineer of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Engineer, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Engineer of Contractor' request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

### PART 3 - EXECUTION (NOT USED)

END OF SECTION 016000

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## SECTION 017300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner's portion of the Work.
  - 6. Coordination of Owner-installed products.
  - 7. Progress cleaning.
  - 8. Starting and adjusting.
  - 9. Protection of installed construction.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for limits on use of Project site.
  - 2. Section 013300 "Submittal Procedures" for submitting surveys.
  - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
  - 4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

#### 1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

#### 1.4 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.

1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Engineer of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
2. Contractor's superintendent.
3. Trade supervisor responsible for cutting operations.
4. Trade supervisor(s) responsible for patching of each type of substrate.
5. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
6. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

B. Layout Conference: Conduct conference at Project site.

1. Prior to establishing layout of new and existing perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Engineer of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:
2. Contractor's superintendent.
3. Professional surveyor responsible for performing Project surveying and layout.
4. Professional surveyor responsible for performing site survey serving as basis for Project design.
5. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
6. Review requirements for including layouts on Shop Drawings and other submittals.
7. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certified Surveys: Submit two copies signed by land surveyor.
- C. Certificates: Submit certificate signed by land surveyor, certifying that location and elevation of improvements comply with requirements.
- D. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
  1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
  2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
  3. Products: List products to be used for patching and firms or entities that will perform patching work.
  4. Dates: Indicate when cutting and patching will be performed.
  5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be

relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

6. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

- E. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

## 1.6 CLOSEOUT SUBMITTALS

- A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

## 1.7 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."
- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements, whose structural function is not known, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
  2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    3. Primary operational systems and equipment.
    4. Fire separation assemblies.
    5. Air or smoke barriers.
    6. Fire-suppression systems.
    7. Plumbing piping systems.
    8. Mechanical systems piping and ducts.
    9. Control systems.
    10. Communication systems.
    11. Fire-detection and -alarm systems.
    12. Conveying systems.
    13. Electrical wiring systems.
    14. Operating systems of special construction.
  15. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or

decreased operational life or safety. Other construction elements include but are not limited to the following:

16. Water, moisture, or vapor barriers.
17. Membranes and flashings.
18. Exterior curtain-wall construction.
19. Sprayed fire-resistive material.
20. Equipment supports.
21. Piping, ductwork, vessels, and equipment.
22. Noise- and vibration-control elements and systems.
23. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: 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.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate



and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work, including Specification Section number and paragraphs, and Drawing sheet number and detail, where applicable.
  2. List of detrimental conditions, including substrates.
  3. List of unacceptable installation tolerances.
  4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Engineer in accordance to requirements in Section 013100 "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Engineer promptly.
- B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish limits on use of Project site.
  - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 4. Inform installers of lines and levels to which they must comply.
  - 5. Check the location, level and plumb, of every major element as the Work progresses.
  - 6. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
  - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

### 3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or control points

- promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.
  2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of four permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
  2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

### 3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
  4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Engineer. Maintain conditions required for product performance until Substantial Completion.

- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items onsite and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Engineer. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
  - 1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

### 3.6 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  - 5. Revise "Mechanical and Electrical Services" Subparagraph below to suit Project.
  - 6. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 7. Retain subparagraph below if required to prevent multiple cutting and patching in the same area. Insert specific requirements for multiple contracts and special conditions requiring coordination.
  - 8. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Engineer. Provide materials and comply with installation requirements specified in other Sections, where applicable.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  - 3. Clean piping, conduit, and similar features before applying paint or other finishing materials.
  - 4. Restore damaged pipe covering to its original condition.
  - 5. Insert specific refinishing requirements for floors, walls, and ceilings. Revise "Floors and Walls" Subparagraph below to suit Project.

6. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  7. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
  8. Revise "Ceilings" Subparagraph below to suit Project or delete.
  9. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  10. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

- A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.
1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
  2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed products.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  2. Preinstallation Conferences: Include Owner's construction personnel and Owner's separate contractors at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### 3.8 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

4. Use containers intended for holding waste materials of type to be stored.
  5. Retain subparagraph below for projects involving multiple contracts.
  6. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls" and Section 017419 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- 3.9 STARTING AND ADJUSTING
- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

### 3.10 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Repair Work previously completed and subsequently damaged during construction period  
Repair to like-new condition.
- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300



## SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition and construction waste.
  - 2. Recycling nonhazardous demolition and construction waste.
  - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
  - 1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
  - 2. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

#### 1.3 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### 1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:
  - 1. Material category.
  - 2. Generation point of waste.
  - 3. Total quantity of waste in tons.
  - 4. Quantity of waste salvaged, both estimated and actual in tons.
  - 5. Quantity of waste recycled, both estimated and actual in tons.
  - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
  - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Qualification Data: For waste management coordinator and refrigerant recovery technician.

- H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- I. Refrigerant Recovery: Comply with requirements in Section 024119 "Selective Demolition" for refrigerant recovery submittals.

## 1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.
- B. Refrigerant Recovery Technician Qualifications: Universal certified by EPA-approved certification program.
- C. Refrigerant Recovery Technician Qualifications: Comply with requirements in Section 024119 "Selective Demolition."
- D. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- E. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
  - 1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
  - 2. Review requirements for documenting quantities of each type of waste and its disposition.
  - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  - 5. Review waste management requirements for each trade.

## 1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work in compliance with Section 024119 "Selective Demolition."
  2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:
1. Total quantity of waste.
  2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
  3. Total cost of disposal (with no waste management).
  4. Revenue from salvaged materials.
  5. Revenue from recycled materials.
  6. Savings in transportation and tipping fees by donating materials.
  7. Savings in transportation and tipping fees that are avoided.
  8. Handling and transportation costs. Include cost of collection containers for each type of waste.
  9. Net additional cost or net savings from waste management plan.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:
1. Demolition Waste:
    - a. Asphalt paving.

- b. Concrete.
- c. Concrete reinforcing steel.
- d. Brick.
- e. Concrete masonry units.
- f. Wood studs.
- g. Wood joists.
- h. Plywood and oriented strand board.
- i. Wood paneling.
- j. Wood trim.
- k. Structural and miscellaneous steel.
- l. Rough hardware.
- m. Roofing.
- n. Insulation.
- o. Doors and frames.
- p. Door hardware.
- q. Windows.
- r. Glazing.
- s. Metal studs.
- t. Gypsum board.
- u. Acoustical tile and panels.
- v. Carpet.
- w. Carpet pad.
- x. Demountable partitions.
- y. Equipment.
- z. Cabinets.
- aa. Plumbing fixtures.
- bb. Piping.
- cc. Supports and hangers.
- dd. Valves.
- ee. Sprinklers.
- ff. Mechanical equipment.
- gg. Refrigerants.
- hh. Electrical conduit.
- ii. Copper wiring.
- jj. Lighting fixtures.
- kk. Lamps.
- ll. Ballasts.
- mm. Electrical devices.
- nn. Switchgear and panelboards.
- oo. Transformers.
- 2. Construction Waste:
  - a. Masonry and CMU.
  - b. Lumber.
  - c. Wood sheet materials.
  - d. Wood trim.
  - e. Metals.
  - f. Roofing.
  - g. Insulation.
  - h. Carpet and pad.
  - i. Gypsum board.
  - j. Piping.

- k. Electrical conduit.
- l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
  - 1) Paper.
  - 2) Cardboard.
  - 3) Boxes.
  - 4) Plastic sheet and film.
  - 5) Polystyrene packaging.
  - 6) Wood crates.
  - 7) Wood pallets.
  - 8) Plastic pails.
- m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
  - 1) Paper.
  - 2) Aluminum cans.
  - 3) Glass containers.

## PART 3 - EXECUTION

### 3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.

2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

### 3.2 SALVAGING DEMOLITION WASTE

- A. Comply with requirements in Section 024119 "Selective Demolition" for salvaging demolition waste.
- B. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
  1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  3. Store items in a secure area until installation.
  4. Protect items from damage during transport and storage.
  5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
  1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area designated by Owner.
  5. Protect items from damage during transport and storage.
- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- F. Plumbing Fixtures: Separate by type and size.
- G. Lighting Fixtures: Separate lamps by type and protect from breakage.
- H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

### 3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - 4. Store components off the ground and protect from the weather.
  - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

### 3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.
  - 1. Crush asphaltic concrete paving and screen to comply with requirements in Section 312000 "Earthwork" for use as general fill.
- B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
  - 1. Pulverize concrete to maximum 4-inch size.
  - 2. Crush concrete and screen to comply with requirements in Section 312000 "Earthwork" for use as satisfactory soil for fill or subbase.
- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
  - 1. Pulverize masonry to maximum 1-1/2-inch size.
    - a. Crush masonry and screen to comply with requirements in Section 312000 "Earthwork" for use as general fill.
    - b. Crush masonry and screen to comply with requirements in Section 329300 "Plants" for use as mineral mulch.
  - 2. Clean and stack undamaged, whole masonry units on wood pallets.
- E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.



- F. Metals: Separate metals by type.
  - 1. Structural Steel: Stack members according to size, type of member, and length.
  - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- J. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.
- K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
  - 1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- L. Carpet Tile: Remove debris, trash, and adhesive.
  - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- M. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.
- N. Conduit: Reduce conduit to straight lengths and store by material and size.
- O. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

### 3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

- a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
  - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
    - a. Comply with local requirements for use of clean ground gypsum board as inorganic soil amendment.
- D. Paint: Seal containers and store by type.

### 3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.
- C. Burning: Do not burn waste materials.
- D. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

END OF SECTION 017419

## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Related Requirements:
  - 1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
  - 2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
  - 3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
  - 4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 5. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

#### 1.2 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Engineer's use prior to Engineer's inspection, to determine if the Work is substantially complete.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

## 1.6 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  - 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
  - 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
  - 3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Engineer.
    - d. Name of Contractor.
    - e. Page number.
  - 4. Submit list of incomplete items in the following format:
    - a. MS Excel Electronic File. Engineer will return annotated file.
    - b. PDF Electronic File. Engineer will return annotated file.
    - c. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).
    - d. Three Paper Copies. Engineer will return two copies.

## 1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where warranties are indicated to commence on dates other than date of Final Acceptance, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Utilization: Submit properly executed warranties within 15 days of Substantial Completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  - 1. Submit on digital media acceptable to Engineer.
- E. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: 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.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.

- f. 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.
  - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
  - i. Vacuum and mop concrete.
  - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
  - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - l. Remove labels that are not permanent.
  - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    - 1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
  - q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
  - r. Clean strainers.
  - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

## SECTION 017823 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory manuals.
  - 2. Emergency manuals.
  - 3. Systems and equipment operation manuals.
  - 4. Systems and equipment maintenance manuals.
  - 5. Product maintenance manuals.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

#### 1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Engineer and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operation and maintenance manuals in the following format:
  - 1. Submit on digital media acceptable to Engineer. Enable reviewer comments on draft submittals.
  - 2. Submit three paper copies. Engineer will return two copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Engineer and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Engineer and Commissioning Authority will return copy with comments.
  - 1. Correct or revise each manual to comply with Engineer's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's and Commissioning Authority's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

#### 1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
  - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary, to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of



contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

#### 1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Include the following information:
  1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for Engineer.
  7. Name and contact information for Commissioning Authority.
  8. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
  9. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

#### 1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
  - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
  - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
  - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

#### 1.8 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
  - 1. Type of emergency.
  - 2. Emergency instructions.
  - 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
  - 1. Fire.
  - 2. Flood.
  - 3. Gas leak.
  - 4. Water leak.
  - 5. Power failure.
  - 6. Water outage.
  - 7. System, subsystem, or equipment failure.
  - 8. Chemical release or spill.

- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
  - 1. Instructions on stopping.
  - 2. Shutdown instructions for each type of emergency.
  - 3. Operating instructions for conditions outside normal operating limits.
  - 4. Required sequences for electric or electronic systems.
  - 5. Special operating instructions and procedures.

## 1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  - 2. Performance and design criteria if Contractor has delegated design responsibility.
  - 3. Operating standards.
  - 4. Operating procedures.
  - 5. Operating logs.
  - 6. Wiring diagrams.
  - 7. Control diagrams.
  - 8. Piped system diagrams.
  - 9. Precautions against improper use.
  - 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
  - 1. Product name and model number. Use designations for products indicated on Contract Documents.
  - 2. Manufacturer's name.
  - 3. Equipment identification with serial number of each component.
  - 4. Equipment function.
  - 5. Operating characteristics.
  - 6. Limiting conditions.
  - 7. Performance curves.
  - 8. Engineering data and tests.

9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed and identify color coding where required for identification.

#### 1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format,

- identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
  2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  3. Identification and nomenclature of parts and components.
  4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
  2. Troubleshooting guide.
  3. Precautions against improper maintenance.
  4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.

## 1.11 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.
  - 4. Material and chemical composition.
  - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION (NOT USED)

END OF SECTION 017823

## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section 012900 "Payment Procedures" for maintaining and exhibiting project record documents as a prerequisite for progress payments.
  - 2. Section 017300 "Execution" for final property survey.
  - 3. Section 017700 "Closeout Procedures" for general closeout procedures.
  - 4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set(s) of marked-up record prints.
  - 2. Number of Copies: Submit copies of Record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit one paper-copy set of marked-up record prints.
      - 2) Submit PDF electronic files of scanned record prints and one set of file prints.
      - 3) Submit Record Digital Data Files and one set of plots.
      - 4) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:
      - 1) Submit three paper-copy set(s) of marked-up record prints.
      - 2) Submit PDF electronic files of scanned Record Prints and three set(s) of file prints.
      - 3) Print each drawing, whether or not changes and additional information were recorded.

- c. Final Submittal:
  - 1) Submit one paper-copy set of marked-up record prints.
  - 2) Submit Record Digital Data Files and three set(s) of Record Digital Data File plots.
  - 3) Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Product Data: Submit annotated PDF electronic files and directories and three paper copies of each submittal.
  - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories and three paper copies of each submittal.
- D. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

#### 1.4 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
  - 1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding photographic documentation.
  - 2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Work Change Directive.
    - k. Changes made following Engineer's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.



- n. Record information on the Work that is shown only schematically.
  3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
  2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  3. Refer instances of uncertainty to Engineer for resolution.
  4. Engineer will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
    - a. See Section 013100 "Project Management and Coordination" for requirements related to use of Engineer's digital data files.
    - b. Engineer will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file with comment function enabled.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Engineer.
    - e. Name of Contractor.

## 1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders and Record Drawings where applicable.
- C. Format: Submit Record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
  - 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

#### 1.6 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
  - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

#### 1.7 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours. As a prerequisite for monthly progress payments, exhibit the updated record documents for review by Owner and Engineer for accuracy and completeness.

### PART 2 - PRODUCTS (NOT USED)

### PART 3 - EXECUTION (NOT USED)

END OF SECTION 017839

**Division 02**  
**Existing Conditions**



## SECTION 024119 - SELECTIVE DEMOLITION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

- B. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
2. Section 017300 "Execution" for cutting and patching procedures.
3. Section 013516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

#### 1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove Hazardous Materials: Isolate and remove hazardous materials from existing construction and properly dispose as required by existing regulations.
- C. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- D. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- E. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- F. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### 1.5 PREINSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site .
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.
  - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  - 5. Review areas where existing construction is to remain and requires protection.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property or property owners, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- D. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations and adjacent property owner's are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Use of elevator and stairs.
  - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.

- F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

## 1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

## 1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. Hazardous materials will be removed by Owner before start of the Work.
  - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
  - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
  - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
  - 3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.
- F. Storage or sale of removed items or materials on-site is not permitted.
- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## 1.9 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so

as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:

- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

#### 1.10 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
  - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.



- F. Survey of Existing Conditions: Record existing conditions by use of measured drawings preconstruction photographs or video and templates.
1. Comply with requirements specified in Section 013233 "Photographic Documentation."
  2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
  3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

### 3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

### 3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  2. Arrange to shut off utilities with utility companies.
  3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    - a. Piping to be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    - c. Equipment to be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - f. Ducts to be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    - g. Ducts to be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

### 3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

### 3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 5. Maintain fire watch during and for at least 1 hour after flame-cutting operations.
  - 6. Maintain adequate ventilation when using cutting torches.
  - 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities. Contractor shall provide continuous access to all roadways as required when using traffic control
- C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic. In historic spaces, areas, and rooms, or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 024296 "Historic Removal and Dismantling."
- D. Removed and Salvaged Items:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area designated by Owner.
  5. Protect items from damage during transport and storage.
- E. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

### 3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

### 3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

### 3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

### 3.9 SELECTIVE DEMOLITION SCHEDULE

- A. Refer to Contract Drawings and corresponding detail sheets for selective demolition

END OF SECTION 024119

**Division 03**  
**Concrete**



## SECTION 033000 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
  - 1. Section 036000 "Grouting" for grouting.

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete Subcontractor.
    - e. Special concrete finish Subcontractor.
  - 2. Review special inspection and testing, and Contractor's inspecting agency procedures for field quality control; cold- and hot-weather concreting procedures; curing procedures, construction, contraction and isolation joints, and joint-filler strips; forms and form removal limitations; steel reinforcement installation, concrete repair procedures, and concrete protection.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials change, source of cement or aggregate change or test results do not meet specification requirements, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, spacing, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Reference bars to be the same identification marks shown on the bar bending details.
- D. Construction Joint Layout: As shown on the Drawings.
- E. Welding certificates.
- F. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Steel reinforcement and accessories.
  - 5. Waterstops.
  - 6. Curing compounds.
  - 7. Floor and slab treatments.
  - 8. Bonding agents.
  - 9. Adhesives.
  - 10. Semirigid joint filler.
  - 11. Joint-filler strips.
  - 12. Repair materials.
- G. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Aggregates
  - 2. Mill Test Reports:
    - a. Cementitious materials.
    - b. Steel Reinforcing.
    - c. Reinforcing Splicing Devices.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.



- B. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork. Formwork shop drawings shall be stamped and sealed by a professional engineer registered in the State of North Carolina.
  - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
- C. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- D. Field quality-control reports.
- E. Minutes of preinstallation conference.
- F. PE Certification form for the design of formwork and shoring.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
  - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

#### 1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Provide reinforcement free from mill scale, rust, mud, dirt, grease, oil, ice, or other foreign matter that will reduce or destroy bond. Deliver, store, and handle steel reinforcement to prevent bending and damage. Store reinforcement off the ground, protect from moisture, and keep out of standing water, and free from rust, mud, dirt, grease, oil, ice, or other contaminants and deleterious films that will reduce or destroy bond.

## 1.10 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
  - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301.
  - 2. ACI 117.

### 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
  - 2. Overlaid Finnish birch plywood.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

## 2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Reinforcing bars to be welded or field bent: Low-Alloy-Steel Reinforcing Bars, ASTM A706/A706M, deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 ASTM A 706/A 706M, deformed bars, assembled with clips.
- D. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn .
- E. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- F. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

## 2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel

wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
- C. Type: Mechanical threaded]; full tension and compression.
1. Use only where indicated. Meet all ACI 318 requirements. Provide threaded type with cap on female end to exclude dirt, debris and wet concrete. Torque couplers to manufacturer's recommended value.
  2. Unless otherwise indicated, mechanical reinforcing splicing devices shall produce a splice strength in tension or compression of not less than 125 percent of the ASTM specified minimum yield strength of the reinforcing bar. Base yield strength on Grade 60 reinforcing unless otherwise indicated or specified.
  3. Compression type mechanical splices shall provide concentric bearing from one bar to the other bar.
  4. Size: To fit joined reinforcing.
- D. Tie wires for reinforcement: 16 gauge or heavier black annealed wire to tie uncoated reinforcing. Use zinc coated wire to tie galvanized reinforcing. Use epoxy coated wire to tie epoxy coated reinforcing.

## 2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
1. Portland Cement: ASTM C150/C150M, Type II, gray.
  2. Fly Ash: ASTM C618, Class F.
  3. Blended Hydraulic Cement: ASTM C595/C595M, Type IP, portland-pozzolan, Type IL, portland-limestone, Type IT, ternary blended cement.
  4. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C33/C33M, Class **4S** Class **4M** coarse aggregate or better, graded. Provide aggregates from a single source
1. Maximum Coarse-Aggregate Size: ASTM C33 Size Number 67 nominal.
  2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C260/C260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
3. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
- 5.

F. Water: ASTM C94/C94M and potable.

## 2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Euclid Chemical Company (The); an RPM company.
    - b. Kaufman Products, Inc.
- E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Euclid Chemical Company (The); an RPM company.
    - b. Kaufman Products, Inc.

## 2.7 RELATED MATERIALS

- A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.8 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
  - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109/C109M.

## 2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash, pozzolan, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent.
  - 2. Combined Fly Ash and Pozzolan: 25 percent.
  - 3. Silica Fume: 10 percent.
  - 4. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, for placement and workability.
2. High-range water-reducing admixture in concrete, may be used, for placement and workability.
3. Water-reducing and -retarding admixture, may be used, when required by high temperatures, low humidity, or other adverse placement conditions.

## 2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Normal-weight concrete.

1. Minimum Compressive Strength: Shall be as shown in Table 1.
2. Maximum W/C Ratio: Shall be as shown in Table 1.
3. Slump Limit: Shall be as shown in Table 1.
4. Air Content: Shall be as shown in Table 1.
5. Minimum cementitious content: Shall be as shown in Table 1.

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

All concrete classes shall have 3.5 to 5 percent air entrainment.

### 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

## 2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.
  - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
  - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, ice, snow and other debris just before placing concrete.



- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
  - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  - 3. Install dovetail anchor slots in concrete structures as indicated.

### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

### 3.4 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
  - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

### 3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose mill scale, rust, mud, dirt, grease, oil, ice, and other foreign materials that reduce or destroy the bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, only where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing, 1.3 times the development length, or 8 inches, whichever is greater. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Splicing:
  - 1. Tension Members: Avoid splicing of reinforcing steel in concrete elements indicated as "tension members." However, if splices are required for constructability, splices in the reinforcement subject to direct tension shall be butted and joined with complete penetration welds to develop, in tension, at least 125 percent of the specified yield strength of the bar. Offset splices in adjacent bars the distance of a Class B splice or 30 inches, whichever is greater.
  - 2. Lap splices in welded wire fabric in accordance with the requirements of ACI 318 but not less than 12 inches. Tie the spliced fabrics together with wire ties spaced not more than 24 inches on center and lace with wire of the same diameter as the welded wire fabric. Offset splices in adjacent widths to prevent continuous splices.
  - 3. Reinforcing Splicing Devices: Use only where indicated. Offset splices in adjacent bars by at least 30 bar diameters. Use only for special splice and dowel conditions indicated or approved by the Engineer.
  - 4. If not indicated on Drawings, locate reinforcement splices at point of minimum stress.
- G. Obtain approval of splice locations from Engineer if different from locations shown on drawings.

### 3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
  2. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces. Intentionally roughen concrete surface and remove laitance prior to applying bonding agent.
  6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces. Intentionally roughen concrete surface and remove laitance prior to applying epoxy-bonding adhesive.
  7. At construction joints and at concrete joints indicated on Drawings to be "roughened", uniformly roughen the surface of concrete to a full amplitude (distance between high and low points and side to side) of 1/4 inch with chipping tools to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by water blasting or sandblasting and prepare for bonding. At least two hours before and again shortly before the new concrete is deposited, saturate joints with water. After glistening water disappears, coat joints with neat cement slurry mixed to consistency of very heavy paste. Coat surfaces to a depth of at least 1/8 inch thick, scrubbed-in by means of stiff bristle brushes. Deposit new concrete before the neat cement dries.
  8. Do not use keyways in construction joints unless specifically shown on the Drawings or approved by the Engineer.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
  2. Terminate full-width joint-filler strips below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated. Terminate joint filler as required by sealant manufacturer or as indicated.
  3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid “cold” joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

### 3.8 FINISHING FORMED SURFACES

- A. Finish concrete surfaces according to ACI 318.
- B. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces not exposed to view.
- C. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and

defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- D. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

### 3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Pads:
1. Coordinate sizes and locations of concrete pads with actual equipment provided.
  2. Minimum Compressive Strength: 4000 psi at 28 days.
  3. Install reinforcing dowels; to connect concrete pad to concrete floor. Unless otherwise indicated.
  4. For supported equipment, install anchor bolts that extend through concrete pad and anchor into structural concrete substrate.
  5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  6. Cast anchor-bolt insert into pads. Install anchor bolts to elevations required for proper attachment to supported equipment.

### 3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
  - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial

application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit sawcut at the perimeter of the area to a depth of 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that

- penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
  3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

### 3.14 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Notify the Owner when the reinforcing is complete and ready for inspection, at least 24 hours prior to the proposed concrete placement. Do not cover reinforcing steel with concrete until the installation of the reinforcement, including the size, spacing and position of the reinforcement has been inspected by the Owner's inspection agency and the Owner's inspection agency release to proceed with the concreting has been obtained. Keep forms open until the Owner's inspection agency has completed inspection of the reinforcement.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements by the Owner's testing agency:



1. Testing Frequency: One composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
  - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests will be performed when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M.
  - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
  - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
  - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
  - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

## SECTION 036000 - GROUTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Portland cement grout.
2. Cement grout.
3. Nonshrink epoxy grout.
4. Nonshrink cementitious grout.

- B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories.
2. Section 033000 - Cast-in-Place Concrete.
3. Section 033200 - Concrete Reinforcing.
4. Section 034500 - Precast Architectural Concrete.
5. Section 042000 - Unit Masonry: Masonry grout.
6. Section 055000 - Metal Fabrications: Grout related to miscellaneous metals.

#### 1.3 ACTION SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.

- B. Product Data: Submit manufacturer information regarding grout and surface preparation, mixing and installation.

1. Commercially manufactured nonshrink cementitious grout. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, and conformity to the specified ASTM standards.
2. Commercially manufactured nonshrink epoxy grout. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, and conformity to the specified ASTM standards.
3. Cement grout. Include the type and brand of cement, the gradation of fine aggregate, product data on any proposed admixtures and the proposed grout mix.
4. Concrete grout. Include data as required for concrete and for fiber reinforcement as delineated in Section 033000 - Cast-In-Place Concrete.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- B. Manufacturer Instructions: Submit instructions for mixing, handling, surface preparation, and placing epoxy-type and nonshrink grouts.
- C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- D. Qualifications Statement:
  - 1. Submit qualifications for manufacturer.
- E. Product Certificates: Provide certification of the following:
  - 1. NSF 61 Certification.

#### 1.5 QUALITY ASSURANCE

- A. Perform Work according to indicated standards.

#### 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' experience in production and use of provided grouts.
- B. Pre-installation Meeting: At least ten working days before grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing and curing procedures for each product proposed for use. Notify all parties involved with grouting, including the Engineer, of the meeting at least ten working days prior to its scheduled date.
- C. Services of Manufacturer's Representative: Provide services of a field technician of the grout manufacturer who has performed at least five projects of similar size and complexity during the last five years, to attend the pre-installation meeting, to be present for the initial installation of each type of grout, and to correct installation problems.
- D. Field Testing:
  - 1. All field testing and inspection services will be provided by the Owner. Assist in the sampling of materials and cooperate by allowing free access to the work and permitting the use of ladders, scaffolding, and such incidental equipment as may be required. Methods of testing will comply with the applicable ASTM Standards.
- E. Field testing of concrete grout will be as specified for concrete in Section 033000 – Cast-In-Place Concrete.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions. Limit total storage time from date of manufacture to date of installation to six months or the manufacturer's recommended storage time, whichever is less.
- D. Remove immediately from the site material which becomes damp, contains lumps, or is hardened and replace with acceptable material.
- E. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location.
  - 2. Provide additional protection according to manufacturer instructions.

## 1.8 AMBIENT CONDITIONS

- A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Maximum Conditions: Do not perform grouting if temperatures exceed 90 degrees F.
- C. Minimum Conditions: Do not perform grouting if the minimum temperature of base plates, supporting concrete and grout are less than 40 degrees F. Maintain minimum temperature of 40 degrees F before, during, and after grouting, until grout has set.

## PART 2 - PRODUCTS

### 2.1 PORTLAND CEMENT GROUT

- A. Portland Cement: Comply with ASTM C 150/C 150M, Type I and II.
- B. Water:
  - 1. Potable.
  - 2. No impurities, suspended particles, algae, or dissolved natural salts in quantities capable of causing:
    - a. Corrosion of steel.
    - b. Volume change increasing shrinkage cracking.
    - c. Efflorescence.
    - d. Excess air entraining.

C. Fine Aggregate:

1. Washed natural sand.
2. Gradation:
  - a. Comply with ASTM C 33.
  - b. Represented by smooth granulometric curve within required limits.
3. Free from injurious amounts of organic impurities according to ASTM C 40.

D. Mix:

1. Portland cement, sand, and water.
2. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.2 NONSHRINK EPOXY GROUT

A. Description:

1. Pre-proportioned, prepackaged, three-component, nonshrink epoxy grout, 100 percent solids system consisting of epoxy resin, hardener, and blended aggregate.

B. Performance and Design Criteria:

1. Minimum Compressive Strength:
  - a. 10,000 psi at seven days.
  - b. Comply with ASTM C 579.
2. Coefficient of Expansion:
  - a.  $30 \times 10^{-6}$  inch per degree F.
  - b. Comply with ASTM C 531.
3. Minimum Tensile Strength:
  - a. 1,800 psi.
  - b. Comply with ASTM C 307.

2.3 NONSHRINK CEMENTITIOUS GROUT

A. Description:

1. Pre-mixed and ready-for-use formulation requiring only addition of water.
2. Nonshrink, non-corrosive, nonmetallic, non-gas forming, not containing expansive cement and no chlorides.
3. No shrinkage when tested in conformity with ASTM C 827.

B. Performance and Design Criteria:

1. Certified to maintain initial placement volume or expand after set, and to meet following minimum properties when tested according to ASTM C 1107/C 1107M for Grades B, C, D and CRD-C621 nonshrink grout:
  - a. Setting Time:
    - 1) Initial: Approximately two hours.
    - 2) Final: Approximately three hours.
    - 3) Comply with ASTM C 191.
  - b. Maximum Expansion: 0.10 to 0.40 percent.
  - c. Minimum Compressive Strength:
    - 1) One-Day: 4,000 psi.
    - 2) Seven-Day: 7,000 psi.
    - 3) 28-Day: 10,000 to 10,800 psi.
    - 4) Comply with CRD-C621.

2.4 CONCRETE GROUT

- A. Description: Conform to the requirements of Section 033000 - Cast-In-Place Concrete, except as follows. Proportion with Type II cement, coarse and fine aggregates, water, water reducing admixture, and air entraining agent to produce specified mix performance:
  1. Average Strength (ASTM C 579): 3500 psi at 28 days nominal strength.
  2. Maximum Coarse Aggregate Size: 3/8-inch.
  3. Minimum Cement Content: 540 lbs per cubic yard.
  4. Maximum Water to Cement Ratio: 0.45.
  5. Maximum Slump: 5 inches.
- B. Add synthetic reinforcing fibers as specified in Section 032000 - Concrete Reinforcing to the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of grout. Add fibers from manufacturer's pre-measured bags and according to manufacturer's recommendations to ensure complete dispersion of fiber bundles as single monofilaments within the concrete grout.

2.5 FORMWORK

- A. As specified in this Section and in Section 031000 - Concrete Forming and Accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Requirements for installation examination.

- B. Verify areas to receive grout.

### 3.2 PREPARATION

- A. Section 017300 - Execution: Requirements for installation preparation.
- B. Place grout where indicated or specified over existing concrete and cured concrete which has attained its specified design strength unless otherwise approved by the Engineer.
- C. Remove defective concrete, ice, laitance, dirt, oil, grease, form release agents, paints and other foreign material from concrete surfaces, which may affect the bond or performance of the grout by brushing, hammering, chipping, sand blasting or other similar dry mechanical means until sound and clean concrete surface is achieved. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.
  - 1. Air compressors used to clean surfaces in contact with grout shall be the oil-less type or equipped with an oil trap in the airline to prevent oil from being blown onto the surface.
- D. Roughen concrete lightly, but not to interfere with placement of grout.
- E. Remove foreign materials from metal surfaces in contact with grout.
- F. Align, level, and maintain final positioning of components to be grouted.
- G. Wash concrete surfaces clean and then keep moist for at least 24 hours prior to the placement of nonshrink cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface or other method acceptable to the Engineer. Upon completion of the 24-hour period, remove visible water from the surface prior to grouting.
- H. Nonshrink epoxy grouts do not require saturation of concrete substrate. Do not wet concrete surfaces to receive nonshrink epoxy grout. Completely dry surfaces in contact with epoxy grout before grouting.
- I. Support equipment during alignment and installation of grout by shims, wedges, blocks or other approved means. Prevent bond of shims, wedges and blocking devices by bond breaking coatings and remove after grouting unless otherwise approved by the Engineer. Grout voids created by the removal of shims, wedges, and blocks.

### 3.3 INSTALLATION - GENERAL

- A. Formwork:
  - 1. Construct leakproof forms anchored and shored to withstand grout pressures.
  - 2. Install formwork with clearances to permit proper placement of grout.
  - 3. As specified in Section 031000 - Concrete Forming and Accessories.



B. Mixing - Portland Cement Grout:

1. Use proportions of two parts sand and one part cement, measured by volume.
2. Prepare grout with water to obtain consistency to permit placing and packing.
3. Mix water and grout in two steps:
  - a. Premix using approximately 2/3 of water.
  - b. After partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing two to three minutes.
4. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
5. Do not add additional water after grout has been mixed.
6. Minimum Compressive Strength (ASTM C 579):
  - a. In 48 hours: 2,400 psi.
  - b. In 28 days 7,000 psi.

C. Placing of Grout:

1. Place grout material quickly and continuously.
2. Do not use pneumatic-pressure or dry-packing methods.
3. Apply grout from one side only to avoid entrapping air.
4. Do not vibrate placed grout mixture or permit placement if area is being vibrated by nearby equipment.
5. Thoroughly compact final installation and eliminate air pockets.
6. Do not remove leveling shims for at least 48 hours after grout has been placed.

D. Curing:

1. Prevent rapid loss of water from grout during first 48 hours by using wet burlap bags, soaker hoses or ponding.
2. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
3. After grout has attained its initial set, keep damp for minimum three days.

E. Reflect all existing underlying expansion joints, partial contraction joints, and construction joints through the grout.

3.4 INSTALLATION - CONCRETE GROUT

- A. Inspect slabs finished under Section 033500 - Concrete Finishing and scheduled to receive concrete grout. Protect and keep the surface clean until placement of concrete grout.
- B. Remove debris and clean the surface by sweeping and vacuuming of dirt and other foreign materials. Pressure wash the surface. Do not flush debris into tank drain lines.
- C. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout by use of saturated burlap bags, soaker hoses or ponding. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout

so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16 to 1/8-in thick cement paste.

- D. Place concrete grout to final grade using the scrapers of the installed mechanical equipment as a guide for surface elevation and to eliminate high and low spots. Unless specifically approved by the equipment manufacturer, do not use mechanical scraper mechanisms powered by their motors as a finishing machine or screed to push grout.
- E. Provide grout control joints as indicated on Drawings.
- F. Steel trowel finish as specified in Section 033500 - Concrete Finishing. Cure the concrete grout as specified for cast-in-place concrete in Section 033000 - Cast-In-Place Concrete.

### 3.5 INSTALLATION - NONSHRINK EPOXY GROUTS

- A. Mix in accordance with manufacturer's recommendations. Mix full batches only, to maintain proper proportions of resin, hardener and aggregate. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Do not entrain air bubbles by mixing too quickly.
- B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 degrees F or above 90 degrees F.
- C. Place grout rapidly and continuously to avoid cold joints. Place grout in lifts in accordance with manufacturer's recommendations.
- D. Provide forms as specified in Paragraph 3.3A. Place grout into the designated areas and prevent entrapment of air. Fill all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes and vent holes as necessary.
- E. Minimize 'shoulder' length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.
- F. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.
- G. Epoxy grouts are self-curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placement, until grout compressive strength reaches 1,000 psi or as recommended by the manufacturer, whichever is longer.
- H. Provide grout control joints as indicated on Drawings.

### 3.6 SCHEDULE

- A. Use particular types of grout as follows:
  - 1. General Purpose Nonshrink Cementitious Grout (CRD-C621 Grade D): Use at locations where nonshrink grout is indicated, except for base plates greater in area than 3-feet wide by 3-feet long.

2. Flowable (precision) Nonshrink Cementitious Grout (CRD-C621 Grade B or C): Use under base plates greater in area than 3-feet wide by 3-feet long. Use at locations indicated to receive flowable (precision) nonshrink grout. Flowable (precision), nonshrink, cementitious grout may be substituted for general purpose nonshrink cementitious grout.
3. Nonshrink Epoxy Grout: Use at all locations specifically indicated to receive nonshrink epoxy grout.
4. Cement Grout: Use where indicated.
5. Concrete Grout:
  - a. Use for overlaying the base concrete as indicated.
  - b. Use for concrete grout fill within liquid retaining structures and other locations where specifically indicated.

END OF SECTION 036000

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**Division 04**  
**Masonry**  
**(Not Used)**



**Division 05**  
**Metals**





## SECTION 055000 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Steel beams.
  - 2. Steel plates.
  - 3. Miscellaneous items fabricated from steel, aluminum or stainless steel.

- B. Products furnished, but not installed, under this Section include the following:

- 1. H-piles.
  - 2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

- C. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
  - 2. Various Sections in Divisions 40 - 46 for process mechanical work scopes.

#### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

#### 1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by aluminum, steel and stainless steel manufacturers, certifying that products furnished comply with requirements.
- B. Welding certificates.
  - 1. Certify that welders have been qualified under AWS, within previous 12 months, to perform welds required under this Section.

## 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless steel."

## 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

# PART 2 - PRODUCTS

## 2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Wide Flange Shapes: ASTM A992.
- C. Steel Other Shapes, Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Stainless steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- E. Stainless steel Bars and Shapes: ASTM A 276, Type 304.
- F. Rolled-Stainless Steel Floor Plate: ASTM A 793.
- G. Steel Pipe: ASTM A 53/A 53M, Type S Grade B Standard Weight (Schedule 40) unless otherwise indicated.
- H. Aluminum Extruded Pipe: ASTM B429, Alloy 6063 T6 and Alloy 6061 T6 as indicated.

- I. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- J. Aluminum Extrusions: ASTM B 221, Alloy 6061 T6.
- K. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- L. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- M. Gray Iron Castings: ASTM A48, Class 35.
- N. Ductile Iron Castings: ASTM A536, Grade 65-45-12.
- O. Stainless steel Bolts: ASTM F593, Type 316.
- P. Stainless steel Nuts: ASTM F594, Type 316.
- Q. Carbon Steel Bolts and Studs: ASTM A307, Grade A (hot dip galvanized nuts and washers where noted)
- R. High Strength Steel Bolts, Nuts and washers: ASTM F3125, Grade A325 (mechanically galvanized per ASTM B695, Class 50, where noted).
  - 1. Elevated Temperature Exposure: Type I.
  - 2. General Application: Type I or Type II.
- S. Galvanizing: ASTM A123, Zn w/0.05 percent minimum Ni.
- T. Galvanizing, hardware: ASTM A153, Zn w/0.05 percent minimum Ni.
- U. Galvanizing, anchor bolts: ASTM F2329, Zn w/0.05 percent minimum Ni.
- V. Welding electrodes, steel: AWS A5.1 E70xx.

## 2.2 FASTENERS

- A. Unless otherwise noted, provide steel machine bolts for the connection of carbon steel or iron; galvanized steel or stainless-steel machine bolts for the connection of galvanized steel or iron; and stainless steel machine bolts for the connection of aluminum or stainless-steel.
- B. Mechanically Galvanized Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM F 3125, Grade A325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- C. Stainless steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 2.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
  - 1. Provide standard headed bolts with heavy hex nuts and Grade A washers.

2. Where galvanized anchor bolts are indicated or specified, provide standard headed bolts with heavy hex nuts and Grade A washers, galvanize in accordance with ASTM F 2329.

## 2.3 MISCELLANEOUS ALUMINUM

- A. Miscellaneous Aluminum: Formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Drill or punch holes. Smooth edges without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.
- B. Connections and Accessories: Sufficient strength to safely withstand the stresses and strains to which they will be subjected. Close fitting exposed joints and jointed where least conspicuous. Conceal threads on threaded connections where practical. Provide continuous welds or intermittent welds on welded connections as specified or shown. Dress face of welds flush and smooth. Weld on unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous Aluminum Items: miscellaneous aluminum indicated and not otherwise specified.
- D. Aluminum Finishes:
  1. Mill Finish: Have a cleaned and degreased mill finish on other aluminum items.

## 2.4 MISCELLANEOUS STEEL

- A. Miscellaneous Steel Work: Formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Drill or punch holes. Smooth edges without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.
- B. Connections and Accessories: Sufficient strength to safely withstand the stresses and strains to which they will be subjected. Close fitting exposed joints and jointed where least conspicuous. Conceal thread on threaded connections where practical. Provide continuous welds or intermittent welds on welded connections as specified or shown. Dress face of welds flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous Steel Items: Beams, plates, piles and any other miscellaneous steel indicated and not otherwise specified.
- D. Steel Finish Work: Thoroughly cleaned, by effective means, of loose mill scale, rust and foreign matter. Provide one shop coat of primer compatible with finish coat after fabrication but before shipment. Omit paint within 3 inches of proposed field welds. Apply paint to dry surfaces and be thoroughly and evenly spread and well worked into joints and other open spaces.

- E. Galvanizing, where required: Use hot-dip zinc process after fabrication, coating not less than 2 oz/sq. ft. of surface.

## 2.5 MISCELLANEOUS STAINLESS-STEEL

- A. Miscellaneous Stainless-Steel Work: Formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Drill or punch holes. Smooth edges without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.
- B. Connections and accessories: Sufficient strength to safely withstand the stresses and strains to which they will be subjected. Close fitting exposed joints, jointed where least conspicuous. Conceal threads on threaded connections where practical. Provide continuous welds or intermittent welds on welded connections as specified or shown. Dress face of welds flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous Steel Items: miscellaneous stainless steel indicated and not otherwise specified.

## 2.6 CASTINGS:

- A. General: Good quality, strong, tough, even-grained, smooth, free from scale, lumps, blisters, sand holes, and other defects. Thoroughly clean castings to remove foreign matter, and deleterious films. Castings will be subjected to a hammer inspection in the field by the Engineer. Damaged castings may be rejected and replaced at no cost to the Owner.
- B. Matching Surfaces: Machine to a true plane surface allowing contact surfaces to seat without rocking. Provide allowances in patterns so specified thickness is not reduced to obtain finished surfaces. Castings will not be acceptable if actual weight is less than 95 percent of theoretical weight computed from dimensions. Provide facilities for weighing castings in the presence of the Engineer.

## 2.7 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/4 by 1 inch, with a minimum 6 inch embedment and 1 1/2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.8 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

## 2.9 MANHOLE STEP

- A. Manhole step for cast-in-place concrete work: 12-3/4 inches wide with a drop front design and a serrated or knurled step surface; comply with OSHA requirements.
- B. Rung Material: Stainless steel, Type 316.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Install all items except those to be embedded in concrete which shall be installed under Division 03. Install items to be attached to concrete or masonry after such work is completed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.
- B. Touch up abrasions in the shop primer immediately after erection. Paint areas left unprimed for welding after welding.
- C. Clean and repair, after installation, zinc coating which has been burned by welding, abraded, or otherwise damaged. Thoroughly clean damaged area and remove all traces of welding flux and loose or cracked zinc coating prior to painting. Paint the cleaned area per the requirements of ASTM A780.
- D. Install specialty products in accordance with the manufacturer's recommendations.
- E. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- F. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- G. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- H. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- I. Corrosion Protection: Coat concealed surfaces of aluminum and steel that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
  - 1. Aluminum Contacting a Dissimilar Metal: Apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.
  - 2. Aluminum Contacting Masonry or Concrete: Apply a heavy coat of approved alkali resistant paint to the masonry or concrete.

3. Aluminum Contacting Wood: Apply two coats of aluminum metal and masonry paint to the wood.
4. Steel Contacting Exposed Concrete or Masonry: Apply heavy bitumastic troweling mastic.
5. Between aluminum stair treads, and steel supports, insert 1/4 inch thick neoprene isolator pads, 85 plus or minus 5 Shore A durometer, sized for full width and length of bracket or support.

### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

END OF SECTION 055000



**Divisions 06-30**  
**(Not Used)**



**Division 31**  
**Earthwork**



## SECTION 310515 - SOILS AND AGGREGATES FOR EARTHWORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Soils: Soil materials and topsoil materials.
  - 2. Aggregates: Coarse aggregate materials and fine aggregate materials.

- B. Related Sections:

- 1. Section 312333 - Trenching and Backfilling: for trenching, backfilling, and compaction in trench excavations.

#### 1.3 ACTION SUBMITTALS

- A. Section 013300 - Submittal Procedures: for requirements of submittals.

- B. Quality Control Testing: Submit conformance testing performed by a certified independent laboratory engaged by Contractor for all fill materials. Verify maximum density, gradation, Atterberg limits, sand equivalent, and other applicable criteria at least 72 hours prior to importing or placing any fill. Perform additional conformance testing at a minimum frequency of 1 per every 2000 cubic yards or change in material.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Materials Source: Submit name and location of imported materials suppliers.

- B. Source's Certificate: Certify materials meet or exceed specified requirements.

- C. Material Test Reports: For each soil and aggregate material proposed for fill and backfill as follows:

- 1. Classification according to ASTM D 2487.
  - 2. Laboratory compaction curve according to ASTM D 1557.
  - 3. Test Reports: Submit any test reports required by this Section to the Engineer.

## 1.5 QUALITY ASSURANCE

- A. Furnish each soil and topsoil material from single source throughout the Work, unless an alternate source is approved by the Engineer.
- B. Furnish each aggregate material from single source throughout the Work, unless an alternate source is approved by the Engineer.
- C. Perform Work according to State of North Carolina Department of Transportation standards except as specified herein.
- D. Quality Control and Quality Assurance consists of laboratory conformance testing of samples supplied from each coarse and fine aggregate source and quality control during installation.
- E. Maintain one copy of each standard affecting Work of this Section on Site.

## 1.6 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. Common Fill - Common fill shall be approved on site excavated material or imported fill material that is composed of durable soil free of debris, organic matter, or other deleterious materials. Common fill shall not contain stones larger than 6 inches in largest diameter, a maximum of 50 percent passing the No. 200 sieve, a maximum liquid limit of 60, a maximum plasticity index of 30, and a maximum dry density of at least 90 pounds per cubic foot (pcf) as determined by ASTM D 1557. Common fill shall not contain granite blocks, broken concrete, masonry rubble, or other similar materials and shall have physical properties such that it can be readily spread and compacted during filling.
- B. Select Common Fill – Select common fill shall be as specified above for common fill except that the material shall contain no stones larger than 2 inches in largest diameter.
- C. Structural Fill – Structural fill shall consist of mineral soil free of organic material, loam, debris, frozen soil or other deleterious material which may be compressible, or which cannot be properly compacted. Structural fill should consist of materials with the following gradation:

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
3-in	100
No. 4	70 to 100
No. 40	5 to 100
No. 200	0 to 12

Structural fill should have a maximum liquid limit of 50 percent, maximum plasticity index of 10 percent, and a maximum dry density of at least 95 pcf as determined by ASTM D 1557.

## 2.2 TOPSOIL MATERIALS

### A. Topsoil :

1. Excavated and reused material.
2. Graded.
3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
  - a. Screening: Double screened.
4. Conforming to ASTM D 2487 Group Symbol OH.

## 2.3 COARSE AGGREGATE MATERIALS

### A. Coarse Aggregate - Crushed Stone: Natural stone; free of clay, shale, organic matter; conforming to State of North Carolina Department of Transportation standard.

1. Coarse Aggregate Designation: NCDOT Standard Size No. 57

### B. Coarse Aggregate - Screened Gravel: Natural stone; hard, durable, rounded, or sub-angular particles of proper size and gradation, and shall be free from sand, loam, clay, excess fines, and other deleterious materials conforming to State of North Carolina Department of Transportation standard.

1. Coarse Aggregate Designation: NCDOT Standard Size No. 78M

## 2.4 FINE AGGREGATE MATERIALS

### A. Fine Aggregate - Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter; graded according to ASTM C 33; within the following limits:

## 2.5 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Testing and inspection services. Submit test result reports to the Engineer.
- B. Subsoil Material - Testing and Analysis: Perform in accordance with ASTM D 1557.

- C. Coarse Aggregate Material - Testing and Analysis: Perform according to ASTM D 1557.
- D. Fine Aggregate Material - Testing and Analysis: Perform according to ASTM D 1557.
- E. When tests indicate materials do not meet specified requirements, change material and retest.
- F. Furnish materials of each type from same source throughout the Work.

## PART 3 - EXECUTION

### 3.1 EXCAVATION - SOILS

- A. Excavate soil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.
- B. Stockpile excavated material meeting requirements for soil and topsoil materials.
- C. Remove excess excavated materials not intended for reuse, from site.
- D. Remove excavated materials not meeting requirements for soil and topsoil materials from site.

### 3.2 EXCAVATION - AGGREGATES

- A. Coordinate excavation of aggregate materials from on-site locations as specified in Section 312000.
- B. Stockpile excavated material meeting requirements for aggregate materials.
- C. Remove excess excavated aggregate materials not intended for reuse, from site.
- D. Remove excavated materials not meeting requirements for aggregate materials from site.

### 3.3 STOCKPILING

- A. Stockpile materials on site at locations approved by Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different soil and aggregate materials with dividers or stockpile individually to prevent mixing. Prevent intermixing of soil types or contamination.
- D. Stockpile topsoil 8-foot-high maximum.
- E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- F. Should NCDOT allow excavated material storage on pavement, a layer of coarse sand, screenings, or acceptable alternative shall be placed on the pavement prior to deposition of



excavated material. Silt and mud shall be removed from pavement by sweeping on a daily basis at a minimum or more frequently as determined by NCDOT inspection.

### 3.4 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 310515

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## SECTION 310519.13 - GEOTEXTILES FOR EARTHWORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Nonwoven geotextile material.

- B. Related Requirements:

- 1. Section 310515 - Soils and Aggregates for Earthwork: for soil and aggregate materials.
  - 2. Section 312000 - Earthwork: for excavating, backfilling and compaction in open areas.
  - 3. Section 312333 - Trenching and Backfilling: for trenching, backfilling, and compaction in trench excavations.
  - 4. Section 312500 - Erosion and Sedimentation Controls: to prevent erosion, sedimentation, and contamination of adjacent properties.

#### 1.3 ACTION SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals. Submit items in this Article at least 30 days prior to installation.
- B. Product Data: Submit certified test results from the manufacturer including tensile strength, elongation, thickness, UV resistance, and other material properties.
- C. Shop Drawings: Indicate fabric layout, seam locations, and overlap details in installation drawings. Provide installation schedule.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- B. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures and quality control and quality assurance.
- C. Manufacturer's quality control program and manual, including a description of laboratory facilities.

- D. Source Quality-Control Submittals: Provide results of factory tests and inspections, including test results that indicate materials meet the requirements of PART 2.
- E. Field Quality-Control Submittals: Provide results of Contractor-furnished tests and inspections.
- F. Qualifications Statements:
  - 1. Submit qualifications for manufacturer and installer.
  - 2. Submit manufacturer's approval of installer.

## 1.5 QUALITY ASSURANCE

- A. Perform Work according to standards and the recommendations of the Manufacturer.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements”: for requirements of transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer’s original packaging that identifies the manufacturer/supplier’s name, style, and roll number. Inspect for damage.
- C. Comply with ASTM D 4873.
- D. Store materials according to manufacturer instructions.
- E. Protection:
  - 1. Protect materials from moisture, dust, chemicals, UV radiation or other environmental conditions that might damage the geotextile by storing at least 3 inches off the ground in a clean, dry location remote from construction operations areas.
  - 2. Provide additional protection according to manufacturer instructions.

## PART 2 - PRODUCTS

### 2.1

#### 2.1 MATERIALS – NONWOVEN GEOTEXTILES

A. Manufacturers:

1. TenCate Geosynthetics America, GEI Works, SKAPS Industries, or approved equal.

B. Description:

1. Non-biodegradable, non-reactive (for pH of three to eleven), UV-resistant, insect/rodent-resistant nonwoven needle punched material consisting of filaments formed into a stable network.
2. Edges: Selvaged or finished to prevent separation of outer material.

C. Performance and Design Criteria:

1. When tested in accordance with ASTM D 4759, test results from any sampled roll in the lot shall meet or exceed the values listed in Table 1. Strength values are in the weaker principal direction.

TABLE 1: NONWOVEN GEOTEXTILE MINIMUM AVERAGE ROLL VALUES

PROPERTIES	TEST METHOD	UNIT	6 oz
Mass per Unit Area	ASTM D 5261	oz/yd2	6
Thickness	ASTM D 5199	mils	75
Grab Strength	ASTM D 4632	lbs	160
Grab Elongation	ASTM D 4632	percent	50
Trapezoid Tear Strength	ASTM D 4533	lbs	60
Puncture Strength	ASTM D 4833/ D 6241	lbs	90
Water Flow Rate	ASTM D 4491	gpm/ft2	110
Permittivity	ASTM D 4491	sec-1	1.5
Apparent Opening Size (Max)	ASTM D 4751	inch	0.008
		US Std. Sieve	70
UV Resistance	ASTM D 4355	percent strength retained	70

#### 2.2 MATERIALS - ACCESSORIES

- A. Use products to secure geotextile fabrics as recommended by geotextile manufacturer.

#### 2.3 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: for requirements of testing, inspection, and analysis.

- B. If requested by the Owner, provide materials for Quality Assurance Laboratory (QAL) testing by an independent GRI accredited laboratory to confirm conformance testing results.
- C. Certificate of Compliance:
  - 1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
  - 2. Specified shop tests are not required for Work performed by approved manufacturer.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION AND PREPARATION

- A. Section 017300 - Execution: for requirements of installation examination.
- B. The Engineer shall inspect subgrade to verify that underlying surface is smooth and free of ruts or protrusions that could damage geotextile material and that subgrade has been properly prepared.
- C. Subgrade Material and Compaction Requirements: As specified in Sections 312000 and 312333.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Comply with manufacturer's published installation instructions. Do not install damaged materials.
- B. Geotextile Material:
  - 1. Lay and maintain smooth and free of tensile stresses, folds, wrinkles, or creases.
  - 2. Ensure that material is in direct contact with subgrade.
  - 3. Orientate with long dimension of each sheet parallel to direction of slope and in accordance with the manufacturer's recommendations and approved shop drawings.
  - 4. Minimum Unseamed Joints Overlap: 18 inches.
- C. Securement Pins or Staples:
  - 1. Insert through geotextile midway between edges of overlaps and minimum 6 inches from free edges.
  - 2. Minimum Spacing:
    - a. Slopes Steeper than 3 Horizontal on 1 Vertical: 24 inches o.c.
    - b. Slopes 3 Horizontal on 1 Vertical to 4 Horizontal on 1 Vertical: 3 feet o.c.
    - c. Slopes Flatter than 4 Horizontal on 1 Vertical: 5 feet o.c.
  - 3. Ensure that washer bears against geotextile.

D. Field Seams:

1. Minimum Seamed Joints Overlap: 12 inches at longitudinal and transverse joints.
2. Seams across Slope: Lap upper panel over lower panel.
3. Sewn Seams:
  - a. Continuously sew seams as recommended by geotextile manufacturer.
  - b. Stitch Type: As recommended by geotextile manufacturer.
  - c. Tie off thread at the end of each seam to prevent unraveling.
4. Thermal Seams:
  - a. As recommended by geotextile manufacturer.
  - b. Comply with ASTM D 4886.

E. Penetrations: As recommended by geotextile manufacturer.

F. Repairing Damaged Geotextiles:

1. Repair torn or damaged geotextile by placing patch of same type of geotextile over damaged area minimum of 12 inches beyond edge of damaged area and fasten as recommended by geotextile manufacturer.
2. Remove and replace geotextile rolls which cannot be repaired.

G. Fill and Cover:

1. Place fill to prevent tensile stress or wrinkles in geotextile.
2. Place fill from bottom of side-slopes upward.
3. Do not drop fill from height greater than 3 feet.

### 3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: for requirements of inspecting and testing.

B. Acceptance:

1. The Engineer will inspect installation and identify repairs or modifications necessary to perform as specified.
2. Make final adjustments and repairs under direction of The Engineer or manufacturer's representative.

### 3.4 PROTECTION

A. Section 017300 - Execution: for requirements of protecting finished Work.

B. Ballast: Adequate to prevent uplift of material by wind.

C. UV Exposure: Do not leave material uncovered for more than 14 days after installation.

D. Do not use staples or pins to hold geotextiles in place where located adjacent to other geosynthetic layers that could be damaged.

- E. Do not operate equipment directly on top of geotextile.

END OF SECTION 310519.13



## SECTION 310900 - GEOTECHNICAL INSTRUMENTATION AND MONITORING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes performing pre-construction surveys and installing and monitoring geotechnical instrumentation and survey markers to measure.
  - 1. Performance of excavation support systems.
  - 2. Performance of trenchless installations.
  - 3. Groundwater levels inside and outside excavation limits.
  - 4. Vertical deformation of ground surface adjacent to and directly over the Work.
  - 5. Vertical and horizontal deformation of existing utilities and structures adjacent to and over the Work.
- B. Related Requirements:
  - 1. Section 312319 "Dewatering" for lowering and disposing of groundwater during construction and dewatering excavations for dewatering and drainage.
  - 2. Section 312333 "Trenching and Backfilling" for trenching, backfilling, and compaction in trench excavations.
  - 3. Section 315000 "Excavation Support and Protection" for temporary support of excavations.
  - 4. Various Sections in Division 02 relating to different types of demolition.

#### 1.3 DEFINITIONS

- A. Excavation Support Monitoring Points (ESMPs): Inscribed marking or fixed markers placed on excavation support systems to measure horizontal movement of the excavation support system.
- B. Groundwater Observation Wells: Screened or slotted pipe with solid riser pipe installed in a drilled hole with the annulus around the pipe backfilled with sand. Near surface groundwater levels are measured in the well.
- C. Surface Monitoring Points (SMPs): Inscribed marking or approved surveyor's nail installed to measure vertical (elevation) movement.

#### 1.4 ACTION SUBMITTALS

- A. Submit in accordance with Section 013300.

B. Submit for the Engineer's review four weeks prior to instrument installation:

1. Installation Plan and Schedule: Full details and plan/layout of proposed instruments/points, schedule for installing and monitoring instruments/points, equipment types, installation methods, reference points, and monitoring and data reporting schedule for instruments/points, and instrumentation protection.
2. Description of methods for installing and protecting all instrumentation including but not limited to observation wells, monitoring points, and reference points.
3. Groundwater observation well construction details including casing type, filter gradation, screen interval, grout mix, drilling methods, and well depths.
4. For instrumentation installed in borings, submit a detailed procedure for installation, including post-installation acceptance test, together with a sample installation record sheet that include:
  - a. Method to be used for cleaning inside of casing or augers.
  - b. Drill casing or auger type and size.
  - c. Depth increments for backfilling boreholes with sand and bentonite.
  - d. Method for overcoming buoyancy of instrumentation components during grouting.
  - e. Method of sealing joints in pipe casing to prevent ingress of grout.

C. Installations Records: Within five working days of installing each instrument, submit to the Engineer, specified as-built instrument location and its corresponding installation record sheet.

1. Include in installation record sheet, location with instrument identification numbers, established elevations, initial elevations and coordinates (baseline readings), boring log, installation, and monitoring date and time.
2. Furnish details of installed instruments showing dimensions, materials used, and as-built drawings of each instrument.
3. Submit field calibrations.

D. Reports and Records: Provide reports of monitoring data to the Engineer. include following minimum information:

1. As-installed location plan, installation records, and baseline values for instrumentation.
2. Monitoring data for instruments with plots against threshold values.
3. Discussion and associated action related to results exceeding threshold values.

E. Submit proposed remedial measures to the Engineer of action to be taken in event that instrument Threshold Values are reached.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Submit names, qualifications, and experience of personnel who will install instruments, perform optical level survey, read instruments, and report data to the Engineer demonstrating compliance with "Quality Assurance" Article in this Section.

## 1.6 QUALITY ASSURANCE

- A. Geotechnical Instrumentation Engineer Qualifications: Professional engineer licensed in the State of North Carolina with at least 5 years' experience in installation of specified

instrumentation and will supervise and direct technicians and be responsible for instrument installation. Be present at installation sites to direct and supervise installations, oversee instrumentation reading, and supervise geotechnical instrumentation data interpretations.

- B. Surveyor Qualifications: Professional Land Surveyor licensed in the State of North Carolina with at least 3 years' experience in surveying of similar instruments. Establish Surface Monitoring Points and Excavation Support Monitoring Points and take baseline readings.
- C. Manufacturer Qualifications: Provide instruments and components from an approved manufacturer currently engaged in manufacturing specified geotechnical instrumentation hardware.
- D. Monitoring Technicians Qualifications: Minimum 3 years' experience for personnel responsible for optical level surveys, instrument readings, and report data.
- E. Instrument Installation Technicians: Experienced in installation and reading of specified geotechnical instrumentation and equipment.
- F. Factory Calibration: Conduct factory calibration on instruments prior to shipment with certification submitted to indicate that test equipment used for this purpose is calibrated and maintained in accordance with test equipment manufacturer's calibration requirements and that, where applicable, calibrations are traceable to U.S. National Institute of Standards and Technology.
  - 1. Include a calibration curve with data points clearly indicated and a tabulation of data. Mark each instrument with a unique identification number.
- G. Perform instrument installations in presence of the Engineer.
- H. Be responsible for installation, maintenance, and monitoring of geotechnical instrumentation.

## PART 2 - PRODUCTS

### 2.1 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Project Requirements:
  - 1. Install geotechnical instrumentation to monitor ground conditions, ground response, and facilities to achieve specified project requirements and prevent damage to facilities potentially affected.
  - 2. Install instrumentation in accordance with approved Instrumentation Schedule.
  - 3. Engineer's monitoring of installed instruments does not relieve Contractor of its obligation to complete project within the requirements specified herein taking necessary additional measurements.
- B. Secure required permits prior to the installation or removal/abandonment of observation wells.
- C. Provide and facilitate safe access to the instruments at all times. Engineer may perform additional monitoring in a manner that will minimize unnecessary work delays. Allow and

facilitate instrument monitoring as required by the Engineer. No claim for lost production time due to this activity will be allowed.

- D. Maintain instrumentation. Report damaged or non-functional instrumentation to the Engineer within 24 hours. Replace damaged instruments within 24 hours.
- E. Availability of Data:
  - 1. Instrumentation readings shall be collected by the Contractor's Geotechnical Instrumentation Monitoring Firm. The Contractor may take their own supplementary readings in addition to those specified.
  - 2. Monitoring data is the property of Owner and is not to be disclosed or published to third parties without Owner's written permission.
  - 3. Contractor is expected to make their own interpretations for their own purposes without additional compensation.
  - 4. Coordinate with the Engineer to verify consistency of collected data.

## 2.2 INSTRUMENTATION - GENERAL

- A. Instruments and materials, including readout units, installation tools, materials, and miscellaneous instrumentation components.
- B. Provide surface protection for instruments flush with surface in paved or other ground surface areas at the time that work is completed.
- C. Minimum Quantity of Instruments: While quantities in following Paragraph are considered minimums, obtain data from instrumentation in quantity to monitor construction, performance, and safety aspects of the Work.
- D. Following subparagraphs identify instrument type, minimum number to be provided, and approximate installed depth from below bottom of excavation / tunnel invert:

<u>Instrument Type:</u>	<u>Number:</u>	<u>Depth:</u>
1. Observation Wells:	As needed	10 feet*
2. Surface Monitoring Points:	As Needed	N/A.
3. Excavation Support Monitoring Points:	As Needed	N/A.

\* 10 feet below bottom of excavation

- E. Locate instruments and obtain approval from the Engineer.

## 2.3 GROUNDWATER OBSERVATION WELLS

- A. Pipe: ASTM D 1785, Schedule 40 PVC pipe, 1-inch minimum inside diameter.
- B. Maximum Screen Size: 0.020 inch, unless otherwise approved by the Engineer.
- C. Use observation wells to monitor groundwater levels outside excavations.

## 2.4 MONITORING POINTS

### A. Surface Monitoring Points (SMPs):

1. Use to monitor vertical deformation at or near ground surface, clearly identifying points with permanent easily readable letters and numbers as approved by the Engineer.
2. Paved Areas: 2 inches long masonry nail, manufactured from hardened zinc-plated steel and driven into an asphalt covered surface. Identify each nail individually with an identification tag or surface marking.
3. Non-Paved Areas: 3 feet 3/4-inch diameter steel rod driven into ground or set in concrete such that no more than 3 inches of rod is exposed above ground surface. Round top of rod and punch-mark it at its center. Identify each rod with a surface marking.
4. Utility Manholes: Observable cross mark or welded bead on top horizontal surface of manhole rim. Clean surface within 3 inches of point and mark it using fluorescent spray paint adjacent to point to permit easy identification of exact location.

### B. Excavation Support Monitoring Points (ESMPs):

1. Use as fixed markers on vertical elements of excavation support system and to monitor horizontal deformation of excavation support system designed by the Contractor's Design Engineer.
2. Clearly identified points with permanent easily readable letters and numbers as approved by the Engineer.
3. Clean surface within 3 inches of each point and clearly identify using fluorescent spray paint adjacent to point.

### C. Non-Shrink Cement Grout: Suitable for intended application.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with the Engineer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Existing Conditions: Locate vaults, structures, conduits and underground utilities in areas where wells are to be drilled and installed. Conduct utility clearance and contact utility companies prior to any drilling.
  1. Modify instrument locations, as approved by the Engineer, to avoid interference with existing vaults, structures, conduits and utilities.
  2. Repair damage to existing facilities resulting from instrument installations without additional compensation.

- B. Prior to commencing installation of excavation support, excavation, and dewatering work, furnish instrumentation and related components that are to be installed during construction.
- C. Protect from damage and maintain instruments. Repair or replace damaged instruments.
- D. Drilling from Ground Surface: Obtain necessary permits for each instrument and conform to permit requirements during drilling and installation.
- E. Implement remedial measures based on interpretations of monitoring data program.

### 3.3 GENERAL REQUIREMENTS

- A. Install instruments at the Engineer approved locations in accordance with approved installation procedures. Engineer may modify instrument locations depending on field conditions and monitoring objectives. Install instrumentation in accordance with approved installation schedule. Install instruments and obtain baseline data before construction starts.
- B. Allow the Engineer access to instrument locations and assistance required in obtaining monitoring data.
- C. Clearly mark and label instruments and protect to avoid being obstructed or otherwise damaged by construction operations or general public. Immediately following installation, survey location and top of instruments to provide horizontal and vertical coordinates.
  - 1. Resurvey if the Engineer questions instrument locations
- D. Assign a unique identification number to each instrument and each point that is clearly marked in a non-destructible manner.
- E. Initial Reading: Immediately following instrument installation take two sets of initial readings in the Engineer's presence to provide baseline readings and to demonstrate adequacy of completed installation.

### 3.4 MONITORING POINTS

- A. Monitoring Points: Include but not be limited to SMPs and ESMPs. Monitor these control points using surveying methods. Modify locations to meet site constraints with the Engineer's approval.
- B. SMPs: Install as described below near excavations, trenchless crossings and open trench locations. Additional SMPs may be required by the Engineer.
- C. Additional SMPs:
  - 1. Install in pavement or ground surface within 10 feet along each side of trench excavations that is over 12 feet deep or that is within 50 feet of structures. Install at spacing not exceeding 50 feet.
  - 2. Install on rim of utility manhole covers located within 50 feet of trenchless crossings or within 30 feet of open excavations.

3. Along trenchless crossing alignments under roadways, install at intervals of not more than 10 feet over proposed trenchless crossing locations in rows of three.
  - a. One directly above the alignment.
  - b. Other two located 10 feet apart on each side oriented perpendicular to pipe alignment.

D. ESMPs:

1. Install on excavation support systems other than trench box along support walls at spacing not more than 25 feet.
2. Install prior to excavation within exaction support system.
3. Read results at least daily during associated excavation and twice a week until backfill is completed.

E. Measurements and Reading Schedule:

1. Obtain two sets of measurements for each monitoring point to establish baseline data within three days of installation. Make at least 24 hours apart, but not more than 48 hours.
2. Check monitoring points with initial surveyed elevations differing by more than 0.1 inch for secure installation and resurvey.
3. Read monitoring points prior to installing excavation support, beginning excavation, operation of groundwater control system or start of installation of excavation support at the site.
4. Read daily during excavation, dewatering, filling and backfilling, trenchless excavation and excavation support installation located within 50 feet of the work, then at least twice a week until excavation, dewatering, and backfill has been completed.
5. Trenchless Crossing Operation under Roadways: Survey once per day starting at least 2 days prior to start of trenchless excavations and extend at least 30 days after crossing completion.

### 3.5 GROUNDWATER OBSERVATION WELLS

- A. Install at least one observation well near excavations that extend greater than 10 feet below grade.
- B. Set screened interval of each well to monitor groundwater levels.
- C. Drill 4 inch minimum diameter holes for observation wells of required size and depth and case with temporary casing. Do not use bentonite drilling mud in drilling holes for observation wells.
- D. Flush cased holes with clean water through an approved bit. Flush until discharge water is free of soil particles.
- E. Construct observation well with 10 feet of slotted PVC well screen, filter sand, bentonite seal, couplings, a pipe cap, and a locking cover.
  1. Place two feet of filter sand in bottom of drilled hole. Then place well screen and surround it with filter sand, as temporary casing is carefully withdrawn.

2. Insert solid PVC casing and cap and fill annular space with bentonite pellets then non-shrink cement grout.
3. Protect observation wells at ground surface by providing a roadway box or outer protective casing with lockable top and padlock. Design surface protection to prevent damage by vandalism or construction operations and to prevent surface water from infiltrating.
  - a. Provide two keys for each padlock to the Engineer for access to each well.
  - b. Develop observation wells to provide a reliable indication of groundwater levels. Re-developed wells if well clogging is observed, in event of apparent erroneous readings, or as directed by the Engineer.
  - c. Submit observation well installation logs, top of casing elevation, and well locations to the Engineer within 24 hours of completion of well installation.

F. Observation Well Maintenance:

1. Maintain each observation well until adjacent structures and pipelines are completed and backfilled. Clean out or replace any observation well which ceases to be operable before adjacent work is completed.
2. Maintain observation wells and repair or replace them without additional compensation, whether or not observation wells are damaged by Contractor's operations or by third parties.

G. Monitoring and Reporting of Observation Well Data:

1. Begin daily monitoring of groundwater levels in work areas prior to initial operation of drainage and dewatering system. Continue daily monitoring in areas where groundwater control is in operation until time that adjacent structures and pipelines are completed and backfilled and until time that groundwater control systems are turned off.
2. Be responsible for processing and reporting observation well data to the Engineer daily. Submit data to the Engineer on a form that includes following information.
  - a. Observation well number.
  - b. Depth to groundwater.
  - c. Top of casing elevation.
  - d. Groundwater level elevation.
  - e. Date and time of reading.

H. Following construction, abandon new observation wells as directed by the Engineer.

1. Abandon observation wells by removing materials within original borehole, including casing, filter, and grout seal in accordance with applicable permits.
2. Using approved tremie methods, completely fill hole and voids with non-shrink cement grout prior to removal of drill casing, such that formation materials do not move into hole prior to grouting.
3. Restore ground surface to its original condition.
4. Abandon wells within paved areas by removing vaults and well caps to pavement subgrade.
5. Remove wells with as discussed above and repair or patch pavement with same surface type.



### 3.6 INSTRUMENT PROTECTION, MAINTENANCE AND REPAIR

- A. Protect instruments from damage. Replace damaged or destroyed instruments within 72 hours of damage, without additional compensation. If necessary, suspend work in areas being monitored by damaged instrument and take remedial action.
- B. Maintain instruments by draining water and flushing debris from under protective covers and keeping covers locked and sealed at all times.

### 3.7 MONITORING

- A. Collect, tabulate, plot, and interpret survey monitoring data and provide the Engineer with tabulated and plotted data. Report status of excavation, bracing, groundwater levels, stationing of the tunnel face and backfilling at time of data collection with each report.
- B. Monitoring frequency may be modified as directed and approved by the Engineer.
- C. Submit data from readings of monitoring points to the Engineer within 24 hours of reading. Communicate verbally with the Engineer immediately after visual observations or data collection if excessive movements or other anomalies are indicated.
- D. Make visual observations of ground conditions and building conditions in the vicinity and communicate immediately with the Engineer if signs of ground or building movements are observed.
- E. Engineer may take independent instrumentation measurements. Cooperate with the Engineer during instrumentation monitoring by providing access to instrumentation locations in a timely manner and by providing and maintaining safe means of access to instrumentation locations for data collection. Data acquired by the Engineer will be made available to Contractor in a timely manner.
- F. Contractor may make their own interpretations of monitoring data for their own purposes. Do not publish or disclose data or interpretations shall to other parties without advance written permission of Owner.
- G. For data collected from an instrument that has been installed to replace a damaged instrument, use formal initial reading as an initial reading for replacement instrument so that data are continuously plotted, without an offset at time of damage. Note time of damage and replacement on plot.

### 3.8 INTERPRETATION AND RESPONSE VALUES

- A. Make interpretations of data resulting from monitoring programs.

B. Threshold and Limiting Values for Instruments:

	<u>Instrument</u>	<u>Threshold Value</u>	<u>Limiting Value</u>
1.	Surface Monitoring Points:	0.5 inch	1.0 inch
2.	Excavation Support:	1.0 inch	2.0 inches
3.	Observation Wells	2 feet*	0 feet**
	* below bottom of excavation.		
	** at bottom of excavation.		

C. Values are subject to adjustment by the Engineer as indicated by prevailing conditions or project circumstances

D. If a Threshold Value is reached:

1. Engineer and Contractor will meet to discuss remedial measures.
2. Increase instrument monitoring frequency as directed by the Engineer.
3. Install and monitor additional instruments as directed by the Engineer.
4. Implement remedial measures in event Threshold Value is reached, so Limiting Value is not reached.

E. Take necessary steps so Limiting Value is not exceeded. Engineer may direct Contractor to suspend activities in affected area with exception of those actions necessary to avoid exceeding Limiting Value.

3.9 TOLERANCES

A. Survey Measurements: Initial location of each instrumentation elements consisting of determining elevation and horizontal positions with respect to the Engineer approved benchmarks.

B. Monitoring Points (SMPs and ESMPs):

1. Instrumentation Elevations: Determine to accuracy of plus/minus 0.01 foot
2. Horizontal Position of Surface Monitoring Points: Determine to accuracy of plus/minus 0.1 foot
3. Horizontal Position of Excavation Support Monitoring Points: Determine to accuracy of plus/minus 0.01 foot

C. If actual field conditions prohibit installation at location and specified elevations, obtain prior acceptance from the Engineer for new instrument location and elevations.

3.10 DISPOSITION OF INSTRUMENTS

A. Monitoring Points: Remove monitoring points during cleanup and restoration work, unless directed otherwise by the Engineer.

- B. Observation Wells: When required by the Engineer, abandon and remove protective housings and caps in accordance with required permits. Restore surfaces affected by installation of instruments to their original condition prior to completion of work.
1. Leave in place any casings located within plan limits of new or existing structures or pipelines or within zone below 1H:1V planes extending downward and out from edges of foundation elements, from downward vertical footprint of pipe, or where removal would otherwise result in ground movements causing adverse settlement to adjacent ground surface, utilities or structures.
  2. Where casings are pulled, fill holes with sand. Where left in place, fill casings with non-shrink cement grout and cut off a minimum of 3 feet below finished ground level or 1 foot below foundation level so as not to interfere with finished structures or pipelines.
  3. Following backfilling, remove precast boxes or vaults and reconstruct pavement in paved areas. Restore surface to conditions existing prior to instrument installation.

END OF SECTION 310900

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## SECTION 311000 - SITE CLEARING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, removing site utilities, and abandoning site utilities in place.

- B. Related Requirements:

1. Section 015000 - Temporary Facilities and Controls: for temporary erosion- and sedimentation-control measures.
2. Section 015639 - Temporary Tree and Plant Protection: for temporary protection of existing vegetation.
3. Section 024119 - Selective Demolition: for disconnecting and removing existing utilities and structures.
4. Section 312000 - Earthwork: for approved soil requirements.
5. Section 312500 - Erosion and Sedimentation Controls for temporary protection of erosion and sedimentation.

#### 1.3 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated according to requirements in Section 015639.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

#### 1.4 MATERIAL OWNERSHIP

- A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
  - 1. Use sufficiently detailed photographs or video recordings.
  - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.
- B. Topsoil stripping and stockpiling program.
- C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

#### 1.6 QUALITY ASSURANCE

- A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.
- B. Conform to applicable code for environmental requirements, disposal of debris, burning debris on site, and use of herbicides.
- C. Perform Work in accordance with all applicable Federal, state, and local requirements.

#### 1.7 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct roads, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed roadways if required by Owner or authorities having jurisdiction.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated. Refer to Section 024119 for additional salvage requirements.
- C. Utility Locator Service: Notify utility locator service and/or One Call for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree-protection measures are in place.
- E. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639.
- F. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.
- G. Contractor shall clear and grub everything within the limits of disturbance and permanent utility easement, only as required to complete the work.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000.
  1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
- B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #23 (surface-tolerant, anticorrosive metal primer) or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639.
- C. Protect existing site improvements to remain from damage during construction.
  1. Restore damaged improvements to their original condition, as acceptable to Owner and applicable authorities including but not limited to NCDOT in public road right of ways.

- D. Call Local Utility Line Information service not less than three working days before performing Work.
  - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- E. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- F. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- G. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- H. Provide traffic control as required within the applicable NCDOT permitting for the Work and maintain continuous access on all roadways during site clearing operations

### 3.2 TREE AND PLANT PROTECTION

- A. Protect trees and plants remaining on-site according to requirements in Section 015639.
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639.
- C. Contractor shall get approval from owner or engineer prior to removing any trees outside the permanent utility easement and within the limits of disturbance.

### 3.3 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
  - 1. Arrange with utility companies to shut off indicated utilities.
- B. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Engineer's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.



### 3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
  - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  - 2. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
  - 3. Use only hand methods or air spade for grubbing within protection zones.
  - 4. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

### 3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials.
  - 1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
  - 1. Limit height of topsoil stockpiles to 72 inches.
  - 2. Do not stockpile topsoil within protection zones.
  - 3. Stockpile surplus topsoil to allow for respreading deeper topsoil.
- D. If NCDOT allows stockpiling of storage on pavement, a layer of coarse sand, screenings, or acceptable alternative shall be placed on the pavement prior to deposition of excavated material. Silt and mud shall be removed from pavement by sweeping on a daily basis at a minimum or more frequently as determined by NCDOT inspection.

### 3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
  - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
  - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

### 3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Burning of tree, shrub, vegetation waste, and other waste and debris is prohibited.
- C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other project work.

END OF SECTION 311000

## SECTION 312000 – EARTHWORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. General: Earthwork includes clearing and stripping, procurement of on-site and imported fill material, excavating, placing, and compacting fill and backfill, structural excavating and backfilling, transportation and storage of excess earthwork materials; disposal of unsuitable, waste, and surplus materials; restoration of excavation and trench surfaces; and subsidiary work necessary to complete the grading of developed areas to conform with required lines, grades, and slopes.
- B. Work includes but is not necessarily limited to; excavation for structures, tanks, foundations, manholes, vaults, electrical manholes, conduits, cables, raceways and ducts, pipes, paving; embankments; grading; and related work such as sheeting, bracing and dewatering.
- C. Provide services of a Professional Engineer licensed in the State of North Carolina to prepare temporary excavation support system, dewatering system designs, and submittals.
- D. Provide temporary excavation support systems, including sheeting, shoring, and bracing, to ensure the safety of personnel and protect adjacent structures, piping, and other materials in accordance with Federal, State and local laws, regulations, and requirements. Temporary excavation support systems are specified in Section 315000 "Excavation Support and Protection."
- E. Provide temporary dewatering, surface water control systems, and operate to dewater and maintain excavations in a dry condition. Control drainage into excavations and remove seepage water and rainwater. Dewatering and surface water control are specified in Section 312319 "Dewatering."
- F. Examine site and review available geotechnical data prior to submitting a proposal, taking into consideration project conditions that may affect the work. Owner and Engineer do not assume responsibility for variations of subsurface conditions at locations other than places shown and at the time investigations were made.
- G. Protect existing structures and utilities that remain.
- H. Related Requirements:
  - 1. Section 013233 "Photographic Documentation" for recording pre-excavation and earthwork progress.
  - 2. Section 310515 "Soils and Aggregates for Earthwork" for soil and aggregate materials.

3. Section 310519.13 "Geotextiles for Earthwork" for filter fabric materials.
4. Section 311000 "Site Clearing" for site preparation work, including stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
5. Section 310900 "Geotechnical Instrumentation and Monitoring" for monitoring of ground, groundwater and existing structures..
6. Section 312333 "Trenching and Backfilling" for trenching, backfilling, and compaction in trench excavations.
7. Section 312319 "Dewatering" for controlling surface and groundwater and disposing of water during construction.
8. Section 312500 "Erosion and Sedimentation Controls" to prevent erosion, sedimentation, and contamination of adjacent properties.
9. Section 315000 "Excavation Support and Protection" for temporary support of excavations.
10. Section 321216 "Asphalt Paving" for flexible paving system.
11. Section 321313 "Concrete Paving" for rigid paving systems that include sidewalks, driveways, curbs, and gutters.

### 1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
  1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- C. Coverage: Pass of compaction equipment over the complete surface area of exposed lift or subgrade to receive compaction.
- D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
  2. Unauthorized Additional Excavation: Excavation as directed by Engineer to correct Contractor's work not in compliance with Contract Documents, which will be performed without additional compensation.
  3. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
  4. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be provided without additional compensation.
- E. Finished Grade: Required final grade elevation indicated on Drawings. Spot elevations take precedent over proposed contours.

- F. In-the-Dry: An excavation subgrade where groundwater level: has been lowered to at least 2 feet below lowest level of excavation; is stable with no ponded water, mud, or muck; is able to support construction equipment without rutting or disturbance; and is suitable for placement and compaction of fill material, pipe, or concrete foundations.
- G. Objectionable Material: Includes topsoil, organic matter, contaminated soil, construction debris, perishable materials, snow, ice, frozen earth, and rocks or lumps of cemented soils over 6 inches in maximum dimension.
- H. Optimum Moisture Content: Moisture content (percent by dry weight) corresponding to maximum dry density of the same material as determined by ASTM Test Method D 1557.
- I. Overexcavation: Removal of unsuitable soil or objectionable material at or below the normal grade of excavation or subgrade as indicated on Drawings.
- J. Percent Compaction: Required in-place dry density of the material, expressed as a percentage of the maximum dry density of the same material, as determined in the laboratory by ASTM Test Method D 1557. Compaction requirements within NCDOT right of ways shall meet AASHTO T 180 (as modified by NCDOT)
- K. Structures: Buildings, wet wells, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, manholes and vaults, or other man-made stationary features constructed above or below the ground surface.
- L. Subgrade: Required surface of subsoil, borrow fill, or compacted fill that is immediately beneath site improvements, especially dimensioned fill, paving, or other surfacing material.
- M. Unsuitable Soil: Includes organic soils, weak native soils, or clays with a plasticity index of greater than 30, and any materials that cannot be properly placed and compacted as specified.
- N. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- O. Zone of Influence: A line extending at least 2 feet beyond foundation or pipeline edge, then outward and downward at a slope of 1 horizontal to 1 vertical. Do not excavate below foundation of existing structures or pipeline.
- P. Professional Engineer: Licensed Professional Engineer meeting project qualifications and who is hired by Contractor.
- Q. The Engineer: The Engineer or their designated representative hired by Owner.
  - 1. Approval given by the Engineer shall not relieve Contractor of its responsibilities for performing the work in accordance with Contract Document requirements.

#### 1.4 ACTION SUBMITTALS

- A. Coordinate various submittal types required by this Section with requirements of dewatering, support of excavation, and geotechnical instrumentation submittals specified in other Sections.

- B. Submit laboratory test results for fill materials that include maximum density, gradation, Atterberg limits, sand equivalent, and other applicable criteria, at least 72 hours prior to importing or placing fill.
- C. Prepare excavation support system designs by a Professional Engineer, licensed in the State of North Carolina and having a minimum of 5 years of professional experience in design and construction of excavation support systems.
  - 1. Submit an original and three copies of licensed Professional Engineer's certification, on PE form specified in Section 013300, stating excavation support systems designs have been prepared by Professional Engineer who is responsible for their execution.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Construction and Operations Plan: Submit proposed methods of construction, including earthwork operations, excavation limits, slopes, fill material moisture conditioning and handling, compaction equipment, excavation support systems designs, backfilling and filling and compaction, and material sources.
  - 1. Submit excavation support system plan as prepared by registered Professional Engineer complying with requirements stated in previous Article.
- B. Submit copies of field daily reports by soil technician at the end of each work day that earthwork and grading operations occur.
- C. Upon completion of earthwork and grading operations, submit density test numbers and locations on record drawings, a table of density test results and depths, and a certification of compliance by geotechnical engineer in charge.
- D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

#### 1.6 QUALITY ASSURANCE

- A. Excavation, trenching, sheeting, bracing, and similar work shall comply with requirements of OSHA excavation safety standards, 29 CFR Part 1926 Subpart P and State and local authorities having jurisdiction. Where conflict between OSHA, State and local regulations exists, apply most stringent requirements.
- B. At least three working days prior to starting any excavation, notify the appropriate regional notification center for underground utilities and underground utility owners who are not members of notification center. To obtain area specific information for project site, refer to [www.nc811.org](http://www.nc811.org).
  - 1. Obtain and test off-site borrow samples in accordance with criteria established by the Engineer. Submit results for review and approval prior to use on site.

## 1.7 FIELD CONDITIONS

- A. Be responsible for construction layout and reference staking necessary for proper control and satisfactory completion of structures, cutting, filling, grading, drainage, fencing, embankment improvements, curbing, and other appurtenances.
- B. Perform construction layout and staking by a Professional Surveyor or Professional Engineer licensed in the State of North Carolina, experienced and skilled in construction layout and staking requirements.
- C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earthwork operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- D. Utility Locator Service: Notify North Carolina 811 before beginning earthwork operations.
- E. Do not commence earthwork operations until temporary site fencing and erosion- and sedimentation-control measures specified in are in place.
- F. Do not commence earthwork operations until plant-protection measures specified in Section 015639 are in place.
- G. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- H. Do not direct vehicle or equipment exhaust towards protection zones.
- I. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

## PART 2 - PRODUCTS

### 2.1 SOIL AND AGGREGATE MATERIALS

- A. Fill materials designated for use in this Section are specified in Section 310515.
- B. On-Site Fill Material: Earth and rock material obtained at project site during excavation, following clearing and stripping, from which any Unsuitable Soil or Objectionable Material has been removed.

- C. General: Provide imported fill materials when sufficient satisfactory soil materials are not available from excavations.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, tanks, utilities, sidewalks, pavements, fencing, landscaping, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
  - 1. If necessary, remove and restore or replace curbing, driveway aprons, and fencing after performing backfilling work.
  - 2. Replace existing facilities damaged by construction with new material fully equal to existing without additional compensation.
- B. Prior to and During Earthwork Operations:
  - 1. Provide, monitor, and maintain geotechnical instrumentation regarding settlement; coordinate with Section 310900.
  - 2. Protect and maintain erosion and sedimentation controls; coordinate with Section 312500 "Erosion and Sedimentation Controls."
  - 3. Provide, monitor, and maintain excavation support; coordinate with Section 315000 "Excavation Support and Protection."
    - a. Use excavation support system for excavations within the zone of influence for existing structures or utilities.
    - b. Do not permit excavations below base level of adjacent foundations or retaining walls, unless excavation design and bracing includes an analysis of structure's stability supported by the foundation. When necessary due to project conditions, incorporate required bracing and foundation underpinning.
  - 4. Provide, monitor, and maintain dewatering and drainage systems; coordinate with Section 312319 .
- C. Test Pits:
  - 1. Perform exploratory excavation work, test pits, for purpose of verifying the location of underground utilities and structures and to check for unknown utilities and structures, prior to commencing excavation work.
  - 2. Backfill and compact test pits as soon as desired information has been obtained. Stabilize backfilled surfaces in accordance with approved erosion and sedimentation control plans.
- D. Clearing and Stripping: Initially clear and strip ground surfaces beneath planned structures and in areas requiring excavation or filling of organic material and debris. Do not use those materials as On-Site Fill Material; remove from the site and properly dispose or reuse as topsoil in landscape areas.



- E. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
- F. Saw cut existing pavement with a saw, wheel, or pneumatic chisel along straight lines before excavating.

### 3.2 DEWATERING AND DRAINAGE

- A. Provide dewatering and drainage in accordance with Section 312319. This Article supplements those requirements.
- B. Prevent surface water and groundwater from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - 1. Reroute surface water runoff and groundwater away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
- D. Prior to excavation, verify groundwater will be at required level indicated on approved dewatering and drainage submittal.
- E. Accomplish dewatering by methods that preserve undisturbed state of subgrade soils. Dewater in a manner to prevent boiling, detrimental under-seepage, or disturbance at excavation base.

### 3.3 SUPPORT OF EXCAVATION

- A. Provide excavation support in accordance with Section 315000. This Article supplements those requirements.
- B. Install excavation support in accordance with reviewed Shop Drawings prior to beginning excavation work. Maintain excavation supports that are required to remain in place, if applicable, as indicated on Drawings or as required by approved Shop Drawings.
- C. Owner or Engineer may direct that certain excavation supports remain in place or be cut off at any specific elevation. Supports directed by Owner or Engineer to be left in place and not so designated on Contract Documents will be paid for according to Contract provisions for changes in the Work.
- D. The right of Owner or Engineer to direct that certain excavation supports remain in place shall not be construed as creating any obligation on Owner or Engineer to give such direction, nor shall failure to give such direction relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient excavation supports to prevent any movement of the ground or damage to adjacent structures.
- E. Construct temporary excavation slopes in accordance with the requirements of OSHA excavation safety standards and approved Shop Drawings.

- F. Where allowed, carefully remove excavation supports in a manner without endangering the Work or other adjacent structures, utilities, or property. Immediately fill voids left or caused by withdrawal of supports with sand and compact.

### 3.4 EXCAVATION

- A. Include material of every description and of whatever substance encountered as an unclassified excavation.
- B. General: Excavate on-site soils using standard earthmoving equipment. Excavation in dense soil or rock may require special equipment. Do not plough, scrape, or dig earth with machinery so near to finished subgrade to result in excavation of or disturbance of below grade material.
- C. Make excavations to grades indicated on Drawings and in widths sufficient for laying of pipe, construction of the structure, installing bracing, excavation supports, dewatering and drainage facilities, and working clearances.
- D. Perform excavation in-the-dry and accomplished by methods which preserve the natural undisturbed condition of subgrade soils.
- E. Moisture Sensitive Soils: Use a smooth-edge bucket to excavate last one foot of depth when excavation is to end in such soils.
- F. If excavation bottom is removed below the limits shown on Drawings, specified, or directed by the Engineer, refill with structural fill, screened gravel, lean concrete or other material satisfactory to the Engineer without additional compensation.
- G. When excavation has reached prescribed depths, notify the Engineer who will observe the conditions. If materials and conditions are not satisfactory, the Engineer will issue instructions for corrective procedures. The Engineer will be the sole judge as to whether the work has been accomplished satisfactorily.
- H. Subgrade soils that have become soft, loose, quick, or otherwise unsatisfactory due to inadequate excavation, dewatering, or other construction methods in the opinion of the Engineer, remove existing soil and replaced with structural fill, screened gravel, lean concrete or other material as acceptable to the Engineer at Contractor's expense.
- I. Exposed subgrades in large open areas and for foundations shall be proofrolled with at least four overlapping coverages of a vibratory drum roller with a minimum static drum weight of 10 ton. Conduct proofrolling in presence of the Engineer. The Engineer will waive this requirement, if in its opinion the subgrade will be rendered unsuitable by such proofrolling.
  - 1. Confined Areas: Proofroll with hand operated vibratory equipment that is approved by the Engineer.
- J. Perform overexcavation at the Engineer's request to remove unsuitable soil, objectionable material, or other materials as determined by the Engineer and to such depth and width as directed. Replace with suitable material as directed by the Engineer.

1. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- K. Perform excavation for pipe lines beneath structures and excavation for footings with excavating equipment operating from the subgrade for the structure, while in-the-dry and in a manner preserving the undisturbed state of subgrade soils.
- L. When excavations have reached the required subgrade, including any allowances for working mats or base materials and prior to their placement, notify Soils Testing Laboratory to verify suitability of existing subgrade soils for anticipated foundation and structural loadings.
  1. If existing subgrade soils are determined to be unsuitable, follow direction provided by the Engineer regarding removal and replacement with suitable materials.
  2. Notify the Engineer if the revised work scope would modify Contractor's cost and thereby entitle a change to the Contract Sum. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- M. Replace overexcavation beyond the limits and depths required by Contract Documents using structural fill, screened gravel, lean concrete or other material satisfactory to the Engineer without additional compensation.
- N. Trenches in Tree- and Plant-Protection Zones:
  1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
  2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
  3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

### 3.5 SUBGRADE PREPARATION

- A. Notify Engineer when excavations have reached required subgrade.
- B. Maintain excavated subgrade in-the-dry condition.
- C. Prior to fill placement, remove objectionable material which includes, but not be limited to, pavement, topsoil, organic matter, contaminated soil, construction debris, perishable materials, snow, ice, frozen earth, and rocks or lumps of cemented soils over 6 inches in maximum dimension.
- D. For subgrades consisting of granular soils, proofroll the final subgrade using at least four coverages of a vibratory drum roller with a minimum static drum weight of 10 ton.
- E. Where existing subgrade contains a significant amount of clay or cohesive soils, overexcavate sufficiently below the bottom of structure for placement of a crushed stone working mat. Remove loose or soft material from the subgrade immediately prior to placing crushed stone working mat.

- F. Remove and replace soft subgrades or unusable material with structural fill, screened gravel, lean concrete or other material satisfactory to the Engineer.
- G. During wet or freezing weather, or in areas where exposed subgrade consists of moisture-sensitive soils, take measures to protect foundation excavations once they have been approved by the Engineer. Protective measures include, but are not limited to, placing insulation blankets, placing a layer of fill, crushed stone, or lean concrete on the exposed subgrade, or covering the exposed subgrade with a plastic tent.
  - 1. If additional overexcavation is required due to the subgrade not being protected against wet or freezing weather, perform additional work without additional compensation.
- H. Notify the Engineer to observe conditions following subgrade preparation and prior to fill placement. If existing subgrade soils are determined to be unsuitable, follow direction provided by the Engineer regarding removal and replacement with suitable materials.
  - 1. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

### 3.6 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust. Protect from precipitation.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.7 FILL PLACEMENT AND COMPACTION PROCEDURES

- A. Fill and Backfill: Place materials in lifts to suit specified compaction requirements to required lines and grades, making allowances for settlement and placement of cover materials, such as topsoil or sod. Correct soft spots or uncompacted areas.
- B. Do not place or compact fill and backfill when materials are too wet to properly compact.
  - 1. In-place Soil Moisture Content: Maximum of three percentage points above optimum moisture content of soil, as determined by laboratory test of moisture-density relation appropriate to specified level of compaction.
- C. Structural Fill and Common Fill: Construct to required lines and grades, making allowances for settlement and placement of cover materials, such as topsoil and sod. Correct soft spots or uncompacted areas.
- D. Fill material shall be free of snow, ice, frost, and frozen earth. Do not place fill materials on frozen surfaces or surfaces covered by snow, ice, or frost.
- E. Complete structure water-tightness tests and installation of dampproofing or waterproofing systems prior to placing various types of fill or backfill around structures.

- F. If subgrade slopes more than 10 percent, step subgrade to produce a stable, horizontal surface for placement of fill materials. Scarify existing subgrade slope to a depth of at least 6 inches.
- G. Compact filled slopes by slope rolling and trimming or overfill and trim back to plan grade to expose a firm, smooth surface free of loose material.
- H. Do not allow fill lifts to contain stones with a dimension larger than 1/2 the specified loose measure lift thickness.
- I. Perform compaction in open areas using compaction equipment by any of the following methods:
  - 1. Fully loaded ten-wheel trucks or front-end loaders.
  - 2. Tractor dozers weighing minimum of 30,000 pounds.
  - 3. Heavy vibratory rollers (minimum 10-ton static weight).
- J. Confined Compaction: Perform compaction in confined areas, including areas within a 45-degree angle extending upward and outward from the base of a wall, and in areas where the use of large equipment is impractical, using hand-operated vibratory equipment or mechanical tampers.
  - 1. Do not exceed lift thickness of 6 inches, measured before compaction, when using hand operated equipment.
- K. Moisture condition on-site fill material prior to placement, unless Contractor demonstrates to the Engineer in-place moisture conditioning methods can achieve the required moisture content.
- L. Conduct compaction of each specified lift of fill materials by a minimum of four complete coverages with acceptable compaction equipment to a specified density as a percentage of maximum dry density as determined by ASTM D 1557, unless otherwise specified.
- M. Use structural fill required beneath foundations or slabs on grade, except sidewalks. Place and compact structural fill in even lifts having a maximum thickness of 8 inches, measured before compaction.
- N. Trench backfill material within NCDOT right of ways shall meet NCDOT Statewide Borrow Criteria. Backfill within NCDOT right of ways shall be in accordance with Section 540-6 of the latest NCDOT Standard Specifications for Roads and Structures.
- O. Use select common fill material placed within 10 feet of all structures. Uniformly place and compact select common fill around the structure in even lifts having a maximum thickness of 8 inches, measured before compaction.
- P. Use common fill in areas beyond those designated for structural fill or select common fill, unless shown or otherwise specified. Place in even lifts having a maximum thickness of 12 inches, measured before compaction.
- Q. Place low permeability fill in controlled, even lifts having a maximum thickness (measured before compaction) of 6 inches.
  - 1. Permeability: Compact to attain a reading of less than  $1 \times 10^{-7}$  cm/sec.

2. Moisture Content: Compact to optimum moisture content of minus 2 percent to plus 3 percent.

### 3.8 COMPACTION REQUIREMENTS

- A. Perform in-place testing of compacted fill lifts to measure in-place density and water content according to ASTM D 6938 and ASTM D 1557.
- B. Beneath Foundations and Slabs-on-Grade, except sidewalks: Compact top 12 inches of existing subgrade and each layer of fill, if applicable to:
  1. Maximum Dry Density: Minimum of 95 percent for ASTM D 1557.
  2. Moisture Content: At or near its optimum moisture content of minus 2 percent to plus 2 percent.
- C. Area Around Structures: Within 10 feet compact each fill or backfill layer to:
  1. Maximum Dry Density: Minimum of 92 percent for ASTM D 1557.
  2. Moisture Content: At or near its optimum moisture content of minus 3 percent to plus 3 percent.
- D. Embankments, Lawn, or Unimproved Areas: Does not include embankments under roadways and earth structures. Compact each fill or backfill layer to:
  1. Maximum Dry Density: Minimum of 90 percent for ASTM D 1557.
  2. Moisture Content: At or near its optimum moisture content of minus 3 percent to plus 3 percent.
- E. Sidewalks: Compact each fill layer to:
  1. Maximum Dry Density: Minimum of 95 percent for ASTM D 1557.
  2. Moisture Content: At or near its optimum moisture content of minus 2 percent to plus 2 percent.
- F. NCDOT Right of Ways, paved areas and Roadway Embankments: Compact each layer of fill or backfill to:
  1. Maximum Dry Density: Minimum of 97 percent for AASHTO T 180 (As modified by NCDOT)
  2. Moisture Content: At or near its optimum moisture content of minus 2 percent to plus 2 percent.

### 3.9 DISPOSAL OF UNSUITABLE, WASTE, AND SURPLUS EXCAVATED MATERIALS

- A. Unsuitable soil, objectionable material, waste, and surplus excavated material shall be removed and disposed of off-site. Materials may be temporarily stockpiled in an area within the limits of construction that does not disrupt construction activities, create any nuisances or safety hazards, or otherwise restricts access to work site.

- B. Topsoil or loam excavated under this Section may be salvaged for use as specified under Section 329200, as approved by the Engineer.

### 3.10 GRADING

- A. Perform grading to lines and grades shown on Drawings. Remove objectionable materials encountered within the limits indicated and disposed of off-site. Completely and continuously drained and dewatered subgrades throughout the grading process. Install temporary drains and drainage ditches to intercept or divert surface water that may affect the execution or condition of grading work.
- B. If it is not possible at the time of grading to place material in its proper section of the Work, stockpile it in approved areas for later use. No additional compensation will be made for stockpiling or double handling of excavated materials.
- C. In cut areas, remove loose or protruding rocks in slopes to line or finished grade of the slope. Uniformly dress, cut, and fill slopes to slope cross-section and alignment shown on Drawings, unless otherwise directed by the Engineer.

### 3.11 FIELD QUALITY CONTROL

- A. Test and observe materials as described in this Article. Cooperate by allowing free access to work for selection of test materials and observations.
- B. General Testing Requirements:
  - 1. At Structures: Prior to placement of bedding material, concrete work mats, structural fill or structural concrete, coordinate with Soils Testing Laboratory to verify suitability of existing subgrade soil.
  - 2. Backfill and Fill: Prior to and during the placement of backfill and fill coordinate with Soils Testing Laboratory to perform in-place soil density tests to verify that backfill and fill material has been placed and compacted in accordance with specified compaction requirements.
    - a. Provide minimum 72 hours' notice prior to placement of backfill and fill.
  - 3. Subgrade: Do not cover with fill without observation, testing, and approval Soils Testing Laboratory.
    - a. Earthwork activities performed without properly scheduled inspection are subject to removal and replacement or additional testing as directed by the Engineer without additional compensation.
- C. If field test results are not in conformance with project requirements, costs involved in correcting deficiencies in compacted materials to satisfaction of the Engineer without additional compensation.
- D. Earthwork activities performed without properly scheduled inspection are subject to removal and replacement or additional testing as directed by the Engineer without additional compensation.

- E. Testing methods shall comply with latest ASTM or equivalent AASHTO Standards applicable during bidding.
- F. During placement of bedding, backfill, and fill, perform in-place soil density testing to confirm that fill material has been compacted in accordance with project requirements. The Engineer may designate areas to be tested. Notify the Engineer at least 72 hours in advance of scheduled compaction testing. In place soil density tests on backfill and fill material shall be as required herein, by authorities having jurisdiction,, but in no instance, shall less than those listed:
  - 1. Structures and Embankments: At least one density and moisture content test for each 2,500 square feet of surface area for each lift of fill at embankment, structure, and manhole locations.
  - 2. Trench Excavations: At least one nuclear density and one moisture content test at a maximum of 50 feet intervals for each lift of fill placed or as directed by the Engineer.
  - 3. The Engineer may designate supplemental areas to be tested at additional compensation.
- G. Materials which have been previously tested may be subjected to further testing from time to time and may be rejected, if it is determined that results do not conform to project requirements. Immediately remove rejected materials when directed by the Engineer, notwithstanding results of previous testing.
- H. The Engineer or Owner may conduct additional soil testing. Cooperate fully in allowing additional test to be made, including free access to the work.

### 3.12 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by the Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION 312000



## SECTION 312319 - DEWATERING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes temporary construction dewatering and surface water control and incorporates the design, equipment, materials, installation, operation, protection, monitoring and removal of dewatering and drainage system. Provide dewatering system sufficient to lower groundwater and collect surface water, regardless of groundwater level or rainfall at any time during the work.
- B. Obtain and pay for permits required for dewatering and drainage systems. Implement measurements to comply with dewatering and discharge permits requirements.
- C. Related Requirements:
  - 1. Section 013233 "Photographic Documentation" for recording pre-existing conditions and dewatering system progress.
  - 2. Section 310515 "Soils and Aggregates for Earthwork" for soil and aggregate materials.
  - 3. Section 310900 "Geotechnical Instrumentation and Monitoring" for monitoring of ground, groundwater and existing structures.
  - 4. Section 312333 "Trenching and Backfilling" for trenching, backfilling, and compaction in trench excavations.
  - 5. Section 312500 "Erosion and Sedimentation Controls" to prevent erosion, sedimentation, and contamination of adjacent properties.
  - 6. Section 315000 "Excavation Support and Protection" for temporary support of excavations.
  - 7. Division 32 "Site Improvements" for various Sections relating to civil and landscape related work.

#### 1.3 DEFINITIONS

- A. In-the-Dry: An excavation subgrade where all of the following are met:
  - 1. Groundwater level has been lowered to at least 2 feet below lowest excavation level.
  - 2. Subgrade is stable with no ponded water, mud, or muck.
  - 3. Subgrade is able to support construction equipment without rutting or disturbance.
  - 4. Subgrade is suitable for placement and compaction of fill material, pipe, or concrete foundations.

- B. Contractor's Engineered Design: Design prepared on behalf of Contractor by a Professional Engineer registered in the State of North Carolina.
- C. Professional Engineer: Professional Engineer registered in North Carolina meeting project qualifications and who is hired by Contractor.
- D. The Engineer: Engineer hired by Owner.
  - 1. Approvals given by The Engineer shall not relieve Contractor of its responsibilities for performing the work in accordance with Contract Document requirements.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at the project site prior to installation of cofferdam.
  - 1. Verify availability of Installer's personnel, equipment, and facilities needed to perform the work, make progress and avoid delays.
  - 2. Review condition of site to be dewatered including coordination with excavation support systems and temporary controls and protections.
  - 3. Review geotechnical data.
  - 4. Review proposed excavations.
  - 5. Review existing utilities and subsurface conditions.
  - 6. Review observation and monitoring of dewatering system.
  - 7. Review sampling and testing requirements for discharge.
  - 8. Review pre-treatment requirements prior to discharge, discharge location(s), and flow rate requirements.

#### 1.5 ACTION SUBMITTALS

- A. Design Plan: Submit written dewatering and drainage system design plan, prepared by a qualified Professional Engineer, that includes:
  - 1. Description of proposed dewatering system and installation methods to be used for system elements and observation wells.
  - 2. Description of equipment, drilling methods, holes sizes, filter sand placement techniques, sealing materials, development techniques, number and location of dewatering points and observations wells.
  - 3. Dewatering system design calculations demonstrating that the proposed system meets all requirements herein and elsewhere.
  - 4. Sequence of well and well-point placement coordinated with support of excavation system installation and control procedures to be adopted, if dewatering problems arise.
  - 5. Identification of anticipated area influenced by dewatering system and address impacts to adjacent existing and proposed structures.
  - 6. Coordinate dewatering and drainage submittals with excavation and support of excavation submittals.

- B. Shop Drawings: For dewatering system, prepared by a qualified Professional Engineer.
  - 1. Include plans, elevations, sections, and details.
  - 2. Show arrangement, locations, and details of wells and well-points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
  - 3. Include pump capacity and anticipated discharge rate.
  - 4. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
  - 5. Show areas and depths of excavation to be dewatered and adjacent structures or facilities within the anticipated area influence.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Professional Engineer.
- B. Field quality-control reports.
- C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.
- D. Record Drawings: Identify locations and depths of capped wells and well-points and other abandoned-in-place dewatering equipment.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in installation of dewatering systems and dewatering work and having a minimum of 5 years' experience.
- B. Professional Engineer Qualifications: Professional Engineer registered in the State of North Carolina; having a minimum of 5 years' experience in design and construction of dewatering and drainage systems; and having completed not less than 5 successful dewatering and drainage projects of equal type, size, and complexity to that required for the work.
- C. Comply with authorities having jurisdiction for the following:
  - 1. Drilling and abandoning of wells used for dewatering systems.
  - 2. Water discharge and disposal from dewatering operations.
- D. Obtain permit from EPA under National Pollutant Discharge Elimination System (NPDES), for storm water discharge from construction sites.

## 1.8 FIELD CONDITIONS

- A. Project-Site Information: Geotechnical data has been prepared for this Project and is available for information only. Owner is not responsible for interpretations or conclusions drawn from this data.
  - 1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
  - 2. Groundwater levels may vary during the work and should not be assumed to be accurately represented by groundwater level readings reported in the geotechnical data.
  - 3. The geotechnical data is included elsewhere in Project Manual.
- B. Survey Work: Engage a qualified land surveyor or Professional Engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

## PART 2 - PRODUCTS

### 2.1 DESIGN REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of surface water and groundwater and permit excavation and construction to proceed in-the-dry in accordance with the requirements herein and elsewhere.
  - 1. Design dewatering system, including comprehensive engineering analysis by the Contractor's Design Engineer.
  - 2. Continuously monitor and maintain dewatering operations to ensure required groundwater lowering, erosion control, stability of excavations, excavation support, and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
  - 3. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
  - 5. Remove dewatering system when no longer required for construction.
- B. Primary Purpose of Work: Preserve natural undisturbed condition of subgrade soils in areas of proposed excavations.
  - 1. Prior to excavation, lower groundwater to at least 2 feet below lowest excavation subgrade elevation.
  - 2. Additional groundwater lowering may be necessary beyond 2 foot requirement, depending on construction methods, equipment used, and prevailing groundwater and soil conditions. Lower groundwater as necessary to complete construction in accordance with Contract Documents without additional compensation
- C. Design deep wells, well-points and sumps, and other groundwater control system components to prevent loss of fines from surrounding soils. Use sand filters with dewatering installations,

unless screens are properly sized by Contractor's Design Engineer to prevent passage of fines from surrounding soils.

- D. Maintain standby pumping systems and sources of standby power at various sites.
- E. Design dewatering system to prevent damage to adjacent properties, buildings, structures, utilities, and facilities from dewatering operations. Be responsible for damage to properties, buildings or structures, sewers and other utility installations, pavements, and work that may result from dewatering or surface water control operations.
- F. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

## 2.2 MATERIALS

- A. Refer to Section 310900 "Geotechnical Instrumentation and Monitoring" for observation well materials.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Control surface water and groundwater such that:
  - 1. Excavation to final grade is made in-the-dry.
  - 2. Natural undisturbed conditions of subgrade soils are maintained.
  - 3. Softening, instability, or disturbance due to presence or seepage of water does not occur.
  - 4. Construction and backfilling proceeds in-the-dry.
  - 5. Floatation 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, perimeter groundwater cutoff, well-points, ejectors, deep wells, or any combination.
- C. Where groundwater levels are above proposed bottom of excavation level, provide a pumped dewatering system for pre-drainage of soils prior to excavation and for maintaining lowered groundwater level until construction has been completed such that structure, pipeline, or fill will not be floated or otherwise damaged.
- D. Vary type of system, spacing of dewatering units, and other details of the work depending on soil and water conditions at each location.
- E. Do work in a manner to protect adjacent structures and utilities without causing loss of ground or disturbance to pipe bearing soils or soils supporting overlying or adjacent structures.
- F. Install, monitor, and report data from observation wells. Evaluate collected data relative to groundwater control system performance and modify systems necessary to dewater site.

- G. Locate groundwater control system components where they will not interfere with construction activities adjacent to the work area or interfere with installation and monitoring of geotechnical instrumentation including observation wells. Do not make excavations for sumps or drainage ditches within or below 1H:1V slopes extending downward and out from edges of existing or proposed foundation elements or from downward vertical footprint of pipe without approval by the Engineer.

### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
  - 1. Prevent surface water and groundwater from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
  - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways, if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 015000 and Section 311000, during dewatering operations.

### 3.3 INSTALLATION

- A. Install dewatering system utilizing wells, well-points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface water controls.
  - 1. Space well-points or wells at intervals required to provide sufficient dewatering.
  - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Place dewatering system into operation to lower water to specified levels before excavating below groundwater level.
- C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

### 3.4 SURFACE WATER CONTROL

- A. Construct surface water control measures, including dikes, ditches, sumps and other methods to prevent flow of surface water into excavations and to allow construction to proceed without delay.
- B. Grade excavation to divert surface water and groundwater within excavation areas into sumps and dewatering wells.

### 3.5 EXCAVATION DEWATERING

- A. Provide and maintain equipment and facilities to promptly remove and properly dispose of water entering excavations. Maintain excavations in-the-dry.
- B. Excavation dewatering shall maintain the subgrade in a natural undisturbed condition and be in operation 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.
- C. Do not place pipe, masonry, and concrete in water or submerge within 24 hours after being installed. Prevent water from flow over new masonry or concrete within four days after placement.
- D. Prevent water from rising to cause unbalanced pressure on structures until concrete or mortar has set at least 24 hours. Prevent pipe flotation by promptly placing backfill.
- E. Conduct dewatering to preserve natural undisturbed condition of subgrade soils at bottom of excavation.
- F. If trench subgrade or excavation bottom becomes disturbed due to inadequate dewatering or drainage, excavate below normal grade as directed by the Engineer and refill with structural fill, screened gravel, or other material as approved by the Engineer without additional compensation.
- G. It is expected that initial dewatering plan may be modified to suit variable soil and water conditions encountered. Dewater and excavate in a manner without causing loss of ground or disturbance to pipe bearing soil or soil that supports overlying or adjacent structures or instability of excavation or trenchless crossing face conditions.
- H. If methods do not properly dewater excavation, install additional groundwater observation wells as directed by the Engineer. Do not place pipe or structure until readings obtained from observation wells indicate that groundwater has been lowered to specified minimum of below bottom of final excavation.
- I. Surround dewatering units with suitable filter sand with no fines being removed by pumping. Pump continuously from dewatering system until pipe or structure is adequately backfilled. Provide stand-by pumps.

- J. Collect water entering excavations from precipitation or surface runoff in shallow ditches around excavation perimeter, drained to a sump, and pump from excavation to maintain a bottom free from standing water.
- K. Dispose of drainage to an approved area as specified in Section 312500. Do not use existing or new sanitary sewers to dispose of drainage.

### 3.6 WELL-POINT SYSTEMS

- A. Where necessary, install a vacuum well-point system around excavation for dewatering purposes. Surround each well-point and riser pipe by a sand filter. Use sand of gradation that after initial development of well-points, quantity and size of soil particles discharged shall be negligible. Provide well-point systems capable of operating continuously under highest possible vacuum. Include sufficient valves and gauges to accurately monitor and control the system. Develop and redevelop well-points to provide reliable performance throughout the duration of the work.
- B. Install well-point systems in the Engineer's presence according with approved submittal.

### 3.7 DEEP WELLS

- A. Where necessary, install a deep well system around an excavation to dewater it. Surround each well with a sand filter having adequate gradation, so quantity and size of soil particles discharged are negligible. Install sufficient number of wells to lower groundwater level allowing excavation to proceed in-the-dry. Develop and redevelop wells as necessary to provide reliable performance throughout the duration of the work.
- B. Install deep wells in the Engineer's presence according with approved submittal.

### 3.8 OBSERVATION WELLS

- A. Refer to Section 310900 "Geotechnical Instrumentation and Monitoring" for observation well execution details.

### 3.9 REMOVAL OF SYSTEMS

- A. At completion of excavation and backfilling work and when approved by the Engineer, remove from site various pipe, deep wells, well-points, pumps, generators, observation wells, other equipment, and accessories used for groundwater and surface water control systems.
  - 1. Removed materials and equipment become property of Contractor.
- B. Restore areas disturbed by installation and removal of groundwater control systems and observation wells to their original condition.
- C. Leave in place deep well casings, well-points, and observation wells located:
  - 1. Within plan limits of structures or pipelines.



2. Within zone below 1H:1V planes extending downward and out from edges of foundation elements or from downward vertical footprint of pipe.
  3. Where removal would result in ground movements causing adverse settlement to adjacent ground surface, utilities, or existing structures.
- D. Fill pulled casings holes with sand. Where left in place, fill casings with cement grout and cut off a minimum of 3 feet below finished ground level or 1 foot below foundation level to prevent interference with finished structures or pipelines.
- E. When directed by the Engineer, leave observation wells in place for continued monitoring. Cut casings flush with final ground level when directed and provide protective lockable boxes with locking devices. Provide protective boxes suitable for traffic and other conditions to which observation wells will be exposed.

END OF SECTION 312319

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## SECTION 312333 - TRENCHING AND BACKFILLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes trench excavation, backfilling, and compaction.
- B. Related Requirements:
  - 1. Section 310515 "Soils and Aggregates for Earthwork" for soil and aggregate materials.
  - 2. Section 312319 "Dewatering" for lowering and disposing of groundwater during construction and dewatering excavations.
  - 3. Section 312500 "Erosion and Sedimentation Controls" to prevent erosion, sedimentation, and contamination of adjacent properties.

#### 1.3 DEFINITIONS

- A. Percent Compaction: Means at least the stated percentage of maximum density as determined by or ASTM D 1557.

#### 1.4 ACTION SUBMITTALS

- A. Submit proposed method of backfilling and compaction prior to start of Work.
- B. Submit method of excavation and trench support, where necessary, including design of sheeting and bracing with calculations signed and sealed by qualified Professional Engineer responsible for their preparation. Coordinate with submittals for Section 315000.
- C. Submit laboratory test results for fill materials that include maximum density, gradation, Atterberg limits, sand equivalent, and other applicable criteria, at least 72 hours prior to importing or placing fill.
- D. Submit as part of the lay schedule for the Concentrate Discharge Pipeline stationing within all NCDOT right of ways that require pipeline trench excavation within the 1:1 of the roadway edge of pavement. In these areas, Contractor shall indicate whether positive shoring shall be utilized, or excavation of pavement and repair according to Contract Documents.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Construction and Operations Plan: Submit proposed methods of construction, including earthwork operations, excavation limits, slopes, fill material moisture conditioning and handling, compaction equipment, excavation support systems designs, backfilling and filling and compaction, and material sources.
  - 1. Submit excavation support system plan as prepared by Professional Engineer registered in the State of North Carolina.
- B. Submit copies of field daily reports by soil technician at the end of each work day that earthwork and grading operations occur.

## 1.6 QUALITY ASSURANCE

- A. Comply with following regulations:
  - 1. Occupational Safety and Health Administration (OSHA): 29 CFR Part 1926 Subpart P.
  - 2. North Carolina Department of Transportation (NCDOT) Roadway Design Manual
    - a. All work within NCDOT right of ways (ROW) shall meeting requirements as indicated in the most recent revision of the design manual, standard drawings, standard specifications, and encroachment permitting.
- B. Provide excavation, trenching, related sheeting, bracing, and related materials to comply with requirements of OSHA excavation safety standards (29 CFR Part 1926 Subpart P) and State of North Carolina requirements. Where conflict exists between OSHA and State regulations, more stringent requirements apply.
- C. The percent compaction requirements for earthwork will be evaluated as follows: The in-place density as compacted by the Contractor will be determined by the field density test using the sand-cone method, drive cylinder method, or the nuclear method. The maximum dry density of the fill at the location of the in-place density test will be estimated using a one-point compaction test and full-curve compaction tests (family of curves) of representative fill materials. Both the one-point compaction test and the full-curve compaction tests will be performed according to ASTM D 1557. The one-point compaction data will be used by the Engineer in conjunction with the representative compaction curves to estimate the maximum dry density of the compacted fill at the location of the in-place density test. The percent compaction in-place will be calculated as the ratio (in percent) of the in-place dry density to the estimated maximum dry density of the compacted fill at the location of the in-place density test.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store excavated materials according to Section 312500 to prevent erosion of soil type materials and contamination of adjacent water sources.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Refer to Section 310515 for soil and aggregate materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine that erosion and sedimentation controls are in place and comply with project requirements and authorities having jurisdiction.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Where excavation activities occur across active vehicular or pedestrian circulation paths, use temporary controls specified in Division 01 to maintain circulation during operations required by this Section. Maintain temporary controls for each day circulation paths are restricted.
- B. Coordinate work of this Section with materials specified in other Sections of Division 31.
- C. Identify required lines, levels, contours, and datum locations.
- D. Protect features to remain-in-place including benchmarks, existing structures and utilities, fences, sidewalks, paving, curbs, etc. from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities indicated to remain.

### 3.3 TRENCH EXCAVATION

- A. Trench excavation includes material of every description and substance encountered, except rock and boulders.
- B. Cut rigid and flexible pavement with a saw, wheel, or pneumatic chisel along straight lines before excavating.
  - 1. Contractor shall repair pavement as required by Contract Drawings.
- C. Strip and stockpile topsoil from grassed areas crossed by trenches.
  - 1. At Contractor's option when required, topsoil may be disposed of and replaced with approved topsoil of equal quality.
- D. While excavating and backfilling is in progress, maintain traffic and protect utilities and other property.

- E. Excavate trenches to indicated depths and in widths sufficient and of practical minimum for pipe laying, bracing, and pumping and drainage facilities and as shown in the Drawings
- F. Accomplish excavation and dewatering by methods preserving undisturbed state of subgrade soils. Excavate trench by machinery to or just below designated subgrade, if material remaining in trench bottom is no more than slightly disturbed.
  - 1. Remove subgrade soils that become soft, loose, quick, or otherwise unsatisfactory due to inadequate excavation, dewatering, or other construction methods and replace with structural fill, screened gravel fill or other material acceptable to the Engineer at the Contractor's expense.
- G. Use care when working in fine grained soils, which 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 12 inches of depth.
- H. Where pipe is to be laid in pipe bedding, excavate trench by machinery to normal depth of pipe, provided material remaining in trench bottom is no more than slightly disturbed.
- I. Where pipe is to be laid directly on trench bottom, manually perform final excavation, providing a flat-bottom, true to grade upon undisturbed material. Make bell holes required by project conditions.
- J. Should NCDOT allow excavated material storage on pavement, a layer of coarse sand, screenings, or acceptable alternative shall be placed on the pavement prior to deposition of excavated material. Silt and mud shall be removed from pavement by sweeping on a daily basis at a minimum or more frequently as determined by NCDOT inspection.

### 3.4 DISPOSAL OF MATERIALS

- A. Stack excavated material without excessive surcharge on trench bank or obstructing free access to hydrants and gate valves. Avoid inconvenience to traffic and abutters. Segregated excavated material for use in backfilling as specified below.
- B. Do not remove excavated material from work site, except as directed by the Engineer. When removal of surplus materials is approved by the Engineer, dispose of such surplus material in approved designated areas.
- C. Should conditions make it impracticable or unsafe to stack material adjacent to trench, haul and store material at a location provided. When required, re-handled and use it in backfilling trench.

### 3.5 SHEETING AND BRACING

- A. Provide and maintain sheeting and bracing required by Federal, State, or local safety requirements to support sides of excavation and prevent loss of ground which could endanger personnel, damage, adjacent structures, or delay the work.
  - 1. Engineer may order additional supports placed at Contractor's expense if it is determined that at any point sufficient or proper supports have not been provided. Compliance with such order shall not relieve Contractor from their responsibility for sufficiency of such

supports. Take care to prevent voids outside of sheeting or excavation support; if voids are formed, immediately fill and ram them.

- B. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support trench sides, take care in placing and moving the boxes or supporting bracing to prevent pipe movement, disturbance of pipe bedding, or screened gravel backfill.
  - 1. Rigid Pipe Installation (such as R.C., V.C., A.C.): Raise that portion of box extending below mid-diameter above this point prior to moving box ahead to install next pipe. Perform to prevent separation of installed pipe joints due to box movement.
  - 2. Flexible Pipe Installation (such as PVC): Do not allow trench boxes, moveable sheeting, shoring, or plates to extend below mid-diameter of pipe. As trench boxes, moveable sheeting, shoring, or plates are moved, place screened gravel to fill voids created. Re-compact screened gravel and backfill to provide uniform side support for pipe.
- C. The Contractor may use steel sheeting wherever sheeting use is necessary. Include cost for use of sheeting in bid items for pipe, including full compensation for driving, bracing, and later removal of sheeting.
- D. Carefully remove sheeting and bracing in manner to not endanger construction of other structures, utilities, or property, whether public or private. Immediately refill voids left after withdrawal of sheeting using sand by ramming with tools especially adapted to that purpose and watering or otherwise directed by the Engineer.
- E. No payment will be given for sheeting, bracing, or other support during progress of the Work. No payment will be given for sheeting left in trench for Contractor's convenience.
- F. Leave sheeting driven below mid-diameter of pipe in place from driven elevation to at least 12 inches above top of pipe.

### 3.6 TEST PITS

- A. Excavation of test pits may be required for purpose of locating underground utilities or structures as an aid in establishing the precise location of new work.
- B. Backfill test pits as soon as desired information has been obtained. Maintain backfilled surface appropriate for travel until resurfaced.

### 3.7 EXCAVATION BELOW GRADE AND REFILL

- A. Drain trench completely and effectively be in-the-dry, whatever the nature of unstable material encountered or groundwater conditions.
- B. If Contractor excavates below grade through error or for their own convenience, through failure to properly dewater the trench, or disturbs subgrade before dewatering is sufficiently complete, the Engineer may direct Contractor to excavate below grade as set forth in following Paragraph, where work shall be performed at its own expense.
- C. If material at trench bottom consists of fine sand, sand and silt or soft earth which may work into the pipe bedding, even with effective drainage, remove subgrade material to extent

directed. Refill excavation with a 6-inch layer of coarse sand or a mixture graded from coarse sand to fine pea stone to form a filter layer preserving voids in pipe bedding.

- D. Subsurface Drainage Geotextile: Non-woven filter fabric as specified in Section 310519.13 may be substituted for filter layer, if approved by the Engineer.

### 3.8 BACKFILLING

- A. Begin backfilling as soon as practicable after laying and jointing pipe and continue expeditiously. Place pipe bedding installed up to 12 inches over the pipe.
- B. Construct a low permeability dam or bulkhead cutoff of clay or other low permeability material in the trench, as directed by the Engineer, to interrupt unnatural flow of groundwater after construction is completed. Key dam into trench bottom and sidewalls. Provide at least one clay or other low permeability material dam in pipe bedding between each manhole where directed or every 300 feet, whichever is less.
- C. Where pipes are laid cross-country, refer to Drawings for pipe bedding and trench backfill requirements.
- D. Where pipes are laid in streets, refer to Drawings for pipe bedding and trench backfill requirements.
- E. To prevent longitudinal pipe movement, do not dump backfill material into trench and then spread, until pipe bedding has been placed and compacted to a level at least 12 inches over the pipe.
- F. Bring backfill up evenly on all sides. Thoroughly compact each layer of backfill material by rolling, tamping, or vibrating with mechanical compacting equipment or hand tamping to 95 percent according to ASTM D 1557. If rolling, use a suitable roller or tractor being careful to compact fill throughout full width of trench.
- G. Do not compact by puddling or water jetting.
- H. Use hand or pneumatic ramming with tools weighing at least 20 pounds for compacting in confined areas. Spread and compact material in layers not exceeding 6 inches thick, an uncompacted loose measurement.
- I. Use granular fill material as backfill around structures. Spread and compact specified backfill under and over pipes connected to structures.
- J. Do not place bituminous paving in backfill. Do not use frozen material under any circumstances.
- K. Broom and hose-clean road surfaces immediately after backfilling. Employ dust control measures throughout construction period.

### 3.9 COMPACTION REQUIREMENTS

- A. Perform in-place testing of compacted fill lifts to measure in-place density and water content according to ASTM D 6938 and ASTM D 1557.



- B. Embankments, Lawn, or Unimproved Areas: Does not include embankments under roadways and earth structures. Compact each fill or backfill layer to:
  - 1. Maximum Dry Density: Minimum of 90 percent for ASTM D 1557.
  - 2. Moisture Content: At or near its optimum moisture content of minus 3 percent to plus 3 percent.
- C. Sidewalks and Reinforced Fill: Compact each fill layer to:
  - 1. Maximum Dry Density: Minimum of 95 percent for ASTM D 1557.
  - 2. Moisture Content: At or near its optimum moisture content of minus 2 percent to plus 2 percent.
- D. NCDOT Right of Ways, paved areas and Roadway Embankments: Compact each layer of fill or backfill to:
  - 1. Maximum Dry Density: Minimum of 97 percent for AASHTO T 180 (As modified by NCDOT)
  - 2. Moisture Content: At or near its optimum moisture content of minus 2 percent to plus 2 percent.

### 3.10 FIELD QUALITY CONTROL

- A. Test and observe materials as described in this Article. Cooperate by allowing free access to work for selection of test materials and observations.
- B. General Testing Requirements:
  - 1. At Structures: Prior to placement of bedding material, structural fill or structural concrete, coordinate with Soils Testing Laboratory to verify suitability of existing subgrade soil.
  - 2. Backfill and Fill: Prior to and during the placement of backfill and fill coordinate with Soils Testing Laboratory to perform in-place soil density tests to verify that backfill and fill material has been placed and compacted in accordance with specified compaction requirements.
    - a. Provide minimum 72 hours' notice prior to placement of backfill and fill.
  - 3. Subgrade: Do not cover with fill without observation, testing, and approval Soils Testing Laboratory.
    - a. Earthwork activities performed without properly scheduled inspection are subject to removal and replacement or additional testing as directed by the Engineer without additional compensation.
- C. If field test results are not in conformance with project requirements, costs involved in correcting deficiencies in compacted materials to satisfaction of the Engineer without additional compensation.
- D. Earthwork activities performed without properly scheduled inspection are subject to removal and replacement or additional testing as directed by the Engineer without additional compensation.
- E. Testing methods shall comply with latest ASTM or equivalent AASHTO Standards applicable during bidding.

- F. During placement of bedding, backfill, and fill, perform in-place soil density testing to confirm that fill material has been compacted in accordance with project requirements. The Engineer may designate areas to be tested. Notify the Engineer at least 72 hours in advance of scheduled compaction testing. In place soil density tests on backfill and fill material shall be as required herein, by authorities having jurisdiction, but in no instance, shall less than those listed:
  - 1. Embankments: At least one density and moisture content test for each 2,500 square feet of surface area for each lift of fill at embankment, structure, and manhole locations.
  - 2. Trench Excavations: At least one nuclear density and one moisture content test at a maximum of 50 feet intervals for each lift of fill placed or as directed by the Engineer.
  - 3. The Engineer may designate supplemental areas to be tested at additional compensation.
- G. Materials which have been previously tested may be subjected to further testing from time to time and may be rejected, if it is determined that results do not conform to project requirements. Immediately remove rejected materials when directed by the Engineer, notwithstanding results of previous testing.
- H. The Engineer or Owner may conduct additional soil testing. Cooperate fully in allowing additional test to be made, including free access to the work.

### 3.11 RESTORING TRENCH SURFACE

- A. Where trench occurs adjacent to paved streets, in shoulders, sidewalks, or in cross-country areas, thoroughly consolidate backfill and maintain surface as the work progresses. If settlement takes place, immediately deposit additional fill to restore ground level.
- B. In and adjacent to streets, refer to Drawings for trench backfill base course requirements.
- C. Restore surface of driveways or other areas which are disturbed by trench excavation to a condition at least equal to that existing before work began.
- D. In areas where pipeline passes through grassed areas, remove and replace sod or loam and seed surface at Contractor's own expense.

END OF SECTION 312333

## SECTION 312500 - EROSION AND SEDIMENTATION CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Sediment Ponds
  - 2. Sediment Traps
  - 3. Sediment Fences
  - 4. Construction Entrances
  - 5. Erosion Control Blanket
  - 6. Straw Wattle.
- B. Related Sections:
  - 1. Section 033000 - Cast-In-Place Concrete
  - 2. Section 051200 - Structural Steel Framing
  - 3. Section 055000 - Metal Fabrications
  - 4. Section 310515 - Soils and Aggregates for Earthwork
  - 5. Section 311000 - Site Clearing
  - 6. Section 321313 - Concrete Paving
  - 7. Section 311216 - Asphalt Paving
  - 8. Section 329119 - Landscape Grading
  - 9. Section 329200 - Turf and Grasses
  - 10. Section 334213.13 – Public Pipe Culverts.

#### 1.3 REFERENCE STANDARD

- A. EPA document titled: “Stormwater Management for Construction Activities – Developing Pollution Prevention Plans and Best Management Practices” document number EPA 832-R-92-005, dated 1992, or most recent edition. State or appropriate Conservation Commission standards can be substituted for the EPA standard if the State or Conservation Commission standard is equal to, or more detailed than, the EPA standard.
- B. Sedimentation and erosion control measures shall conform to the requirements of the North Carolina Sedimentation Pollution Control Act.
- C. Sedimentation and erosion control measures shall conform to the latest version of the Erosion and Sediment Control Planning and Design Manual.

#### 1.4 ACTION SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
1. Submit, within 10 days after award of Contract, technical product literature for all commercial products.

#### 1.5 QUALITY ASSURANCE

- A. Prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the U.S. Environmental Protection Agency (EPA) National Pollution Discharge Elimination System (NPDES) General Permit applicable to this work) document number EPA 832-R-92-005, dated 1992, or most recent edition.
- B. Prepare and submit the EPA NPDES Notice of Intent to Discharge to the applicable EPA office in accordance with EPA regulations.
- C. Perform Work according to all Federal, State, and local standards.

#### 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.

### PART 2 - PRODUCTS

#### 2.1 SILT FENCE

- A. Silt fence filter fabric shall be a woven, polypropylene, ultraviolet resistant material meeting minimum requirements below:

<b>Fabric Properties</b>	<b>Minimum Acceptable Value</b>	<b>Test Method</b>
Grab Tensile Strength (lbs)	110	ASTM D 4632/ D 4632M
Elongation at Failure (%)	20	ASTM D 4632/ D 4632M
Mullen Burst Strength	300 psi	ASTM D 3786/ D 3796M
Puncture Strength (lbs)	60	ASTM D 4833/ D 4833M
Minimum Trapezoidal Tear Strength (lbs)	50	ASTM D 4533/ D 4533M
Flow through Rate (gal/min/sf)	25	ASTM D 4491/ D 4491M
Equivalent Opening Size	40 – 80	US Std Sieve ASTM D 4751
Minimum UV Residual (%)	70	ASTM D 4355/ D 4355M

- B. Products: Provide one of the following:
1. “Mirafi FW402,” by TenCate Geosynthetics

2. "Carthage 15%," by Carthage Mills
  3. "HSP2." by ACF Environmental, Inc.
  4. Or equal.
- C. Sediment 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. Posts: Standard T or U steel fence posts weighing not less than 1 pound / linear foot.
- E. Tie wires for securing silt fence fabric to wire mesh shall be light gauge metal clips (hog rings), or 1/32 inch diameter soft aluminum wire.
- F. Wire fence shall be minimum 14 gage with maximum 6 inch mesh opening.

## 2.2

### 2.2 EROSION CONTROL BLANKET

- A. Erosion control blankets: 100 percent agricultural straw fiber matrix, 0.5 lbs / sq yd, stitch bonded with degradable thread between two photodegradable polypropylene nettings.
1. Product: Provide Model S150 Double Net Short-Term Blanket (12 months) by North American Green, Evansville, IN), or equal.
- B. Prior to start of work, provide a certified statement as to the number of pounds of materials to be used per 100 gallons of water. Specify the number of square feet of seeding that can be covered with the quantity of solution in the Contractor's hydroseeder.

### 2.3 STRAW WATTLE

- A. Straw Wattle: Prefabricated commercial product with outside casing made up of organic hessin
1. Effective Height: 12 inches plus or minus 1 inch.
  2. Effective Circumference: 3 38 inches.
- B. Product: Provide products by Phase II Stormwater Products Wrentham MA or equal.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.
- C. Verify gradients and elevations of base or foundation for other work are correct.

### 3.2 SILT FENCE

- A. Position sediment fences as indicated on the Drawings and to prevent off site movement of sediment produced by construction activities as directed by the Engineer. Areas beyond limits of silt fence shall be undisturbed or stabilized.
- B. Dig trench approximately 6 inch wide and 6 inch deep along proposed fence lines.
- C. Drive stakes, 10 feet on center (maximum) at back edge of trenches. Drive stakes 2 feet (minimum) into ground.
- D. Hang filter fabric on posts carrying to bottom of trench with about 4 inches of fabric laid across bottom of trench. Stretch fabric fairly taut along fence length and maintain secure both ways.
- E. Backfill trench with excavated material and tamp.
- F. Install pre-fabricated silt fence according to manufacturer's instructions.

### 3.3 CONSTRUCTION ENTRANCE

- A. Construct entrance with minimum of 6 inch of course aggregate at all points of ingress/egress.
- B. Width: Minimum 20 feet, increased as needed for typical construction vehicles.
- C. Minimum Length: 50 feet.
- D. Install filter fabric below aggregate.
- E. Maintain entrance throughout construction, adding more aggregate or increasing length as needed.

### 3.4 EROSION CONTROL BLANKETS

- A. Install erosion control blankets onto all exposed slopes to be loamed and seeded that are steeper than 4(Horizontal) to 1(Vertical) as shown on the Drawings. Erosion control blankets shall also be installed in all seeded drainage swales and ditches, and as directed by the Engineer in accordance with manufacturer's instructions.
- B. 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.
- C. Place blankets and stapled together in accordance with manufacturer's instructions. Side overlaps shall be 4-inch minimum. The staples shall be made of wire, 0.091 inch 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 side. Upper and lower ends of the matting shall be buried to a depth of 4-in in a trench. In swales and ditches, 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

- D. 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. EC blankets for bottom of swales and along edge of pathways.

### 3.5 STRAW WATTLE

- A. Position straw wattles as indicated on the Drawings and as necessary to prevent off site movement of sediment produced by construction activities as directed by the Engineer.
- B. Drive wooden stakes, 5 feet on center (maximum) at back edge of wattle. Drive stakes 2 feet (minimum) into ground.
- C. Install pre-fabricated straw wattle according to manufacturer's instructions.

### 3.6 SITE STABILIZATION

- A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.
- B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.
- C. Stockpile and waste pile heights shall not exceed 35 feet. Slope stockpile sides at 2: 1 or flatter.
- D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
  - 1. During non-germinating periods, apply mulch at recommended rates.
  - 2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year.
  - 3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 329200 seeding specifications.
- E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

### 3.7 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

- C. Field test concrete in accordance with Section 033000.
- D. Compaction Testing: As specified in Section 312333.

### 3.8 CLEANING

- A. Section 017300 "Execution" and 017700 "Closeout Procedures": Requirements for cleaning.
- B. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.
- C. Do not damage structure or device during cleaning operations.
- D. Do not permit sediment to erode into construction or site areas or natural waterways.
- E. Clean channels when depth of sediment reaches approximately one half channel depth.

### 3.9 PROTECTION

- A. Section 017300 "Execution": Requirements for protecting finished Work.
- B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Do not permit construction traffic over paving for 7 days minimum after finishing.
- D. Protect paving from elements, flowing water, or other disturbance until curing is completed.

END OF SECTION 312500



## SECTION 313600 - GABIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Gabions facing panels.
2. Leveling pad.
3. Granular backfill.
4. Soil stabilizing and reinforcing straps.
5. Wall Drain.

- B. Related Requirements:

1. Section 312319 "Dewatering" for control of surface water and groundwater during construction.
2. Section 312333 "Trenching and Backfilling" for trenching, backfilling, and compaction in trench excavations.
3. Section 315000 "Excavation Support and Protection" for temporary support of excavations.

#### 1.3 DEFINITIONS

- A. Gabion: A wire-fabric container of custom size, partitioned into cells and typically filled with stone on Site. A gabion is used as a permeable earth retention structure and may be interconnected with other units according to Project requirements.
- B. Lacing Wire: For gabions, a metallic coated steel wire with PVC coating used to assemble and interconnect empty gabion units, and to close and secure stone filled units; used as an alternate to spiral binders.
- C. Spiral Wire: For gabions, a length of metallic coated steel wire with PVC coating preformed into a spiral, used to assemble and interconnect empty gabion units, and to close and secure stone filled units; used as an alternate to lacing wire.
- D. Stiffener: For gabions, a length of metallic coated steel wire with PVC coating used to support by forming a diagonal brace across the corners, and inside of gabion container. Produce using lacing wire for on-site application or shipped preformed using heavier gage wire.
- E. Diaphragm: An internal member that subdivides a gabion.

- F. Reinforced Fill: Soil which is placed and compacted within the next line volume of reinforcement as outlined on the drawings.
- G. Reinforcement: Reinforcement consisting of a geogrid or a geotextile product manufactured for use as reinforcing. Reinforcement does not include steel products.
- H. Long-Term Design Strength: The long-term design strength (LTDS) is:

$$LTDS = T_{ult} / (RF_D * RF_{ID} * RF_{CR})$$

where:

$T_{ULT}$  = ultimate strength

$RF_D$  = reduction factor for chemical and biological durability

$RF_{ID}$  = reduction factor for installation damage

$RF_{CR}$  = reduction factor for creep

#### 1.4 COORDINATION

- A. Section 013100 "Project Management and Coordination": Requirements for coordination.
- B. Coordinate Work of this Section with rough grading, excavating, utilities and backfilling Work.

#### 1.5 ACTION SUBMITTALS

- A. Section 013300 "Submittal Procedures": Requirements for submittals.
- B. Submit to the Engineer, at least 30 days prior to beginning any work on the gabion basket reinforced soil system, the proposed gabion basket reinforced soil system detailed design prepared by the Contractor's Design Engineer. The detailed design should include at a minimum the following:
  - 1. Fabrication and installation drawings indicating fabrication and erection details for the slope, including sequencing and construction procedures. Indicate type of wall, location, length, top elevation, bottom of leveling pad elevation, cross-sections including backfill material type and limits, and quantities. Include details for soil stabilization and reinforcement anchor and connection for anchoring soil stabilization geogrids or geotextiles to gabions. The drawings shall show exact dimensions for the reinforcement supplied. The design and layout of the internal reinforcement shall be subject to the following:
    - a. Each reinforcement level shall run as continuous as practical throughout the profile. If a geotextile filter is present, the reinforcement shall be laid out so that interference with the geotextile is minimized.
    - b. Any reinforcement not placed with the machine direction as the design reinforcement direction shall be identified on the shop drawings.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualifications: Submit qualifications of Installer and Contractor's Design Engineer.
- B. Product Data:
  - 1. Submit manufacturer information about wire fabric.
  - 2. Submit size distribution and types for stone filler.
  - 3. Submit structural fill materials to be used as reinforced fill meeting the requirements of Section 310515.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Installation:
  - 1. Installation equipment.
  - 2. Assembly instructions.
  - 3. Details of installation.
  - 4. Details of filling baskets with stone.

## 1.7 DESIGN AND PERFORMANCE RESPONSIBILITY

- A. Design of the retaining wall using gabion baskets soil reinforced slope shall be the sole responsibility of the Contractor's Design Engineer.

## 1.8 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout Work of this Section.
- B. Quality of all materials, the process of manufacture, and the finished structure shall be subject to inspection and approval by the Engineer, or other representative of the Owner. Such inspection may be made at the place of manufacture or after delivery, or at both places, and the materials shall be subject to rejection at any time on account of failure to meet any of the specified requirements even though samples may have been accepted as satisfactory at the place of manufacture.

## 1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' experience and approved by manufacturer.
- C. Contractor's Design Engineer: Registered Professional Engineer in the State of North Carolina with at least 5 years' professional experience in design and construction of support of gabion basket and reinforced soil slope retaining wall systems and having completed a minimum of 5 successful excavation support projects of equal type, size, and complexity to specified work.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 “Product Requirements”: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Label each roll with the manufacturer's name, product identification, roll dimensions, lot number, and date manufactured.
- E. Handling:
  - 1. Minimize reduction in sizes during handling of stone filler.
  - 2. Geosynthetic rolls shall be handled and unloaded by hand, or with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Geosynthetic rolls shall not be dragged, lifted by one end, lifted by cables or chains, or dropped to the ground.
- F. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Provide additional protection according to manufacturer instructions.
  - 3. Protect geosynthetics from cement, paint, excessive mud, chemicals, sparks and flames, temperatures in excess of 160 degrees F, and any other environmental condition that may degrade the physical properties. If stored outdoors, elevate the rolls from the ground surface. Protect geosynthetics, except for extruded grids, with an opaque waterproof cover. Deliver geosynthetics to the site in a dry and undamaged condition. Geotextiles shall not be exposed to direct sunlight for more than 7 days.

#### 1.11 AMBIENT CONDITIONS

- A. Section 015000 “Temporary Facilities and Controls”: Requirements for ambient condition control facilities for product storage and installation.
- B. Minimum Conditions: Do not install PVC-coated materials when ambient temperature is at or below 20 degrees F.

#### 1.12 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

## PART 2 - PRODUCTS

### 2.1 GABIONS

#### A. Manufacturers:

1. Maccaferri
2. Modular Gabion Systems
3. Gabion Supply Co.
4. Substitutions: As specified in Section 016000 - Product Requirements.

#### B. Double-Twisted Wire Mesh:

1. Description:
  - a. Type: Non-raveling.
  - b. Fabrication: Continuous twisting of pairs of wires through three half-turns to form hexagonal-shaped opening.
  - c. Wire and Mesh Opening Sizes: Comply with ASTM A 975.
2. Coating:
  - a. PVC:
    - 1) Integrity: No cracks or breaks after wires are twisted for mesh fabrication.
    - 2) Brittleness Temperature: Maximum 145 degrees F when tested according to ASTM D 746.
    - 3) Salt Spray Exposure: No cracks, no noticeable change of color, no blisters, and no splits after 3,000 hours, according to ASTM B 117.
    - 4) UV Light Exposure: No cracks, no noticeable change of color, no blisters, and no splits after of 3,000 hours, according to ASTM D 1499 and ASTM G 152.
3. Wire Tensile Strength:
  - a. Comply with ASTM A 641/A 641M.
  - b. Testing: Comply with ASTM A 370.
4. Mesh Strength and Panel-to-Panel Joint Strength:
  - a. Metallic-Coated Gabions:
    - 1) Parallel to Twist: 2900 lb./ft.
    - 2) Perpendicular to Twist: 1400 lb./ft.
    - 3) Panel to Panel: 1200 lb./ft.
  - b. Testing: Comply with ASTM A 975.

#### C. Welded-Wire Fabric:

1. Description: Series of longitudinal and transverse steel wires welded together at points of intersection by electrical-resistance welding to form sheets.
2. Coating:
  - a. PVC:
    - 1) Integrity: No cracks or breaks after wires are twisted for mesh fabrication.
    - 2) Brittleness Temperature: Maximum 145 degrees F when tested according to ASTM D 746.
    - 3) Salt Spray Exposure: No cracks, no noticeable change of color, no blisters, and no splits after 3,000 hours, according to ASTM B 117.

- 4) UV Light Exposure: No cracks, no noticeable change of color, no blisters, and no splits after of 3,000 hours, according to ASTM D 1499 and ASTM G 152.
3. Wire Tensile Strength: Comply with ASTM A 641/A 641M.
4. Weld Shear Strength: 70 percent of breaking strength.
5. Panel-to-Panel Joint Strength:
  - a. 1200 lb./ft.
  - b. Testing: Comply with ASTM A 974.
6. Gabion Classification: Style 5.

D. Stone Filler:

1. Description:
  - a. Hard, angular-to-round, durable, and resistant to water and weathering during lifetime of structure.
  - b. From natural deposits of the required sizes, or crushed stone meeting required sizes.
  - c. Greater than 5 percent by weight of sand, clay, and fines will not be accepted.
  - d. Comply with ASTM C 33/C 33M and ASTM D 5312/D 5312M.
2. Gradation:
  - a. Comply with ASTM C 136/C 136M.
  - b. Gabions 12 Inches or Higher: 4 to 8 inches.

E. Filter Material:

1. Description: Well-graded sand.
2. Gradation:
  - a. Comply with ASTM C 136/C 136M.
3. Geotextile Fabric:
  - a. Type: Unwoven.
  - b. As specified in Section 310519 "Geotextiles for Earthwork".

## 2.2 GABION ACCESSORIES

- A. Ring Fastener Material: Stainless steel.

## 2.3 GEOGRID REINFORCEMENT

- A. Provide geogrid which is a geosynthetic manufactured for reinforcement applications. The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil, aggregate, or other fill materials. The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. The geogrid shall be manufactured with 100 percent virgin resin consisting of polyethylene, polypropylene, or polyester, and with a maximum of 5 percent in-plant regrind material. Polyester resin shall have a minimum molecular weight of 25,000 and a carboxyl end group number less than 30. Polyethylene and polypropylene shall be stabilized with long term antioxidants.

## 2.4 GEOTEXTILE REINFORCEMENT

- A. Geotextile shall be a pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 95 percent by weight polyethylene, polypropylene, or polyesters. The geotextile shall be manufactured with 100 percent virgin resin, and with a maximum of 5 percent in-plant regrind material. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the selvages. Polyester resin shall have a minimum molecular weight of 20,000 and a carboxyl end group number less than 50. Polyethylene and polypropylene shall be stabilized with long term antioxidants. For survivability during installation, and in addition to installation damage used in calculating the long-term design strength, the geotextile shall meet the minimum requirements in AASHTO M 288 Class 1 and shall have a minimum mass per unit area of 8 ounces/square yard.

## 2.5 REINFORCED FILL

- A. Reinforced Fill: Soil placed in the reinforced fill zone shall consist of structural fill in accordance with Section 310515.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that earthwork excavations or fills have been completed to required elevations and gabion substrates are ready to receive work of this Section.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created during installation.
- B. Protect and maintain erosion and sedimentation controls during installations.
- C. Protect subgrades and foundation soils or substrates from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
- D. Cut and grade the foundation on which the gabions are to be placed to the lines and grades shown on the final shop drawings. Surface irregularities, loose material, vegetation, and all foreign matter shall be removed from the foundation area. When fill is required, it shall consist of structural fill conforming to the requirements of Section 310515. Do not place bedding layer until the foundation preparation is completed, and the subgrade surfaces have been inspected and approved by the Engineer.
- E. Compaction of bedding or filler material shall conform to the requirements of Section 311233. The surface of the finished material shall be to grade and free of mounds, dips or windrows.

Extra care should be taken with foundation preparations in order to ensure a level and smooth surface.

### 3.3 INSTALLATION

- A. Place gabions as indicated on Drawings. Assemble each gabion per manufacturer's instructions.
- B. Require interior diaphragms where any inside dimension exceeds 3 feet for gabion baskets thicker than 12 inches. Install diaphragms to assure that no open intervals are present that exceeds 3 feet.
- C. Do not place gabions over frozen or spongy subgrade surfaces.
- D. Geotextile Fabric:
  - 1. Prepare surface to receive the fabric to a relatively smooth state, free of obstructions, depressions and debris
  - 2. Spread geotextile fabric uniformly on prepared foundation surface to slopes, lines, and grades as indicated on Drawings.
  - 3. Overlap fabric a minimum of 2 feet with securing pins at no greater than 3 feet intervals. Place additional pins as needed to prevent slippage of the geotextile fabric. Stagger overlaps at a minimum of 5 feet.
  - 4. Place material so that upstream material overlaps downstream material.
  - 5. Replace damaged areas of fabric damaged during installation prior to placing stones.
  - 6. Do not drop stones from more than 2 feet height onto the geotextile fabric.
  - 7. At locations of pipe penetration, wrap the ends of the pipe two times with geotextile fabric and attach to the gabion. Maintain continuous fabric between the geotextile around the pipe and the fabric at gabion surface.
    - a. Structural fill shall be compacted in accordance with the requirements of Section 312333.
- E. Double-Twisted Wire-Mesh Gabions:
  - 1. According to manufacturer instructions.
- F. Welded-Wire Fabric Gabions:
  - 1. According to manufacturer instructions.
- G. Placing Gabions:
  - 1. Assemble empty gabions and place on designated surfaces.
  - 2. No gaps are allowed between contact surfaces of adjacent finished structures.
  - 3. Interconnect each layer of gabions to the underlying layer of gabions along the front, back, and sides. Stagger vertical joints between gabions of adjacent rows and layers by at least one-half of a cell length.
  - 4. Connect adjoining empty units along contact perimeters to obtain a monolithic structure.
  - 5. Securely fasten wire terminals.
  - 6. During filling operation of gabion baskets, some manual stone placement is required to minimize voids. Do not drop rock from a height greater than 12 inches. Place rock in



back of the gabion first. Then hand-place rock to the exposed faced vertically to create a flat and compact appearance. Fill cells in stages. At no time, fill one cell to a depth higher than 12 inches than the adjoining cell. Uniformly overfill by 1 to 2 inches to compensate for future rock settlement.

7. Slopes:
  - a. Fill baskets starting from lower side of bank.
  - b. On steep slopes 3 horizontal to 2 vertical, secure mattresses with galvanized-steel pipes driven into ground inside upper end panel at 6 feet o.c.
8. Curves: Secure empty gabions as specified, and place to required curvature by holding in position with hardwood pegs staked into ground before filling.
9. Any damage to the wire or coatings during assembly, placement and filling shall be repaired promptly in accordance with the manufacturer's recommendations or replaced with undamaged gabion baskets.

#### H. Reinforcement Installation

1. Before placing reinforcement, compact the subgrade or subsequent lift of fill and level-grade it. The surface shall be smooth and free of windrows, sheepsfoot impressions, and rocks.
2. Reinforcement shall be placed at the elevations and to the extent shown on the drawings and the approved shop drawing submittal. Orient the reinforcement with the design strength axis perpendicular to the slope face. Place reinforcement strips immediately next to adjacent strips to provide 100 percent coverage.
3. Install the reinforcement in tension. The reinforcement shall be pulled taut and anchored with staples or stakes prior to placing the overlying lift of fill. The tension shall be uniform along the length of the slope and consistent between layers.
4. All reinforcement shall be 100 percent covered by soil so that reinforcement panels do not contact in overlaps. Where the slope bends, a veneer of fill shall be placed to a nominal thickness of 3 inches to separate overlapping reinforcement.
5. Splicing. Splicing shall not be allowed unless identified on the shop drawings. Splicing shall be limited to only one splice per reinforcing strip and no two consecutive reinforcing strips shall include a splice. Splices shall be located randomly without a pattern. Individual reinforcing lengths less than 10 feet shall be discarded. Seams shall be placed facing upward for inspection purposes.

#### I. Fill Placement

1. Reinforced fill shall be placed from the slope face (i.e., gabion baskets) back toward the fill area to ensure that the reinforcement remains taut. Fill shall be placed, spread, and compacted in such manner that minimizes the development of wrinkles in or movement of the reinforcement.
2. A minimum fill thickness of 6 inches is required prior to operation of vehicles over the reinforcement. Sudden braking and sharp turning shall be avoided. Tracked equipment shall not turn within the reinforced fill zone to prevent tracks from displacing the fill and damaging the reinforcement. Construction equipment shall not be operated directly upon the reinforcement as part of the planned construction sequence. Rubber tired equipment may operate directly on the reinforcement if the travel is infrequent, equipment travels slow, turning is minimized, and no damage or displacement to the reinforcement is observed.
3. At the end of each day, slope the last lift of fill away from drains in a manner that will allow drainage and direct runoff away from aggregate.

4.     Compaction

J.     Tolerances

1.     Horizontal: The slope crest and toe shall be within 6 inches of the plan location.
2.     Vertical: The slope crest elevations shall be within 3 inches above to 3 inches below the prescribed elevations shown on the drawings

K.     Closing:

1.     Secure lids along all edges, ends, and diaphragms as specified for other components.
2.     Use of single-point leverage tools, such as crowbars, will not be allowed.
3.     Turn in and securely fasten end wires.

3.4     REPAIR/REPLACEMENT

- A.     Replace units that suffer damage in erecting or backfilling or any element that cannot be placed satisfactorily in wall.

3.5     CLEANUP

- A.     Remove from the site and dispose of surplus materials and debris resulting from gabion installation.

3.6     FIELD QUALITY CONTROL

- A.     Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B.     Compaction Tests:
1.     Compaction Testing: As specified in Section 312323.

3.7     MANUFACTURER'S FIELD SERVICES

- A.     Section 014000 - Quality Requirements: Requirements for manufacturer's field services.
- B.     Furnish manufacturer's representative at Project site to assist Contractor and Engineer until they are familiar with and confident in installation, and construction procedures.
- C.     Furnish visit to Project site by manufacturer's representative at the commencement of wall construction.

END OF SECTION 313600

## SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes temporary excavation and trench support and protection systems.
- B. Related Requirements:
  - 1. Section 013233 "Photographic Documentation" for recording pre-existing conditions and excavation support and protection system progress.
  - 2. Section 014000 "Quality Requirements" for testing and laboratory services.
  - 3. Section 310515 "Soils and Aggregates for Earthwork" for soil and aggregate materials.
  - 4. Section 310900 "Geotechnical Instrumentation and Monitoring" for monitoring of ground and groundwater.
  - 5. Section 312333 "Trenching and Backfilling" for trenching, backfilling, and compaction in trench excavations.
  - 6. Section 312319 "Dewatering" for lowering and disposing of groundwater during construction and dewatering excavations.

#### 1.3 ACTION SUBMITTALS

- A. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified Professional Engineer, meeting the minimum performance requirements in Part 2 of this Section.
  - 1. Include overall system plan, indicating clearances, dimensions, material properties, member sizes, locations, spacing and member penetrations depths, and locations of various types of lateral supports.
  - 2. Show details, layout, arrangement, equipment requirements, and method of construction of proposed excavation support system.
  - 3. Indicate existing and proposed utilities, structures or other obstructions.
  - 4. Show wall elevations and locations of bracing.
  - 5. Show overall installation sequence and removal of bracing. Indicate work levels to be performed before bracing is installed or removed.
  - 6. Method of preloading bracing, if required, including preload for each member, and method of locking-off the preload. Submit detailed drawings of connections, jacking supports, and method of shimming.  
Include procedures for resolving difficulties arising from misalignment of members exposed during excavation and criteria for implementing those procedures. n.

- B. Design Calculations: For excavation support and protection system. Include analysis data prepared, signed, and sealed by Professional Engineer licensed in the State of North Carolina responsible for their preparation.
  - 1. Include loads on excavation support system for all stages of excavation, bracing removal, and concrete placement, including material and equipment loads on adjacent ground during construction.
  - 2. Include design of wall and bracing members including details for all construction stages.
    - a. Design: Account for water pressures associated with flood conditions.
  - 3. Include theoretical deflections of excavation support system and deformation of structures, pipelines, and other improvements located within areas influencing excavations.
- C. Submit to the Engineer for review, a plan of action to be implemented in the event any deformation threshold value is reached as specified in Section 310900. Identify positive measures in action plan to further limit wall movement, including but not limited to trenching for struts and wales, placement of granular earth berms against the wall, installation of additional struts, or combinations thereof.
  - 1. Include description and details of mitigating measures, work schedule, location and availability of materials, and structural details for connections to wall and support elements.
  - 2. Be prepared to work 24 hours per day to implement such measures.
  - 3. Perform remedial work and mitigating measures at no additional cost to Owner.
- D. Submit as part of the lay schedule for the Concentrate Discharge Pipeline stationing within all NCDOT right of ways that require pipeline trench excavation within the 1:1 of the roadway edge of pavement. In these areas, Contractor shall indicate whether positive shoring shall be utilized, or excavation of pavement and repair according to Contract Documents.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Submit quality control measures to ensure that performance of excavation support system complies with project requirements.
- B. Submit welder qualifications and weld procedures in accordance with AWS D1.1.
- C. Qualification Data: For land surveyor.
- D. Maintain at least one copy of design at job site during excavation that includes a plan indicating sizes, types, and configurations of the materials to be used in protective system. Identify registered Contractor's Design Engineer who stamped the design.
- E. Do not proceed with excavation support or protection activities until submittals have been reviewed by the Engineer.
- F. Submit inspection documentation for cofferdam excavation support system:

1. On-site inspections of excavation support system as the systems are constructed.
2. Review of quality control measures and performance data.
3. Certification that excavation support system is constructed per applicable design following completion of each support system and following Contractor modifications during construction.

## 1.5 QUALITY ASSURANCE

- A. Contractor Qualifications: Minimum 5 years' experience compatible to indicated Work, and who employs labor and supervisory personnel similarly experienced in Work of this Section.
- B. Contractor's Design Engineer: Registered Professional Engineer in the State of North Carolina with at least 5 years' professional experience in design and construction of support of excavation systems and having completed a minimum of 5 successful excavation support projects of equal type, size, and complexity to specified work.
- C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.
- D. Regulatory Requirements: Comply with authorities having jurisdiction, including OSHA requirements.
- E. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

## 1.6 FIELD CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
  1. Contact utility companies and other responsible authorities to locate and mark underground utilities.
  2. Notify the Engineer and Owner no fewer than two days in advance of proposed interruption of utility.
  3. Do not proceed with interruption of utility without Owner's written permission.
- B. Project-Site Information: A geotechnical data has been provide for this Project and is available for information only. The opinions expressed in this data are those of a geotechnical engineer and represent soil borings and tests, conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
  1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements.
  2. The geotechnical data is included elsewhere in Project Manual.

- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads within specified movement criteria (Section 310900).
  - 1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified Professional Engineer.
  - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 3. Install excavation support and protection systems to minimize horizontal and vertical movements without damaging existing buildings, structures, and site improvements adjacent to excavation.
  - 4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.
- B. Do not permit excavations below the level of the base of adjacent existing foundations or retaining walls, unless excavation design and bracing includes an analysis of stability of structure supported by foundation and if necessary, incorporates required bracing or underpinning of foundation.
- C. For support systems in which bracing is installed between opposite sides of the excavation, design excavation support of both sides to be nearly the same as feasible.
- D. Where necessary to resist point loads, fill pipe piles used as soldier piles with concrete. Do not consider concrete strength in design of pipe pile for bending stress.
- E. Design, install, operate, and maintain groundwater control system to control groundwater inflows, prevent piping or loss of ground, and maintain stability of the excavation. Refer to the requirements of Section 312319.
- F. Design review and field monitoring activities by Owner or the Engineer does not relieve Contractor of its work responsibilities.

### 2.2 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Steel Pipe Used as Soldier Piling: ASTM A 252, Grade 3 or better.

- D. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
  - 1. Corners: Site-fabricated mechanical interlock.
- E. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 3 inches with minimum allowable flexural strength of 1,100 psi.
- F. Cast-in-Place Concrete: ACI 301, with minimum compressive strength of 3,000 psi, unless a higher strength is required for application.
- G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that instrumentation required under Section 310900 is installed and initialized prior to start of work required by this Section.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Obtain permits from local authority having jurisdiction prior to initiating excavation work.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
  - 1. Shore, support, and protect utilities encountered.
- C. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
  - 2. Install fencing, gates, lights, and signs around excavations and staging areas to provide for public safety.
- D. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

### 3.3 GENERAL

- A. Install excavation support systems in accordance with the shop drawings and applicable permits.
- B. Fill voids between excavation support system and earth with materials acceptable to the Engineer.
- C. If unstable material is encountered during excavation, take immediate measures to contain it in place and prevent ground displacement.
- D. If settlement or deflections of supports indicate that support system requires modification to prevent excessive movements, redesign and resubmit revised shop drawings and calculations to the Engineer without additional compensation.
- E. Maintain sufficient quantity of material on site for protection of work and for use in case of accident or emergency.

### 3.4 PORTABLE TRENCH BOXES

- A. Use portable trench boxes or sliding trench shields only for worker protection.
- B. Do not use trench boxes as trenchless launch and exit shafts.
- C. Additional excavation, backfilling, and surface restoration required as result of trench box use shall be provided without additional compensation.
- D. Design, construct, and maintain trench boxes or shields to meet acceptable engineering and industry standards.
- E. Install shields in a manner to restrict lateral or other hazardous movement of the shield in the event of sudden lateral loads.
- F. Maintain a written copy of trench box manufacturer's specifications, recommendations, and limitations at job site during excavation work.

### 3.5 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation.
  - 1. Install using impact hammer or vibratory hammer in pre-drilled holes.
  - 2. Soldier Piles in Pre-Drilled Holes:
    - a. Provide casing or other methods of support to prevent caving of holes and loss of ground.
    - b. Backfill with concrete from elevation of bottom excavation to pile tip elevation. Backfill remainder of pre-drilled hole with lean concrete or sand.
    - c. Predrilled hole of sufficient diameter allowing for proper alignment and concrete backfilling of pile.



3. Install driven piles with driving shoes where hard driving is anticipated.
  4. Advance driven soldier piles without aid of a water jet.
- B. Extend soldier piles below excavation grade level to depths shown on reviewed Shop Drawings. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment .
- C. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging.
1. Install lagging so ground loss does not occur between adjacent or below lowest board. As excavation proceeds, a maximum height of 4 feet is permitted for an unlagged face of excavation.
  2. Do not exceed unlagged face of 2 feet, if water seeps or flows from excavation face or excavation face becomes unstable.
- D. Fill voids behind lagging with soil, and compact.
- E. Install wales at locations indicated on Drawings and secure to soldier piles.

### 3.6 STEEL SHEET PILING

- A. Thoroughly cleaned and inspect sheet piles for defects and proper interlock dimensions prior to installation. Provide a tool for checking interlock dimensions.
- B. Before starting excavation, drive one-piece sheet piling lengths in plumb position and tightly interlock vertical edges for its entire length to form a continuous barrier. Form a continuous diaphragm throughout length of each run of wall, bearing tightly against original ground.
1. Exercise care in driving so interlocking members can be extracted without damaging adjacent structures or utilities.
  2. Use driving, cutting, and splicing methods conforming to approved Shop Drawings.
  3. Use templates or other temporary alignment facilities to maintain piling line.
- C. Accurately place piling, using templates and guide frames unless otherwise recommended in writing by sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 5 feet. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- D. Install each sheet pile having sufficient clearance in interlocks to slide under its own weight into interlock of previously placed sheet pile.
- E. Do not excavate in advance of steel sheet piling installation.
- F. Where obstructions are anticipated, pre-excavate or pre-drill along sheet pile wall alignment without additional compensation. Do not extend pre-excavation and pre-drilling below lowest excavation level or into bearing soils for existing or future structures.

- G. Remove obstructions encountered before the specified embedment for piles. Where obstructions cannot be removed, re-evaluate sheet pile system by Contractor's Design Engineer show reduced embedment and additional toe stability measures to be implemented for sheet pile wall realignment. Submittal proposed design measures to the Engineer for review.
- H. Withdraw damaged or faulty aligned pilings with provide new piling, driven properly in its place without additional compensation.
- I. Cut tops of sheet piling to uniform elevation five feet below ground finished grade as indicated on the Drawings.

### 3.7 LINER PANELS

- A. Install liner plates as soon as excavation has progressed sufficiently to install next complete circumferential ring of liner plates. Complete ring of liner plates prior to continuing excavation.
  - 1. Do not install more than one ring of liner plates at any time.
- B. Stagger plates in vertical direction to facilitate shaft strength and leakage resistance.
- C. Grout liner plates in accordance with approved Shop Drawings.

### 3.8 INTERNAL BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
  - 1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by the Engineer.
  - 2. Install internal bracing if required to prevent spreading or distortion of braced frames.
  - 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.
- B. Provide internal bracing to carry maximum design load without distortion or buckling.
- C. Include web stiffeners, plates, or angles required to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities caused by field fabrication and assembly.
- D. Install and maintain bracing support members in tight contact with each other and with the surface being supported. Do not use wood shims.
- E. Coordinate excavation work with installation of bracing. Extend excavation no more than 2 feet below any brace level prior to installation of the bracing.
- F. Use procedures that produce uniform loading of bracing member without eccentricities, overstressing, or distortion of system members.

### 3.9 FIELD QUALITY CONTROL

- A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.
- B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
- C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

### 3.10 REMOVAL

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
  - 1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
  - 2. Fill voids immediately with approved backfill compacted to density specified in Section 312000.
  - 3. Repair or replace, as approved by Engineer, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place as indicated on the Drawings and cut off 5 feet below finished grade.
- C. Do not remove vertical support members that were installed within zone of influence of new or existing structures. Cut off support members installed within this zone at 5 feet below finished grade and abandon in place.
- D. Do not remove internal bracing or transfer loads to permanent structure without prior acceptance of the Engineer.
- E. Begin removal at excavation bottom and progress upward. Slowly release members noting indication of possible failure of remaining members or possible cave-in of excavation sides.
- F. Progress backfilling together with removal of support systems from excavations.
- G. Remove all portions of excavation support, unless otherwise indicated by approved Shop Drawings.
  - 1. Zone of Influence Definition: Zone extending down and away from outer edge of the structure at 1 horizontal to 1 vertical.
- H. Do not leave wood as part of abandoned portion of the work.

- I. When removing excavation support system, do not disturb or damage adjacent buildings, structures, waterproofing material, or utilities. Fill voids immediately with lean concrete or well-graded cohesionless sand or as directed by the Engineer.
- J. Immediately remove excavation support system material from site.

END OF SECTION 315000

## SECTION 316216 - STEEL H-PILES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes steel H-piles.
- B. Related Requirements:
  - 1. Section 312333 "Trenching and Backfilling" for trenching, backfilling, and compaction in trench excavations.
  - 2. Section 312319 "Dewatering" for lowering and disposing of groundwater during construction and dewatering excavations.
  - 3. Section 315000 "Excavation Support and Protection" for temporary support of excavations.

#### 1.3 DEFINITIONS

- A. Production Pile: A pile driven at a permanent pile location, using same methods, materials, and equipment as submitted and approved and as used for test pile.
- B. Practical Refusal: Practical refusal is count of hammer blows that exceed 20 blows per inch with the hammer operating at a determined setting and results in no more than 1/4 inch of pile rebound per blow.
- C. Pile Heave: Pile heave is upward movement of a pile from its originally driven elevation.
- D. Redriving: Redriving occurs when a pile which has been previously driven to required design elevation, required driving criteria, or to practical refusal and is re-driven with same methods, materials, and driving equipment used for test piles and production piles.
  - 1. Perform redriving when required to reset piles that have heaved, to advance piles that encountered high driving resistance due to excess pore water pressures, to advance piles that encountered low driving resistance and require pile set up, or for other reasons as determined by the Engineer.
- E. Professional Engineer: Professional Engineer licensed in the State of North Carolina meeting project qualifications and who is hired by Contractor.

- F. The Engineer: The Engineer or designated representative hired by Owner.
  - 1. Approvals given by the Engineer shall not relieve Contractor of its responsibilities for performing the work in accordance with Contract Document requirements.
- G. Special Inspection Engineer: Entity hired by Owner to perform special inspections related to pile installations.

#### 1.4 ACTION SUBMITTALS

- A. Submit for review and acceptance in accordance with Section 013300, product data and shop drawings showing materials of construction, installation equipment, and details of installation.
- B. Product Data: For each type of product.
- C. Shop Drawings: Show fabrication and installation details for piles, including size of steel sections, lengths, and details of pile accessories.
  - 1. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
  - 2. Details of top connection to structure, splice locations, and pile tip reinforcement or points where applicable.
  - 3. Include details of equipment assemblies and proposed templates. Indicate dimensions, weights, loads, and required clearances. Include:
    - a. Crane, leads, hammer make and model, cap block, pile helmet, cushion block dimensions and material type, and anvil.
    - b. Ram mass, anvil mass, rated stroke, rated energy range, rated speed, steam or air pressure, pile driving cap, make and mass, and other applicable data. Equipment is subject to satisfactory field performance.
    - c. Describe pile slings, chokers, and other apparatus or mechanisms used to support piles prior to and during driving.
    - d. Pile splice locations and details of proprietary splices to be used.
    - e. Details and drawings of proposed templates.
  - 4. Submit results of preliminary wave equation analysis for pile type and proposed pile driving system.
    - a. Submit documentation to support the selection of soil damping and quake values used in the wave equation analysis.
    - b. Submit preliminary corresponding driving stresses and overall installation procedures. Include installation procedures to limit driving stresses to mitigate pile damage.
    - c. Perform sufficient analysis to address variability in anticipated pile lengths.
    - d. Perform, seal, and sign, wave equation analysis by a Professional Engineer.
    - e. Submit a revised wave equation analysis whenever there is a change in pile type, pile installation equipment, or as requested by the Engineer.

5. Submit shop drawings and structural design calculation and analysis data sealed and signed by qualified Professional Engineer responsible for their preparation who is licensed in the State of North Carolina.
- D. Work Requiring a Submittal: Do not start fabrication or installed materials prior to approval of such item. Fabrication performed, materials purchased, or on-site construction accomplished which does not conform to approved shop drawings and data shall be at Contractor's risk. Remove non-compliant materials and replace with approved materials. Owner will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, qualified Professional Engineer, and surveyor.
- B. Certificates:
1. Mill Certificates: Show chemical composition and physical properties, including yield strength, of steel to be furnished
  2. Manufacturer's Certificates: Submit installation instructions and other relevant data.
- C. Reports:
1. Mill Test Reports: For steel H-piles, steel castings, and steel plate, signed by manufacturer.
  2. Pile-Driving Records: Submit within three days of driving each pile.
- D. Certified Piles Survey:
1. Within three working days after a driven pile is deemed to be permanently obstructed or when an installed pile is observed to exceed specified tolerances, submit a sketch to the Engineer showing as-driven locations of driven piles immediately adjacent to the pile and established building lines as indicated on Drawings.
  2. Submit within two weeks of completing all pile driving, submit a plan showing designation number of each pile and its as-driven location with respect to specified tolerances and established building lines as indicated on Drawings, including final as-installed pile tip and pile cutoff elevations.

## 1.6 QUALITY ASSURANCE

- A. Pile Installer Qualification:
1. Pile driving company experienced in type of specified piling work and having at least five years' experience and at least 10 successful installations of same general type and class of piles.
  2. Superintendent: Have at least five years' experience in pile driving and operations of pile type, size, length, and ground conditions similar to project requirements.
  3. Use available data to plan and execute the work, including geotechnical data, Contract Documents, test pile driving records and other pile driving records or summaries of piles driven on nearby projects, and pile driving behavior.

- B. Surveyor Qualifications: Professional Land Surveyor hired by Contractor and registered in the State of North Carolina and having not less than 10 years' experience performing surveys on similar projects.
- C. Professional Engineer Qualifications: Engineer hired by Contractor and registered in the State of North Carolina and having not less than 10 years' experience in pile design on similar projects.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Develop and submit plans for delivery, storage, and handling of piles for review and approval to the Engineer. Handle and store piles at Project site to prevent buckling or physical damage.
- B. Do not dump piles. Store piles to prevent low spots where water can accumulate. Keep stored piles clean. Stack piles during delivery and storage:
  - 1. So that each pile is maintained in a straight position and is supported every 10 feet or less along its length, including ends, to prevent exceeding maximum camber or sweep.
  - 2. Not more than 5 feet high.
- C. Lift piles using a cradle or multiple point pick-up system to ensure that maximum permissible camber or sweep is not exceeded due to insufficient support. Inspect piles for excessive camber, sweep, and damage before transporting them from storage area to driving area and immediately prior to placement in the driving leads.
  - 1. Maximum Permissible Camber or Sweep: 2 inches over pile length.
  - 2. Reject piles having excessive camber or sweep.
- D. Handle in such a way as to minimize bending stresses. Brace piles in plumb and rigid leads to prevent whipping during driving.

#### 1.8 FIELD CONDITIONS

- A. Project Information Geotechnical data has been prepared for this Project and is available for information only. Owner is not responsible for interpretations or conclusions drawn from this data.
  - 1. Make additional test borings and conduct other exploratory operations necessary for subsurface work according to the performance requirements.
  - 2. Groundwater levels may vary during the work and should not be assumed to be accurately represented by groundwater level readings reported in the geotechnical data.
  - 3. The geotechnical data is included elsewhere in Project Manual.
- B.
- B. Be completely responsible for damages resulting from pile driving operations and at a minimum take whatever measures are necessary to maintain peak particle velocities within specified limits.



## 1.9 LINES AND GRADES

- A. Employ a Professional Land Surveyor to establish lines and levels. Be responsible for correct location, orientation of piles, and keeping a record of piles driven, as well as a record of amount of uplift or settlement of individual piles. Give daily records of uplift or settlement measurements to the Engineer.
- B. Establish a baseline and datum elevation as approved by the Engineer. Stake and maintain pile locations and establish required elevations, including elevation of top of pile prior to cutting off any length of pile.
- C. Within one working day, provide the Engineer with a written tabulation indicating the following information for each pile:
  - 1. Pile number.
  - 2. Elevation of top of pile prior to cutting or build up, measured to nearest 0.10 feet.
  - 3. Elevation of top of pile after cutting or build up, measured to nearest 0.10 feet.
  - 4. Deviation from plan location at cut-off grade, measured to nearest 0.01 feet.

## 1.10 OBSERVATION AND INSPECTION

- A. Perform pile driving installations under full-time observation of the Engineer. Notify the Engineer at least 48 hours in advance of starting or restarting any pile driving work. Do not proceed with pile driving operations unless the Engineer is present; piles not observed by the Engineer will not be accepted.
- B. Give the Engineer safe access to the work at all times. Furnish the Engineer with materials and facilities for checking conformance with Contract Document requirements.
- C. Provide legible markings on each pile in one-foot increments, starting at the tip, and using enlarged numerals to indicate pile length at 5 feet intervals. Maintain readable markings slinging, handling, and driving. Orient piles in the leads so markings are visible from a safe location during driving.
- D. Have available and provide to the Engineer two saximeters in good working condition for use during pile driving operations.
- E. Install piles in the presence of the Engineer. Piles not installed in the Engineer's presence will not be accepted.
- F. The Engineer will maintain a record copy of each pile driven. Records will:
  - 1. Include pile designation number, driving resistance record, pile length as driven, date and time of driving, time delays during driving, tip and cut off elevations, deviations from drawing location and from plumb or batter, hammer data and other applicable data.
  - 2. Show unusual events during installation including interruptions during driving, obstructions, redriving, and other relevant conditions.
  - 3. Show driving resistance record including number of blows per foot for each foot of driven length and number of blows per inch for final 6 inches of penetration.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Pile Accessories: Subject to compliance with requirements, provide products by one of the following or equal:
  - 1. Associated Pile and Fittings Corporation.
  - 2. L.B. Foster Piling.
  - 3. Titus Steel
  - 4. Versa Steel, Inc.

### 2.2 MATERIALS - STEEL H-PILES

- A. High-Strength, Low-Alloy, Columbium-Vanadium Structural Steel: ASTM A572/A572M, Grade 50.
- B. High-Strength, Low-Alloy, Nickel, Copper, Phosphorous Steel H-piles: ASTM A690/A690M.
- C. High-Strength, Low-Alloy, Structural Steel: ASTM A588/A588M.
- D. Keep deformations, defects, camber, and sweep of piles placed in the leads within those values allowed in ASTM A6.
- E. Bearing Collars, End Plates, and Splicers: Use same material as steel piles.

### 2.3 MATERIALS - PILE ACCESSORIES

- A. Driving Points: Manufacturer's standard one-piece driving point, fabricated from steel castings as follows to provide full bearing of web and flange of pile tip:
  - 1. High-Strength Steel Castings: ASTM A148/A148M, Grade 80-40Grade 90-60.

### 2.4 DRIVING EQUIPMENT

- A. Pile Hammer: Single or double acting, air-, steam-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated at a blow count that does not cause damage to the pile. Do not use drop hammers.
  - 1. Keep hammer in good mechanical condition.
  - 2. Operate hammer at speed and pressure recommended by manufacturer
  - 3. When making final driving resistance, have hammer operating at energy required by approved submittals. Maintain fuel setting, boiler or air pressure recommended by manufacturer and employ the proper size hose and connections.
- B. At the Engineer's discretion, a vibratory hammer of sufficient capacity (force and amplitude) may be used to drive steel bearing piles to a depth that will allow access to an impact hammer

or to stand the pile. The Engineer will determine the depth to which the piles may be installed using a vibratory hammer; however, use an impact hammer to drive all bearing piles for at least the final 15 feet of penetration.

- C. Closed-End or Double-Acting Diesel Hammers: Equip with a bounce-chamber pressure gauge in good working order or other similar approved apparatus to measure gas chamber pressure inside the hammer and total hammer energy. Mount gauge near ground surface so it can be easily read.
- D. Open-Ended or Single-Acting Diesel Hammers: Equip with a scale, jump stick, that extends above the ram cylinder that allows one to visually determine the hammer stroke at all times. Make access of the jump stick available to the Engineer.
- E. Hammer Cushions and Driving Caps:
  - 1. Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.
  - 2. Combine driving helmet or cap and cushion block capable of protecting pile head, minimizing energy absorption and dissipation, and transmitting hammer energy uniformly and consistently during entire driving period.
  - 3. Fit driving helmet or cap loosely around pile top so pile may rotate slightly without binding within the driving head.
- F. Leads:
  - 1. During driving operations, firmly hold pile and hammer in proper alignment by fixed driving leads of sufficient length to prevent the use of a follower.
  - 2. Include intermediate supports for pile in the leads to reduce unbraced length of the pile during driving.
- G. Do not allow changes in the selected pile driving equipment after being reviewed, except as directed by the Engineer. No additional contract time shall be allowed for Contractor proposed changes to methods, materials, and equipment.
- H. Use driving equipment to drive production piles of same type and operated in same manner as used to drive test piles. Do not use driving equipment that damages piles.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches above bottom of footing or pile cap.
- B. Prior to commencing with the Work in this Section, carefully inspect job site and verify that piles may be installed in accordance with the Contract Documents. Verify that site conditions will support pile driving equipment and that adequate space is available to safely lift and install piles.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 GENERAL

- A. Install piles so they bear at the pile tip elevations shown on the Drawings. Re-drive piles obstructed above the bearing soils after removing the obstruction or after being relocated as approved by the Engineer.
- B. Discrepancies:
  - 1. In the event of discrepancy, immediately notify the Engineer in writing.
  - 2. Do not proceed with construction in areas of discrepancy, until all such discrepancies have been fully resolved.
- C. When piles are located in an area where site grading is required, do not drive piles until grading work is complete. Correct changes in grade resulting from pile driving without additional compensation.
- D. Pile Tips: Equip piles with manufactured steel reinforcing tips.

### 3.3 PREDRILLING AND JETTING

- A. Predrilling for steel H-piles is not permitted.
- B. Jetting of H-Piles is not permitted.
- C. Spudding is not permitted.

### 3.4 DRIVING CRITERIA

- A. Drive each pile to tip elevations indicated on Drawings.
- B. Do not drive piles beyond practical refusal.
- C. Perform pile re-drives at the discretion of the Engineer.
- D. The Engineer may waive or modify the requirements for final driving resistance based on production pile driving conditions.

### 3.5 INSTALLATION

- A. Do no pile driving within 200 feet of any concrete operation or within 100 feet of any concrete less than 48 hours old.
- B. Inspect piles when placed in the leads immediately before driving. Handle piles to protect pile coatings. Repair damage or defects in pile coatings as specified.

- C. Take care to avoid damage in placing the pile in the leads and during pile driving operations. Laterally support piles during driving, but do not restrain from rotation in the leads. Where pile or projecting reinforcement orientation is essential, take special care to maintain the orientation during driving.
- D. Once pile driving has begun, keep pile alignment and batter constant. Monitor pile alignment and batter during driving with an accurate level. Drive piles continuously and without interruption until either meeting required tip elevation and corresponding acceptance criteria or attaining practical refusal.
- E. Cutoff steel H-piles at grade by an approved method. Use templates or other devices to ensure cut off will be true and level. Where cutoff is below existing ground or mudline elevation, complete excavation, sheeting, and dewatering before driving pile to cutoff elevation.
- F. Legally dispose offsite pile cutoff lengths less than 4 feet.

### 3.6 PILE ACCEPTANCE

- A. Only piles meeting the requirements of this Article will be accepted for payment.
- B. Piles that are damaged below cut-off elevation during driving will be rejected.
- C. Piles indicating sudden or peculiar decrease in penetration resistance during driving will be assumed broken and will be rejected unless the Engineer's review of available data indicates that sudden decrease in driving resistance is due to natural, subsurface conditions, and continued acceptable driving behavior is observed.
- D. Upon comparing a pile's performance with that of other driven piles and based on knowledge of subsurface conditions, the Engineer will determine if pile has been damaged sufficiently to make it unacceptable. If this is the case, the pile will be rejected. If Contractor does not agree that a pile is incapable of performing satisfactorily, testing may be required.
- E. During driving, the Engineer will evaluate the piles for alignment, buckling, visible breakage, or other irregularities. Piles that fail to meet the requirements of Contract Documents or for any other justifiable reason are unacceptable will be considered defective and shall be rejected.
- F. Removal of piles driven in permanent work for convenience, for prosecution of the work, or for any other reason, except at the direction of the Engineer, shall be replaced with another pile. Where piles are withdrawn, backfill pile hole with clean granular fill. Perform work without additional compensation.
- G. Contractor will be compensated only for rejected piles that are driven within the specified tolerances and whose damage is not attributed to Contractor's error in the opinion of the Engineer.
- H. Cut off piles that are damaged, mislocated, or driven out of alignment and cannot be removed, at least 5 feet below planned cut off and abandoned. Drive additional piles as directed by the Engineer without additional compensation.

- I. Submit plans for correcting defective work to the Engineer for approval before performing corrections. Pay for all additional costs including engineering, concrete work, steel, forms required for pile caps, and other foundations because of having to drive additional piles to replace rejected piles attributable to Contractor's error.

### 3.7 OBSTRUCTIONS

- A. Remove obstructions encountered within 10 feet of ground surface or mudline which prevent pile advancement in accordance with the acceptance criteria and within tolerances without additional compensation. Clear obstruction by excavation, pre-augering, or other feasible means as approved by the Engineer and then re-drive pile in the original location without additional compensation.
- B. If obstructions are encountered below 10 feet from ground surface and piles cannot be advanced to proper bearing strata in accordance with acceptance criteria and within specified tolerances, resort to methods to install pile as required, including excavation, predrilling, or other feasible means as approved by the Engineer. If in the judgment of the Engineer, Contractor is unable to properly complete any pile by resorting to such methods, the Engineer may order an additional pile for which Contractor will be paid in accordance with Contract unit price.
- C. Take care when obstructions are removed by excavation so as not to eliminate lateral support of adjacent individual piles or structures. Backfill excavated areas prior to re-driving the pile.
- D. If in the opinion of the Engineer, a pile has been damaged by an obstruction during driving, abandon and drive a replacement pile with payment being made in accordance with Contract unit price.
- E. Cut off or pull and re-driven abandoned piles at the discretion of the Engineer. Payment for piles cut off and abandoned and for pile removal will be made as delineated in project specifications.

### 3.8 TOLERANCES

- A. Install piles in correct locations, orientations, and alignments, both laterally and longitudinally, and to vertical lines indicated. Prior to driving production piles, the Engineer will provide a permanent base line for inspection of pile placement. Maintain base line during production pile installations.
- B. Maximum Tolerances:
  1. A final lateral deviation from planned horizontal location at cutoff elevation: 3 for vertical piles.
  2. A vertical deviation of not more than 1-1/2 inches above or more than 4 inches below indicated cutoff elevations.
  3. Vertical Piles: A variation of not more than 1/4 inches per foot of pile length from vertical.
- C. Manipulation of installed piles shall not be permitted.

- D. Where installed piles exceed the specified lateral deviation tolerances, the Engineer has the option to determine the total load on individual piles based on the survey information.
  - 1. If the load on any pile exceeds the specified load capacity, the Engineer will provide a design and corrections shall be made in accordance with the design without additional compensation.

### 3.9 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  - 1. Pile foundations.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

### 3.10 DISPOSAL

- A. Remove withdrawn piles and cutoff sections of piles from site, and legally dispose of them off Owner's property.

END OF SECTION 316216

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**Division 32**  
**Exterior Improvements**



## SECTION 321216 - ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Asphalt materials.
- 2. Aggregate materials.
- 3. Aggregate subbase.
- 4. Asphalt paving base course, binder course, and wearing course.
- 5. Asphalt paving overlay for existing paving.
- 6. Surface slurry.
- 7. Mill and Overlay

- B. Related Requirement:

- 1. Section 321723 - Pavement Markings: Painted pavement markings, lines, and legends.
- 2. Section 330513 - Manholes and Structures: Manholes, Drains including frames.

#### 1.3 PRICE AND PAYMENT PROCEDURES

- A. Section 012200 – Unit Prices and Section 012900 - Payment Procedures: Contract Sum/Price.

- B. Aggregate Subbase:

- 1. Basis of Measurement: By cubic yard
- 2. Basis of Payment: Includes supplying and stockpiling aggregate, scarifying substrate surface, placing, and compacting subbase.

- C. Asphalt Paving Base Course:

- 1. Basis of Measurement: By cubic yard
- 2. Basis of Payment: Includes priming surfaces, tack coating surfaces, furnishing, placing, compacting, and testing base course.

- D. Asphalt Paving Binder Course:

- 1. Basis of Measurement: By cubic yard
- 2. Basis of Payment: Includes priming surfaces, tack coating surfaces, furnishing, placing, compacting, and testing binder course.

E. Asphalt Paving Wearing Course:

1. Basis of Measurement: By cubic yard
2. Basis of Payment: Includes priming surfaces, tack coating surfaces, furnishing, placing, compacting, and testing wearing course.

F. Tack Coat:

1. Basis of Measurement: By square yard.
2. Basis of Payment: Includes preparing surfaces and applying.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit product information for asphalt and aggregate materials.
2. Submit mix design with laboratory test results supporting design.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Mixing Plant: Conform to State of North Carolina DOT standard.

B. Obtain materials from same source throughout.

C. Perform Work in accordance with State of North Carolina DOT standard.

D. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 5 years experience.

1.7 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.

B. Do not place asphalt mixture when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

C. Place asphalt mixture when temperature is not more than 15 degrees F less than initial mixing temperature.

## PART 2 - PRODUCTS

### 2.1 ASPHALT PAVING

#### A. Performance / Design Criteria:

1. Paving: Design for movement of trucks up to 60,000 lbs

#### B. Asphalt Materials:

1. Bituminous concrete prime coat, surface course, intermediate course, base and tack coat shall comply with the requirements of Division 6 of the NCDOT "Standard Specifications for Highway Construction," latest edition. Thickness shall be as shown on the Drawings.
2. Bituminous concrete surface course shall be S9.5B, intermediate course shall be I19.0B, and base course shall be B25.0B. Thickness shall be as shown on the Drawings.
3. Asphalt – Tack coat shall consist of either emulsified asphalt, or cutback asphalt, conforming to the above referenced NCDOT Specifications.

### 2.2 MILL AND OVERLAY

1. Mill the entire area a depth of 2.0"
  - a. Milling shall be in accordance with NCDOT Standard Specifications Section 607 "Milling Asphalt Pavement.
2. Overlay the entire shown with 2.0" S9.5C or 9.5B Asphalt Concrete Surface Course.
  - a. Butt joints are required with no feathering of joints.
3. All Milling and overlay indicated on the plans within NCDOT right of way edge of pavement shall be required for an entire lane width.

### 2.3 ACCESSORIES

- A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.

### 2.4 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 017300 "Execution": Requirements for installation examination.
- B. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

- C. Verify compacted subgrade subbase is dry and ready to support paving and imposed loads.
  - 1. Proof roll subbase with loaded 3-axel truck in minimum two perpendicular passes to identify soft spots.
  - 2. Remove soft subbase and replace with compacted fill as specified in Section 312000.
- D. Verify gradients and elevations of base are correct.
- E. Verify gutter drainage grilles and frames, manhole frames, and valve boxes are installed in correct position and elevation.

### 3.2 DEMOLITION

- A. Saw cut and notch existing paving as indicted on Drawings.
- B. Clean existing paving to remove foreign material, excess joint sealant and crack filler from paving surface.
- C. Repair surface defects in existing paving to provide uniform surface to receive new paving.

### 3.3 INSTALLATION

- A. Subbase:
  - 1. Remove loose and foreign material from compacted base course surface immediately before application of paving.
  - 2. Use power brooms or blowers, and hand brooming as required.
  - 3. Do not displace base course material.
- B. Primer:
  - 1. Uniformly apply at a rate of 0.20 to 0.5 gal. per sq. yd. over compacted and cleaned base course surface.
  - 2. Apply enough material to penetrate and seal, but not flood the surface.
  - 3. Allow to cure and dry as long as required to attain penetration and evaporation of volatiles, and in no case less than 24 hours unless otherwise acceptable to the Engineer.
  - 4. Blot excess asphalt with just enough sand to prevent pick-up under traffic.
  - 5. Remove loose sand before paving.
- C. Tack Coat:
  - 1. Apply tack coat on asphalt and concrete surfaces over subgrade surface at uniform rate.
    - a. New Surfaces: 0.05 to 0.15 gal/sq yd.
    - b. Existing Surfaces: 0.05 to 0.15 gal/sq yd.
  - 2. Apply tack coat to contact surfaces of curbs and gutters.
  - 3. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.

D. Single Course Asphalt Paving:

1. Install Work in accordance with NCDOT standards.
2. Place asphalt within 24 hours of applying primer or tack coat.
3. Place to thickness indicated on Drawings.
4. Compact paving by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
5. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

E. Curbs

1. Install extruded asphalt curbs of profile as indicated on Drawings.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Tolerances.
- B. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- C. Scheduled Compacted Thickness: Within 1/4 inch.
- D. Variation from Indicated Elevation: Within 1/2 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting, testing.
- B. Take samples and perform tests in accordance with NCDOT Standards.
- C. Asphalt Paving Mix Temperature: Measure temperature at time of placement.
- D. Asphalt Paving Thickness: ASTM D3549; test one core sample from every 1000 square yards compacted paving.
- E. Asphalt Paving Density: ASTM D1188 or ASTM D2726; test one core sample from every 1000 square yards compacted paving.

3.6 PROTECTION

- A. Section 017300 "Execution": Requirements for protecting finished Work.
- B. Immediately after placement, protect paving from mechanical injury for 24 hours or until surface temperature is less than 140 degrees F.

### 3.7 ATTACHMENTS

- A. Paving at Truck Ramp and Garbage Area: Single course of 3-1/2 inch compacted thickness, with surface slurry.
- B. Paving at Parking Areas: Two courses; binder course of 2-1/2 inch compacted thickness and wearing course of 1 inch compacted thickness.
- C. Paving at Rear Bus Loading Area: Thickness and compaction of subbase to support vehicles up to 30,000 lb.
- D. Paving Front Sidewalks: Thickness and compaction of subbase to support moderate pedestrian traffic.

END OF SECTION 321216



## SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Section 033000 Cast in Place Concrete.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Cold-applied joint sealants.
  - 2. Hot-applied joint sealants.
  - 3. Joint-sealant backer materials.
  - 4. Primers.

#### 1.3 UNIT PRICES

- A. Quantity of sealant shall be included in Cubic Yard measurement of concrete material.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: submit manufacturer certificate (data sheet) for each type of product and installation recommendations.
- B. Copies of test reports
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Paving-Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

- B. Product Testing: Perform testing of the materials in an approved independent laboratory and submit certified copies of the test reports for approval 15 days prior to the use of the materials at the job site.

## 1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When the temperature within the joint wall is outside limits permitted by joint-sealant manufacturer or is below 40 deg F
  - 2. When moisture is observed within the joint.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
  - 5. On the same day as sawing occurred

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Hot-Applied Joint Sealants

Provide joint sealants for various areas of the types indicated in the drawings and summarized below:

- 1. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type II or III.
- C. Cold-Applied Joint Sealants:
  - 1. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS.
- D. Joint-Sealant Backer Materials

Provide backer material that is a compressible, non-shrinking, non-absorbing material. Use backer material that is 20 to 30 percent larger in diameter than the nominal width of the joint. The backer material shall be nonreactive with the proposed joint sealant. The material shall have a melting point at least 5 degrees F (3 degrees C) greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. The material shall also have a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C1016.

- E. Primers:

1. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Inspect the application equipment to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Evidences of bubbling, or improper installation will result in suspending the operations until causes of the deficiencies are determined and corrected.

### 3.2 PREPARATION

- A. Removal of existing sealant: cut loose the in-place sealant from both joint faces and to the depth shown on the drawings, using the routing equipment, concrete saw, or waterblaster. Prior to further cleaning operations, remove all loose old sealant remaining in the joint opening by blowing with compressed air.
- B. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions. Thoroughly clean the joints to remove all laitance, curing compound, and protrusions of hardened concrete.
  1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- C. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

### 3.3 INSTALLATION

- A. Seal joints immediately following final cleaning of the joint walls and following the placement of the backup material. Open joints, that cannot be sealed under the conditions specified, or when rain interrupts sealing operations shall be recleaned and allowed to dry prior to installing the sealant.
- B. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless the installation instructions are modified by the Engineer.

- C. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
- D. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of joint-sealant backings.
  - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
  - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
  - 1. Place joint sealants so they fully contact joint substrates.
  - 2. Completely fill the joint from the bottom up to ¼ inch+/- 1/16<sup>th</sup> inch (6mm+/- 2.0mm) below the pavement surface.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
  - 4. Remove and discard excess or spilled sealant from the pavement by approved methods.
  - 5. Install the sealant in such a manner as to prevent the formation of voids and entrapped air.
  - 6. Traffic shall not be permitted over newly sealed pavement until authorized by the Engineer's representative.
- F. Tooling of Non-sag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
  - 1. Remove excess joint sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

### 3.4 PROTECTION

- A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
- B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 321373

## SECTION 321723 - PAVEMENT MARKINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes painted markings applied to asphalt and concrete pavement.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include technical data and tested physical and performance properties.
- B. Shop Drawings: For pavement markings.
  - 1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
  - 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of NCDOT for pavement-marking work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials 55 deg F for water-based materials, and not exceeding 95 deg F.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Columbia Paint & Coatings, Inc.; a subsidiary of Sherwin-Williams Company (The).
  - 2. Kelly-Moore Paint Company Inc.
  - 3. PPG Paints.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

### 2.3 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.
  - 1. Color: as required to meet NCDOT requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

### 3.2 ROADWAY MARKINGS

- A. Markings: Located as follows:
  - 1. Traffic control and pavement repair area as indicated shown on the Drawings for all NCDOT roadways. All marking shall be in accordance with NCDOT Standard Details and Specifications.
- B. Remove all surface dirt within the areas to be painted. Large areas of tar, grease or foreign materials may require sand blasting, steam cleaning or power brooming to accomplish complete removal. Do not proceed with the application of stripes until final authorization is received from the Engineer.

- C. Markings: Fast drying white water-borne traffic paint as follows:

Material Application Material	Line Temperature	Reflectorized Bead Thickness	Application
M7 .01.23	40 to 120 deg F	15 mils	6 lbs / gal

- D. Use no thinners for the above listed pavement marking applications except in accordance with the manufacturer's specifications and at the direction of the Engineer.
- E. Do not heat paint or pavement marking material above the temperature marked on the container.
- F. Bituminous concrete pavements must be in place for 48 hours prior to the application of pavement markings.
- G. If for any reason material is spilled or tracked on the pavement, or any markings applied, in the Engineer's judgement, fail to conform because of a deviation from the desired pattern, remove such material by a method that is not injurious to the roadway surface and is acceptable to the Engineer, clean the roadway surface and prepare the surface for a reapplication of markings and reapply the markings as directed without additional compensation for any of the foregoing corrective operations.

### 3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

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## SECTION 329119 - LANDSCAPE GRADING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Final grade topsoil for finish landscaping.

- B. Related Sections:

- 1. Section 310515 - Soils and Aggregates for Earthwork
  - 2. Section 312000 - Earthwork
  - 3. Section 312333 - Trenching and Backfilling

#### 1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Submittal procedures
- B. Materials Source: Submit name of any imported materials source.

#### 1.4 QUALITY ASSURANCE

- A. Furnish each topsoil material from single source throughout the Work.
- B. Perform Work in accordance with all Federal, State, and local standards.

### PART 2 - PRODUCTS

#### 2.1 MATERIAL

- A. Topsoil: Fill Type as specified in Section 310515.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 017300 – Execution: Verification of existing conditions before starting work.
- B. Verify building and trench backfilling have been inspected.
- C. Verify substrate base has been contoured and compacted.

### 3.2 PREPARATION

- A. Protect landscaping and other features remaining as final Work.
- B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

### 3.3 SUBSTRATE PREPARATION

- A. Eliminate uneven areas and low spots.
- B. Remove debris, roots, branches, stones, in excess of 2 inch in size. Remove contaminated subsoil.
- C. Scarify surface to depth of 6 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

### 3.4 PLACING TOPSOIL

- A. Place topsoil in areas where seeding is required. to nominal depth of 6 inches. Place topsoil during dry weather.
- B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
- C. Remove roots, weeds, rocks, and foreign material while spreading.
- D. Manually spread topsoil close to plant material, building, and other structures to prevent damage.
- E. Lightly compact placed topsoil.
- F. Remove surplus subsoil and topsoil from site.
- G. Leave stockpile area and site clean and raked, ready to receive landscaping.

### 3.5 TOLERANCES

- A. Section 014000 - Quality Requirements: Tolerances.

- B. Top of Topsoil: Plus or minus 1/2 inch.

### 3.6 PROTECTION OF INSTALLED WORK

- A. Section 017300 - Execution: Requirements for protecting finished Work.
- B. Prohibit construction traffic over topsoil.

END OF SECTION 329119

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## SECTION 329200 - TURF AND GRASSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Seeding.
  - 2. Hydroseeding.
  - 3. Erosion-control material(s).
- B. Related Requirements:
  - 1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

#### 1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer.

- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
  - 1. Certification of each seed mixture for turfgrass. Include identification of source and name and telephone number of supplier.
- C. Product Certificates: For fertilizers, from manufacturer.
- D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
  - 1. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
  - 2. Pesticide Applicator: State licensed, commercial.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in the Turfgrass Producers International's (TPI) "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.
- C. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Accompany each delivery of bulk materials with appropriate certificates.

## 1.8 FIELD CONDITIONS

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
  1. Spring Planting: March 1 through May 15.
  2. Fall Planting: September 1 through October 15.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

## PART 2 - PRODUCTS

### 2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with Association of Official Seed Analysts (AOSA's) "Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species:
  1. Quality: State-certified seed of grass species as listed below for solar exposure.
  2. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
    - a. Refer to Sheet C-D-6 for approved seeding and mulching

### 2.2 FERTILIZERS

- A. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the composition as shown on Sheet C-D-6.

### 2.3 LIME

- A. Description: Agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent.
- B. Comply with ASTM C 602.

## 2.4 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Material in "Asphalt Emulsion" Paragraph below may be used as a tackifier in a hydroseeding slurry or to temporarily bond straw mulch in place.
- C. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

## 2.5 PESTICIDES

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

## 2.6 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd. 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.
- C. Erosion-Control Mats: Cellular, nonbiodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel,



- paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
- 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
- 3. Uniformly moisten excessively dry soil that is not workable, or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Engineer and replace with new planting soil.

### 3.2 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
  - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
  - 2. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

### 3.3 LIMING AND FERTILIZING

- A. Apply lime at application rate recommended by soil analysis.
- B. Work lime into top 6 inches of soil.
- C. Apply fertilizer at application rate recommended by soil analysis.
- D. Apply fertilizer after smooth raking of topsoil and prior to installation of sod.
- E. Mix fertilizer thoroughly into upper 4 inches of topsoil.
- F. Lightly water soil to aid dissipation of fertilizer.

### 3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Turf Area Preparation" Article.
- B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.

- D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

### 3.5 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
  - 1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
  - 2. Do not use wet seed or seed that is moldy or otherwise damaged.
  - 3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 3 to 4 lb/1000 sq. ft..
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with erosion-control mats where indicated on Drawings; install and anchor according to manufacturer's written instructions.
- F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
  - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
  - 2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft.. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

### 3.6 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, slow-release fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
  - 1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
  - 2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

### 3.7 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
  1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
  2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
  3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
  1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
  2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.

### 3.8 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Engineer:
  - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

### 3.9 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

### 3.10 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove nondegradable erosion-control measures after grass establishment period.

### 3.11 MAINTENANCE SERVICE

- A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
  - 1. Seeded Turf: 60 days from date of Substantial Completion.
    - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

END OF SECTION 329200

**Division 33**  
**Utilities**



## SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping joining materials.
  - 2. Transition fittings.
  - 3. Sleeves.
  - 4. Tapping Saddles.
  - 5. Corporation Stops.
  - 6. Identification devices.
  - 7. Piped utility demolition.
  - 8. Piping system common requirements.
  - 9. Painting.
  - 10. Grouting
- B. Related Requirements:
  - 1. 330513 Manholes and Structures
  - 2. 330519 Ductile Iron Utility Pipe
  - 3. 330526 Utility Identification
  - 4. 330531.16 Polyvinyl Chloride Pressure Pipe
  - 5. 330533.23 Polyethylene Pressure Pipe

#### 1.3 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- C. ABS: Acrylonitrile-butadiene-styrene plastic.
- D. PE: Polyethylene plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. DIP: Ductile Iron Pipe

- G. PCCP: Prestressed Concrete Cylinder Pipe
- H. RCP: Reinforced Concrete Pipe

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Identification devices.
  - 2. Sleeves
  - 3. Painting

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

#### 1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### 1.8 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.



- C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete."

## PART 2 - PRODUCTS

### 2.1 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping will not be allowed. Ductile iron fittings in compliance with AWWA C110 will only be allowed.

### 2.2 TRANSITION FITTINGS

- A. HDPE to Mechanical Joint adapters shall be required when transitioning from HDPE piping to mechanical joints.
  - 1. Adapters shall conform to ductile iron pipe sizes (DIPS) and shall be SDR 11 or DR 9
  - 2. Adapters shall be in accordance with AWWA C906 and ASTM D3261
  - 3. Adapters shall be manufactured by Drisco, Central, Fife or approved equal
- B. Fusible PVC shall utilize Sleeves as specified in this Specification Section.

### 2.3 SLEEVES

- A. Provide couplings where needed to make piping connections

- B. Provide full length, mechanical joint, ductile iron solid sleeve with twelve (12) inch minimum length. Provide ductile iron cut-in sleeve with mechanical restrained joints where installing fittings in an existing line
  - 1. Sleeves shall comply to AWWA C110 and AWWA C219
  - 2. Sleeves shall be manufacturer fabricated and approved for installation on the specific main line pipe material including but not limited to ductile iron, plastic, cast iron, HDPE etc.
  - 3. Mechanical restrained joints shall be wedge action, ductile iron per ASTM A536 as manufactured by EBAA Iron Series 1100 Megalug or equal
  - 4. Sleeves shall match the working maximum working pressure of the main line piping
  - 5. Sleeve shall have fusion bonded epoxy coating in accordance with ANSI/AWWA C116/Aw1.16 and shall be applied to interior and exterior surfaces.

## 2.4 TAPPING SADDLES

- A. Provide tapping saddles for air release valves as shown on Drawings
  - 1. Tapping saddles shall be type 304 stainless steel or better with valve and nipple same material
  - 2. Tapping saddles shall be manufacturer fabricated and approved for installation on the specific main line pipe material including but not limited to ductile iron, plastic, cast iron, HDPE etc.
  - 3. Tapping saddles shall match the working maximum working pressure of the main line piping
  - 4. Fabricated steel shall meet ASTM A36
  - 5. Tapping saddles shall be Cascade CS22 series or equal

## 2.5 CORPORATION STOPS

- A. Provide corporation stops for air release valves and water services as shown on Drawings
  - 1. Corporation stop shall have AWWA inlet threads, ball type, outlet connection to be CTS/OD, conductive compression type (grip nut).
  - 2. Size of corporation stop shall match that of tapping saddle.
  - 3. Corporation stops shall be Mueller B 25028, Ford – Ball Corp FB 1100 or 1000, McDonald – Ball Corpor 4704-BT, or approved equal

## 2.6 IDENTIFICATION DEVICES

- A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.
- B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
  - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
  - 2. Location: Accessible and visible.

- C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
- D. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.
- E. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
- F. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
  - 1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.
- G. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.
  - 1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
  - 2. Color: Comply with ASME A13.1, unless otherwise indicated.
- H. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.
  - 1. Material: 0.0375-inch- thick stainless steel.
  - 2. Shape: As indicated for each piping system.
- I. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

## PART 3 - EXECUTION

### 3.1 PIPED UTILITY DEMOLITION

- A. Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
  - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.

5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 3.2 PIPING INSTALLATION

- A. Install piping according to the following requirements and utilities Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  1. Steel Pipe Sleeves: For pipes smaller than NPS 6.
  2. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
- J. Verify final equipment locations for roughing-in.
- K. Refer to equipment specifications in other Sections for roughing-in requirements.

### 3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- H. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- K. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End PE Pipe and Fittings: Use butt fusion.
  - 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

### 3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.5 EQUIPMENT INSTALLATION

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

### 3.6 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.7 IDENTIFICATION

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
  - 1. Stenciled Markers: According to ASME A13.1.
- B. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

### 3.8 GROUTING

- A. Refer to Section 036000 for Grouting
- B. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- C. Clean surfaces that will come into contact with grout.
- D. Provide forms as required for placement of grout.
- E. Avoid air entrapment during placement of grout.
- F. Place grout, completely filling equipment bases.
- G. Place grout on concrete bases and provide smooth bearing surface for equipment.
- H. Place grout around anchors.
- I. Cure placed grout.

END OF SECTION 330500

## SECTION 330507.13 - UTILITY HORIZONTAL DIRECTIONAL DRILLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Excavation for approach trenches and pits.
2. Horizontal directional drilling (HDD) Midi & Maxi.
3. Pipe.
4. Drilling fluid system.
5. Staging areas.
6. Spoils disposal.

- B. Related Requirements:

1. Section 310515 "Soils and Aggregates for Earthwork" for soil and aggregate materials.
2. Section 312319 "Dewatering" for lowering and disposing of groundwater during construction and dewatering excavations for dewatering and drainage.
3. Section 312333 "Trenching and Backfilling" for trenching, backfilling, and compaction in trench excavations.
4. Section 315000 "Excavation Support and Protection" for temporary support of excavations.

#### 1.3 DEFINITIONS

- A. Annular Space: Space between the HDD final reamed bore diameter and the product.
- B. Bent Sub: A section of drill pipe behind the cutting tools that is inclined at an angle of one to three degrees from the axis of the bore in the desired direction of steering. The bent sub allows steering while rotating the cutting tools.
- C. Break-Away Connection: A connection to the product pipe that will fail at a pull force less than the rated stresses that is acceptable for the product pipe.
- D. Conductor Casing: A short length of large-diameter casing set to provide ground support at the entry and exit point, if necessary.

- E. Drilling Fluid/Mud: A mixture of water, bentonite, and/or polymers continuously pumped to the drilling tools to facilitate the removal of soil cuttings, and stabilization of the bore. These fluids also cool the cutting tools and lubricate the drill pipe and product pipe string.
- F. Drill String: Total length of the drill pipe in the borehole.
- G. Drilling Tool/Bit: A tool or system of tools which excavates at the face of a bore.
- H. Entry Pit: Location where the pilot bore initially penetrates the ground surface and where the HDD rig is positioned.
- I. Exit Pit: Location where the pilot bore exits the ground surface.
- J. Horizontal Directional Drilling: A surface-launched, guided, steerable drilling system used for the trenchless installation of pipes, conduits, and cables.
- K. Hydrolock: Loss of drilling fluid flow and the resulting inability to advance or retract drilling tools or pipe. Inadvertent Return: Uncontrolled flow of drilling fluid/mud to the surface at a location other than the entry pit or exit pit. In certain conditions, this may also be known as hydrofracture or frac-out.
- L. Pilot Bore: Action of creating the first guided pass of the HDD process which is then reamed in one or more passes to the size required to allow pullback of the pipe.
- M. Pullback: Part of a horizontal directional drilling process in which the drill pipe, swivel, and product pipe or cable is pulled back through the bore to the entry.
- N. Pullback Loads: Loads (forces) applied to a drill string and product pipe during the pullback process which also includes tensile pullback loads, bending, buckling and combination loads.
- O. Reamer: A cutting tool pushed or pulled through the borehole in order to enlarge the pilot bore hole to a diameter sufficient for the installation of the product pipe.
- P. Tracer Wire: Wire used to track the drill string, achieved by using a downhole wireline survey tool.

#### 1.4 COORDINATION

- A. Section 013100 – Project Management and Coordination: Requirements for coordination.
- B. Coordinate Work of this Section with North Carolina Department of Transportation and utilities within construction area.
- C. Advance Notices and Inspections: Provide at least 72 hours advance written notice to the Engineer of the major drilling activities, including pilot bore launch, pre-reaming, reaming, and pipe pullback. Notify the Engineer immediately, in writing, when significant problems are encountered or if ground conditions are considered to be materially and significantly different than those represented by the geotechnical data.
- D. Work shall be performed in the presence of the Engineer, unless Engineer grants prior written approval to perform such Work in Engineer's absence.



- E. Certified Work Zone Traffic Control Plan: Submit a control plan for proposed traffic lane or sidewalk diversions or closures. Plans shall depict detailed sequences and requirements for traffic control devices required, dimensioned positions of devices, and pavement striping. Before construction of work in the public right-of-way, coordinate with North Carolina Department of Transportation and local authorities as applicable for traffic lane diversions or closures and obtain their permits or written approvals.
- F. At least 15 working days prior to mobilization for HDD operations, submit a detailed schedule for the HDD installation showing major construction activities and durations, with beginning and completion dates shown. Update the schedule at least every week or more frequently, as directed by the Engineer, and include:
  - 1. “One call” utility locate requests and visual confirmation of crossing utilities and parallel utilities within the vicinity of the bore centerline.
  - 2. Risk mitigation meetings
  - 3. Rig mobilization and setup.
  - 4. Installation of conductor casing.
  - 5. Pilot bore drilling.
  - 6. Pre-reaming and reaming.
  - 7. Layout and fusing/welding/assembly of pipe.
  - 8. Pressure testing of pipe prior to pullback.
  - 9. Final reaming and pullback of pipe.
  - 10. Contact grouting.
  - 11. Pressure testing of pipe after installation.
  - 12. Pig test.
  - 13. Cleanup, surface restoration, and demobilization.

## 1.5 RISK MITIGATION MEETINGS

- A. Section 013100 – Project Management and Coordination: Requirements for preinstallation meeting.
- B. Convene minimum of one week prior to commencing Work of this Section.
- C. Risk Mitigation Meetings: At least 15 working days prior to the long HDD near the river (i.e., approximate 1,050 linear foot HDD included on Sheets C-CP-25 to C-CP-27), the Contractor and HDD superintendent shall attend a risk mitigation meeting with representatives of the Engineer and Owner for the HDD crossing to discuss major operational milestones.
  - 1. The construction segments of the work requiring a risk mitigation meeting include the following:
    - a. Work for the long HDD near the river (i.e., approximate 1,050 linear foot HDD included on Sheets C-CP-25 to C-CP-27).
  - 2. Specific risk mitigation meetings shall be held and include a discussion of the following as a minimum:
    - a. Prior to drilling of pilot-hole to discuss the following at a minimum:
      - 1) Rig mobilization and setup.
      - 2) Pilot bore drilling.
    - b. Prior to reaming to discuss the following at a minimum:
      - 1) Pre-reaming and reaming.

- 2) Layout and fusing of pipe.
- c. Prior to pullback to discuss the following at a minimum:
  - 1) Pressure testing of pipe prior to pullback.
  - 2) Final reaming and pullback of pipe.
  - 3) Layout of pipe in the river including mobilization of cranes, excavator and barges, as required for the Work.
- d. Prior to testing to discuss the following at a minimum:
  - 1) Pressure testing of pipe after installation.
  - 2) Pig test.

## 1.6 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
  - 1. Identify source of water used for drilling.
  - 2. Submit copy of approvals and permits for use of water source.
- C. Qualifications.
- D. Schedule.
- E. Daily logs and records.
- F. Construction Records.
- G. Safety Plan: Submit a Safety Plan, including the name of the Site Safety Representative, emergency telephone numbers for medical facilities, and precautions for handling and disposal of hazardous or flammable materials. The Safety Plan shall include a code of safe practices and an emergency plan in accordance with OSHA requirements.
- H. Permits

## 1.7 DELEGATED DESIGN SUBMITTALS:

- A. Submittals as indicated in the following Paragraphs shall be signed and sealed by a licensed Professional Engineer registered in the State of North Carolina. The Contractor's Design Engineer shall complete the P.E. form included in Section 013300.
- B. Provide sufficient detail to allow the Engineer to evaluate whether or not the proposed equipment, materials, and procedures will meet the Contract requirements. The Engineer's review of submittal details and data will be based on considerations for the completed Work, utilities, and the possibility of necessary delays in the execution of the Work to be constructed under this Contract.
- C. Unless otherwise noted, Shop Drawings shall have been reviewed and accepted by the Engineer prior to the mobilization of HDD equipment. Drawings to be legible with dimensions accurately shown and clearly marked in English.

- D. Combine submittals at discretion but at a minimum the following information shall be addressed and provided for review.
1. Methods, Equipment, and Materials Description Plan.
  2. Surveying Equipment and Procedures.
  3. Protection of Adjacent Structures and Facilities Plan.
  4. Contingency Plan for Remediation of Potential Problems.
  5. Disposal of Spoils and Drilling Fluids Plan.
  6. Equipment Layout Plan.
  7. Inadvertent Return and Surface Spill Contingency Plan.
  8. Horizontal Directional Drilling Work Plan.
  9. Soil Separation Plan.
  10. Maximum Allowable Drilling Fluid Pressure Calculations.
  11. Pipe Filling Methods and Testing.
  12. Pipe Stress Calculations.
  13. Pullback Calculations.
  14. Radius of Curvature Confirmation.
  15. Rig Capacity Plan.
  16. Contact Grouting Plan.
  17. Certified Work Zone Traffic Plan.
- E. Methods, Equipment, and Materials Description Plan:
1. Submit detailed descriptions of methods, equipment, and materials to be used for the pipeline installation.
  2. Describe drilling fluid additives accompanied by Safety Data Sheets (SDS) and Manufacturers' descriptions and warranties.
  3. Describe equipment including Manufacturers' specifications, calibrations, appropriate drawings, photographs, and descriptions of modifications since manufacture.
  4. Include the means for complying with local noise ordinances.
- F. Surveying Equipment and Procedures: Submit records of equipment calibrations and certifications for equipment used for downhole surveys and tracking of the drill head. Procedures for operating the downhole survey tools shall be described, including measures to verify the accuracy of the equipment readings. Procedures for layout of wire grid system shall also be provided.
- G. Submit a plan that provides details on measures to be taken to monitor and protect adjacent utilities, structures, roadways and sidewalks, and provide details on monitoring equipment and provisions, including the layout of settlement and other monitoring points. Provide two copies of pre-construction video, pre-construction survey of adjacent structures and photographs with captions to document pre-construction conditions prior to beginning HDD construction. Be solely responsible for the identification, location and monitoring, including frequency, of all existing utilities, structures, roadways and sidewalks in addition to any monitoring points that may be indicated
- H. Contingency Plan for Remediation of Potential Problems: Submit a Contingency Plan for Remediation of Potential Problems that may be encountered during the drilling operations. The contingency plan shall address the observations that would lead to the discovery of the problem and the methods that would be used to mitigate the problem. Potential problems that shall be addressed in this Plan include, but are not limited to, the following:

1. Loss of returns/loss of circulation of drilling fluids.
  2. Inadvertent returns/hydrofracture or surface spills resulting in drilling fluids entering water or reaching the surface. Stand-by equipment shall be in place and provided to recover fluids at all times during drilling operations. Turbidity barriers or other appropriate methods of containing and clean-up shall be part of the stand-by equipment to minimize dispersion in the event that drilling fluids reach the surface. Submit letter signed by an authorized representative confirming that the Plan will be followed. If required by permit conditions, revise the Plan as necessary to satisfy the associated regulatory agency.
  3. Encountering obstruction during pilot bore or reaming/pullback.
  4. Drill pipe or product pipe cannot be advanced.
  5. Deviations from design line and grade and/or from the planned bore path exceed allowable tolerances.
  6. Drill pipe or product pipe broken off in borehole.
  7. Product pipe collapse or excessive deformation.
  8. Utility strike.
  9. Hydrolock occurs or is suspected.
  10. Excessive ground settlement or heave.
- I. Disposal of Spoils and Drilling Fluids Plan: Submit Plan for disposal of waste materials resulting from the pipeline construction, including drilling fluids, cuttings, waste oil, fuel, discharge water, etc. Identify the disposal site(s) and submit a letter indicating willingness and legal authority to accept the described and anticipated waste products.
- J. Equipment Layout Plan: Submit a plan which provides sketches depicting the layout and locations of equipment within the rig side work area and pipe side work area, including proposed drilling fluid containment and recirculation pits. The equipment layout plan shall include the area to fuse the pipe for the river pullback, locations of any cranes, barges, tugboats, etc. required for the river pullback. Confirm that operations shall be completely contained within the right-of-way, permanent and temporary construction easement shown on the Drawings.
- K. Horizontal Directional Drilling Work Plan: Submit an HDD Work Plan complete with Drawings and written description identifying details of the proposed method of construction and the sequence of operations to be performed during construction including placement, entry and exit points.
1. Plan shall include a detailed plan and profile of the bore (planned bore path), showing utilities and structures and plotted. Proposed deviations from the Drawings shall be shown.
  2. HDD Work Plan shall provide details of the planned bore path and the method for monitoring and controlling the speed, line, grade and rate of fluids delivery. It shall include the sequence, size, and description of each reamer and capabilities of each through anticipated subsurface conditions. The drill plan shall also include details on the swabbing of the borehole prior to pullback of the pipe.
  3. HDD Work Plan shall include a pullback plan with details of staging during pullback and buoyancy modification procedure.
  4. Submit a contingency plan to implement in the event of flooding conditions including protection, mooring and/or removal of equipment within the river. Include proposed procedures for monitoring river levels during the course of the work and provide a timeline for implementing flood contingency plans.

- L. Soil Separation Plan: Submit details on the pump and soil separation plant. Include dimensions, manufacturer's specifications, pump capacity, noise rating, and soundproofing details on the system.
1. Pump capacity shall be specified for water at sea level elevation and adjusted for actual elevation and fluid viscosity.
  2. Provide details on the generator, including dimensions, noise ratings at 25 feet, and soundproofing. Confirm that the generator and other on-site equipment can be operated without exceeding the maximum allowable noise tolerances specified in the Contract Documents.
- M. Maximum Allowable Drilling Fluid Pressure Calculations:
1. Identify the critical downhole pressure that would cause hydrofracture or inadvertent return of drilling fluid.
  2. Identify the critical points in the alignment beneath the creeks and near the exit point where the soil cover above the bore is low.
  3. Identify parameters used and state assumptions made in the calculations.
  4. The calculations shall be signed and sealed by a Professional Engineer registered in the State of North Carolina.
- N. Pipe Filling Methods and Testing: Submit methods and procedures for filling the pipe with water during pullback, if necessary, and testing, See the requirements in Paragraph 3.7 I.
- O. Pipe Stress Calculations:
1. Submit calculations for pipe stresses expected to result from the pullback, bending, buckling loads, earth loads, groundwater loads, and other installation and service loads expected to be exerted on the pipe.
  2. Identify parameters and state assumptions made in the calculations including the radius of curvature, assumed drilling fluid weights, whether pipe is assumed to be filled or empty during pullback, and temperature. These calculations shall be signed and sealed by a Professional Engineer registered in the State of North Carolina.
- P. Pullback Calculations:
1. Submit calculations for pullback loads for the conditions and operating practices anticipated.
  2. In addition to the tensile pullback loads, bending, buckling and combination loads shall be considered in design.
  3. The calculations shall identify parameters used and state assumptions made in the calculations. These calculations to be signed and sealed by a Professional Engineer registered in the State of North Carolina.
- Q. Radius of Curvature Confirmation: Confirm that the bore can be completed using the radius of curvature and geometry shown on the Drawings along with the calculations showing that installation stresses do not exceed allowable pipe stresses. Submit temporary bend radii of product pipe for river pullback to confirm that the short-term radii of curvature are within manufacturer specifications.

- R. Rig Capacity Plan: Submit a plan which provides details on the capacity of the drill rig verifying that the pullback capacity is greater than the required pullback calculated and submitted under Paragraph 1.7.P.
- S. Contact Grouting Plan: Submit descriptions of methods, equipment, and materials to be used for contact grouting areas where over-excavation, aborted bores, voids, or cavities are created or encountered during construction.

## 1.8 CLOSEOUT SUBMITTALS

- A. Section 017700 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of pipe and centerline elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- D. Record actual depth of pipe at 20-foot intervals.
- E. Record actual horizontal location of installed pipe.
- F. Show depth and location of abandoned bores.
- G. Record depth and location of drill bits and drill stems not removed from bore.

## 1.9 QUALITY ASSURANCE

- A. Perform Work according to following standards:
  - 1. API Specifications 13A. Specification for Drilling Fluid Materials, American Petroleum Institute.
  - 2. API Recommended Practice 13B-1. Recommended Practice for Field Testing Water-Based Drilling Fluids, American Petroleum Institute.
  - 3. API Recommended Practice 13B-2. Recommended Practice on the Rheology and Hydraulics of Oil-Well Drilling Fluids, American Petroleum Institute.
  - 4. API Recommended Practice 13L, Second Edition, November 2017. Training and Qualification of Drilling Fluid Technologists, American Petroleum Institute.
  - 5. ASTM F1962. Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings.
  - 6. NASST - Horizontal Directional Drilling Good Practices Guidelines, HDD Industry Consortium.
  - 7. IADC Drilling Manual, 1992. Eleventh Edition, Houston, Texas, International Association of Drilling Contractors.
  - 8. CPAR-GL-98-1, April 1998. Installation of Pipelines Beneath Levees Using Horizontal Directional Drilling, US Army Corps of Engineers, Waterways Experiment Station, Final Report,
  - 9. PR-227-9424, April 1995. Installation of Pipelines by Horizontal Directional Drilling, Pipeline Research Committee, American Gas Association.

10. PPI TR-46 - Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe.
11. ASCE Manuals and reports on Engineering Practice No. 108, 2005. Pipeline Design for Installation by Horizontal Directional Drilling,

B. Surveying Equipment and Procedures: Surveying equipment used for downhole surveying and tracking of the bore path and drill head shall be inspected and calibrated by the equipment manufacturer prior to use. Proof of this inspection and calibration shall be provided to the Engineer prior to commencement of drilling operations.

#### 1.10 QUALIFICATIONS

- A. Contractor Qualifications and Experience: The Contractor or the subcontractor who will perform the HDD work shall meet the following minimum qualifications:
1. Be licensed in the State of North Carolina as an underground utility Contractor for a minimum of five years.
  2. Demonstrated at least ten years of successful experience installing pipelines by the means of HDD.
  3. Experience of employees on projects with previous employers or where subcontractors were hired to perform the HDD cannot be used to meet requirements.
  4. Experience shall include:
    - a. HDD installations 25 feet or deeper.
    - b. Pipe of diameter of at least 24 inches.
    - c. Installation of a minimum length 1,000 ft.
  5. Provide information on three successfully completed, wet (i.e., HDD drills completed from within a water body such as a river, lake, bay, etc. and the pipe was floated within the water body prior to pullback activities) utility projects where the carrier pipe was installed with HDD techniques meeting the following criteria:
    - a. Carrier pipe type: HDPE or FPVC.
    - b. Carrier pipe nominal diameter of at least 24-in.
    - c. Minimum length of 1000 linear feet in a single pull through soil.
    - d. Provide the following for each project:
      - 1) Project Description.
      - 2) Depth of pipe at deepest point.
      - 3) Was carrier pipe restrained joint?
      - 4) Pipe Diameter, Length, Material, DR.
      - 5) Bore Length.
      - 6) Identify Minimum length of linear feet in a single pull through soil?
      - 7) Soil Types.
      - 8) Owners' contact information.
      - 9) Engineers contact information.
      - 10) Change Orders.
      - 11) Scheduled Completion Date and Actual Completion Date.
  6. The superintendent for this Project shall have at least ten years of successful experience using the HDD process, with at least one project requiring floatation of pipe string in water body prior to pullback.
  7. HDD equipment operator for this Project shall have at least five years of successful experience using the HDD process, with at least one project meeting the criteria of Paragraph 1.10.A.5.

B. HDD Contractor shall be one of the following:

1. Carson Corporation  
171 Route 94  
Lafayette, NJ 07848  
(973) 579-4100
2. Delta Directional LLC  
9027 Eastside Drive  
Newton, MS 39345  
(601) 683-0879
3. Laney Directional Drilling Co.  
831 Crossbridge Drive  
Spring, Texas 77373  
(281) 540-6615
4. Mears Horizontal Directional Drilling  
5051 Westheimer Road, #1650  
Houston, TX 77056  
(281) 448-2488
5. Michels  
817 Main Street  
Brownsville, WI 53006  
(920) 583-3132

C. Furnish resumes of the superintendent(s) and key personnel. Personnel experience records shall include project names, locations, pullback lengths, ground conditions, pipe materials, project description, project Owner, Engineer, and references with names, addresses, and telephone numbers. The superintendent listed in the submittal shall be on site during construction related activities required for the HDD installation for this Project. Do not alter personnel assigned to the Project without prior written approval from the Engineer and Owner.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Handling:
  1. Support pipes with nylon slings during handling.
- D. Storage:
  1. According to manufacturer instructions.
  2. Stack piping lengths no more than three layers high.



E. Protection:

1. Protect pipe from entry of foreign materials and water by installing end caps and closures completing sections of Work, and isolating parts of completed system.
2. Provide additional protection according to manufacturer instructions.

1.12 EXISTING SUBSURFACE CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

B. Engineer has relied upon geotechnical data for general information purposes only and the geotechnical report is not part of the Contract Documents. Owner and Engineer do not assume responsibility for variations of subsurface conditions at locations other than places shown and at the time the investigation was made. Contractor is cautioned of the potential for inadvertent returns at the time of drilling and the potential for loss of circulation during drilling operations.

C. Locations and depictions of existing utilities on the Drawings are shown based on best available information. Contractor is responsible for any and all additional geotechnical or subsurface investigation necessary to execute the proposed Work safely and with no impact to existing infrastructure.

PART 2 - PRODUCTS

2.1 HORIZONTAL DIRECTIONAL DRILLING

A. Performance and Design Criteria:

1. Drilling Steering System: Remote with continuous electronic monitoring of boring depth and location.
2. Ratio of Reaming Diameter to Pipe Outside Diameter:
  - a. Nominal Pipe Diameter Larger than 6 Inches: Submit recommended ratio and reaming procedures for review by Engineer.

B. Drill Rig Capacity: The capacity of the directional drilling system shall be adequate to install the specified pipeline.

C. Pump Capacity: The pumps used shall be adequate to supply the required flow rate and pressures at the anticipated drilling fluid viscosity at all times.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Provide equipment, materials, and personnel necessary for completing the installation as shown on the Drawings and specified herein. The equipment and materials shall include but are not limited to:
  - 1. Directional drilling rig with ancillary equipment, including drill pipe, drilling fluid, cutting tools, reaming bits, swivels, expanders, motors, pumps, hoses, mixing equipment, drilling fluid processing equipment (cuttings separation equipment), downhole survey equipment, fluid pressure and flow rate monitoring equipment, spare parts, pipe handling equipment (cranes, backhoes, rollers, side boom tractors) control equipment, and office equipment.
  - 2. Drilling fluids, water, fuel, lubricant, polymers, or other additives.
  - 3. Other expendable or reusable materials, supplies, and equipment needed for the installation.
- B. Drilling equipment shall be capable of advancing through the subsurface conditions to be encountered at the site, as described by the geotechnical data and as anticipated.
- C. Drilling fluid shall be designed for the subsurface conditions to be encountered along the bore path, as described in the geotechnical data and as anticipated.
- D. Drilling system shall include a fluid pump and separation plant that can achieve the rates of drilling fluid pumping, spoil separation, and slurry cleaning required to achieve planned production rates for the soils described in the geotechnical data, and as anticipated. Shaker screens and hydro-cyclones may be required for efficient separation of spoils. Be advised that the separation plant shall fit within the allowable Work areas shown on the Drawings, or in areas obtained with written approval from the affected property owner(s).
- E. Spoils and slurry shall be contained in trucks, tanks, accepted recirculation pits, or other containers at all times. Dumping of spoil or slurry on the ground, discharge into sewers, or discharge into the water bodies will not be permitted.
- F. Spoils will be transported and disposed of off-site at an accepted disposal facility that meets State of North Carolina and local requirements.
- G. Perform Work within Work areas shown on the Drawings or in areas obtained by with written approval from the affected property owner.
- H. Pipeline shall be installed using the radii of curvatures and entry and exit angles as specified herein, or as shown on the Drawings, unless deviations are accepted in writing by the Engineer.
- I. For sections of pipe that are to be fused/welded, pipe rollers and lifters will be required to help the transition of the carrier pipe into the bore and to minimize the pull force. The number of pipe rollers and lifters shall be determined in accordance with the pipe supplier's recommendations. Location and spacing of the rollers and lifters will be done in accordance with the pipe manufacturer's recommendations based on bend radius and to protect pipe during pullback over hard or sharp surfaces. Pipe rollers and lifters will be in a condition so not to damage the pipe during construction activities. In addition, should work be required in the river,

the Contractor shall supply any barges, cranes, excavators, etc. that are required to facilitate pullback from the river to the pipe entry location.

- J. The fused/welded fabricated pipe will be pressure-tested prior to pullback using a low-pressure air test of 3.5 to 5 pounds per square inch of pressure to check for potential leaks in accordance with the manufacturer's instructions. Installed in-place carrier pipe will be hydrostatically pressure tested after installation is completed in accordance with Section 330531.16 "Polyvinyl Pressures Pipe" or Section 330533.23 "Polyethylene Pressure Pipe".
- K. Allow access to the Owner and/or Engineer and furnish necessary assistance and cooperation to aid the Engineer in observations and data and sample collection, including, but not limited to the following:
  - 1. The Owner and/or Engineer shall have full access to the operator control container prior to, during, and following HDD operations. This shall include, but not be limited to, providing visual access to real-time operator control screens, gauges, and indicators.
  - 2. The Owner and/or Engineer shall have full access to the slurry separation plant prior to, during, and following HDD operations. This shall include, but not be limited to, full access to shaker screens, hydrocyclones, conveyor belts, and slurry and spoil holding tanks. The Engineer shall be allowed to collect soil samples from the shaker screens and/or spoil holding tanks on the slurry separation plant a minimum of once per installed pipe section, and whenever changes in conditions are observed or suspected. If requested, assist in the collection of these samples as directed by the Engineer.
- L. Comply with local noise ordinances. Sound levels in excess of these values are sufficient cause to have the Work halted until equipment can be quieted to these levels. Submit a Plan identifying noise reduction/abatement procedures prior to construction. The Plan will be reviewed by the Engineer prior to construction.
  - 1. If mufflers cannot achieve the necessary noise reduction, noise abatement shall be accomplished by installation of baffles (or other acceptable means) positioned to break line-of-sight from the noise source to affected residences and/or commercial structures. Minimum noise abatement measures shall consist of equipping engines with hospital grade mufflers or silencers

## 2.3 WATER

- A. Secure a suitable source of water, and shall be responsible for transporting, storing, and disposing of water required.
- B. Source of water for the HDD operations is the Owner's potable water system. The Owner will provide a hydrant meter. Pay a refundable deposit fee for the hydrant meter which will be returned when the hydrant meter is returned to the Owner. Be responsible for paying associated water usage fees and providing temporary piping, isolation valves, backflow preventer and connections for his use.

## 2.4 UNDERGROUND PIPE MARKERS

- A. Trace Wire: Electronic detection materials for nonconductive piping products.
  - 1. 10 AWG solid.
  - 2. Conductor:
    - a. Hard-drawn, 21% IACS, copper-clad steel, utilizing an AISI 1055 high carbon steel core with minimum break load of 1,940 lbs or 238,000 psi (required to meet break load).
    - b. Extruded with 45 mil, high density, high molecular weight polyethylene (HMW-HDPE) cover/coating pursuant to ASTM D1248.
  - 3. Rated for direct burial use at 30 volts and RoHS compliant.
  - 4. PRO-TRACE HDD-CCS PE45 as manufactured by Pro-Line Safety Products or approved equal.

## 2.5 MATERIALS

- A. Drilling Fluid:
  - 1. Select drilling fluid mixture proportions to ensure continuous circulation, bore stability, reduce drag on the pipe, and completely fill the annular space between the bore and the pipe to control settlement. Be responsible for management and disposal of drilling fluid. Drilling fluids shall not be disposed of on-site or discharged to sanitary or storm sewers, the waterways or adjacent wetlands.
- B. Drill Pipe
  - 1. Provide high quality drill pipes that have been inspected and determined to be adequate for the Project requirements. Bent, racked, or fatigued drill pipes shall not be used. Threads shall be in good condition. The length of each drill pipe shall be measured and recorded.
- C. Carrier Pipe
  - 1. Provide carrier pipe in accordance with Section 330531.16 "Polyvinyl Pressures Pipe" or Section 330533.23 "Polyethylene Pressure Pipe".
  - 2. Pipe thickness shall conform to the most conservative design with respect to design calculations for the critical combination of internal and external pressure, pullback and bending. The carrier pipe shall not be greater than the dimension ratio (DR) specified in Section 330531.16 "Polyvinyl Pressures Pipe" or Section 330533.23 "Polyethylene Pressure Pipe".

## 2.6 CEMENT GROUT

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 017300 - Execution 3: Requirements for installation examination.

### 3.2 PREPARATION

- A. Section 017300 - Execution: Requirements for installation preparation.
- B. Call local utility line information service at North Carolina 811 not less than three working days before performing Work.
  - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- C. Maintain access to existing facilities indicated to remain; modify pipe installation to maintain access to existing facilities.
- D. Locate and identify utilities indicated to remain and protect from damage.
- E. Identify required lines, levels, contours, and data locations.
- F. Protect plant life, lawns, and other features remaining as portion of final landscaping.
- G. Protect benchmarks and survey control points from excavating equipment and vehicular traffic.

### 3.3 GENERAL

- A. Provide adequate control of surface water and drilling fluids drainage and runoff, and provide silt fences, hay bales, and wattles to prevent surface water or drilling fluids from being transported off-site.
- B. Provide barricades, fencing, or other safety measures to prevent public access into Work and staging areas.

### 3.4 PROTECTION OF UNDERGROUND UTILITIES

- A. Contract Drawings show existing buried utilities that are believed to be near the directional drill alignment. There is no guarantee that these utilities are located as shown or that other utilities are not present. Field locate nearby utilities or other potential subsurface obstructions that may interfere with the Work.
- B. Notify North Carolina 811 system to request marking of utilities that subscribe to North Carolina 811, and individually notify other known or suspected utilities to request marking of these utilities. Confirm that requested locates are made prior to commencing drilling operations. Make diligent efforts to locate unmarked or abandoned utilities using available information, maps, and drawings. Visually confirm and stake existing lines, cables, or other underground

facilities including exposing crossing utilities and utilities within 20 feet laterally of the centerline of designed drilled path.

- C. Control drilling practices to prevent damage to existing utilities, existing pavement and sidewalks and waterways.
- D. Make diligent effort to locate surface evidence of other potential subsurface obstructions, such as piers and piles.
- E. Be responsible for losses and repairs occasioned by damage to underground utilities, pavement/sidewalks and waterways resulting from drilling operations.

### 3.5 WORK STAGING AREA

- A. Barricades, Warning Signs, and Lights: Erect appropriate barriers, warning lights, and signs, painted with approved colors, warnings, and graphics, in accordance with approved Traffic and Safety Plans, to ensure adequate warnings to personnel and the public and in accordance with approved permits for work on barges, tug boats and/or watercraft.
- B. Combustible Materials: Combustible materials (fuel, oil, lubricants, etc.) shall be stored off-site or in a well-ventilated storage facility removed from the immediate vicinity of the drilling area by at least 20 feet.
- C. Construction Impacts: Maintain the Work area in a manner that shall minimize adverse impacts on other public use activities. Proceed with Work in a safe, orderly manner, while maintaining the Work site free of debris and unnecessary equipment and materials.
- D. Control of Drilling Fluids: Follow requirements of the Inadvertent Return and Surface Spill Contingency Plan as submitted and approved and shall control operational pressures, drilling mud weights, drilling speeds, and other operational factors required to avoid hydrofracture fluid losses to formations, and control drilling fluid spillage. This includes spillages or returns at entry and exit locations or at intermediate points. Inadvertent returns or spills shall be promptly contained and cleaned up. Maintain on-site mobile spoil removal equipment during drilling, pre-reaming, reaming, and pullback operations and be prepared and capable of quickly removing spoils. Immediately notify Engineer of inadvertent returns or spills and immediately contain and clean up the return or spill.
- E. Removal of Temporary Facilities: At the completion of construction, remove temporary facilities installed. Unused soil, aggregate, and other materials shall be removed and disposed of at approved sites in accordance with Federal, State, and Local regulations. Damage to streets, lawns, common areas, and sidewalks shall be restored to original or better conditions at no additional cost to the Owner.
- F. Site Security: Install an enclosure fence around the Work area. The enclosure fence shall be adequate to prevent entry of unauthorized persons. Be completely responsible for site security throughout the entire duration of construction.
- G. Temporary Lighting: Procure and maintain temporary lighting needed for operations, safety, testing, and inspection. Temporary lighting shall be removed immediately after completion of construction.

H. Pipe Layout Staging Areas:

1. All pipe layout shall be within the easement shown or approved by applicable water permits.
2. Limit the pipe layout to the pipe staging area.
3. Visit the proposed areas prior to submitting a bid for this work.
4. Do not conduct excavation or earthwork activities in the pipe staging area without prior acceptance by the Engineer.
5. Be responsible for securing necessary permits and approvals for the use of the temporary staging area layout of the pipe, storage of equipment and materials, parking, drilling and other Work
6. Obtain any permits and permission for barge, tug boat and/or watercraft mobilization and pipeline layout in the river, as necessary for completion of the pullback near the Cape Fear River.
7. Costs associated with this shall be included in bid price.

3.6 MOBILIZATION

- A. Mobilize equipment, materials, and personnel necessary to construct the carrier pipeline using the HDD process at the locations shown in the Contract Drawings.
1. Entry Area: Set up temporary workspace within the areas delineated on the Drawings. Appropriate precautions and measures shall be employed to prevent erosion, surface drainage, and spillage of drilling fluids or other materials that could adversely impact the environmental quality of the site. Use appropriate precautions and measures to minimize erosion and contain spillage or runoff. Shovels, brooms, buckets, and barrels shall be kept on-site to facilitate containment and cleanup. A vacuum truck or trailer unit will be on stand-by and capable of responding within one hour to spills or inadvertent return incidents.
  2. Exit Area: The exit area shall have appropriate precautions and measures for containing drilling fluids and cuttings. Use appropriate methods to minimize erosion and runoff. Containment and cleanup equipment shall be available to contain and clean up surface spills and inadvertent returns.
  3. Pipe Layout Area: Layout area shall be free of stones, wood, debris, and obstructions. Pipe rollers shall be provided during the assembly process to facilitate pipe joining and pullback. Pipe rollers and pipe handling shall be non-abrasive and cushioned using special devices and methods to prevent damage. Pipe rollers that are uncushioned, unsteady or pose a possibility of damaging or scratching the pipe shall not be used. The pipe layout area may not allow the entire length to be joined in a single length before start of pull-in. Plan work accordingly. Maintain access to properties unless written permission has been granted by the individual property owners.

3.7 DRILLING EXECUTION

- A. Bore Tracking and Monitoring: At all times during the pilot bore, provide and maintain a bore tracking system that is capable of accurately locating the position of the drill head in the x, y, and z axes. Record these data at least once per drill pipe length or every 20 feet, whichever is less.

1. Tracking System: Monitor and record the x, y, and z coordinates relative to an established surface survey benchmark. Where the pilot hole is greater than 10 feet from the surface, a downhole wire line tracking locator system shall be installed and shall be supplemented by a "TruTracker" or equivalent tracking system installed between the entry point and the exit point. The coordinates of the surface wire grid system shall be surveyed and recorded. The grids shall be surveyed to establish horizontal and vertical position to 0.1-foot accuracy.
  2. Deviations between the recorded and design bore path shall be calculated and reported on the daily log. If the deviations exceed tolerances specified, such occurrences shall be reported immediately to the Engineer. Undertake necessary measures to correct deviations and return to design line and grade.
  3. Drilling Fluid Pressures and Flow Rates:
    - a. Continuously monitor and record.
    - b. Make measurements, including downhole pressure, during pilot bore drilling.
    - c. Monitor pressure at the pump during reaming and pullback operations.
  4. Drilling Speeds:
    - a. Maximum allowable drilling speeds for pilot boring and each reaming pass shall not be exceeded for pilot boring or reaming passes.
    - b. Measurements shall be taken every 20 feet or 30 minutes, whichever is more frequent.
    - c. Drilling speeds shall not exceed pump capacity.
    - d. Drilling speeds shall be monitored continuously during HDD operations.
  5. Drilling Fluid Viscosity and Density (Mud Weight): Measure and record drilling fluid viscosity and density at least three times per shift or at least once per 200 feet of drilled and reamed length, whichever is more frequent with at least two hours between readings, using calibrated Marsh funnel and mud balance. These measurements shall be included in daily logs submitted to the Engineer. Document modifications to the drilling fluids, by noting the types and quantities of drilling fluid additives and the dates and times when introduced. The reason for the addition of drilling fluid additives or other modifications shall be documented and reported.
- B. Location of Entry and Exit Points: Entry and exit points are shown on the Drawings. Where entry and exit points are shown, they shall be constructed in the location shown, unless otherwise approved in writing by the Engineer or as shown on the accepted HDD Work Plan. Employ experienced licensed surveyors registered in the State of North Carolina to locate the entry and exit points, and to establish horizontal and vertical datum for the bore and the pipe layout and assembly areas. A conductor barrel casing may be installed at either entry or exit points (if not designated on the Drawings) at no additional cost to the Owner.
- C. Entry and Exit Angles: Drill entrance angles shall be between as shown on the Drawings and exit angles shall be as shown on the Drawings, unless otherwise accepted in writing by the Engineer.
1. Pilot Bore: The pilot bore shall follow the design path of the bore shown on the Drawings, unless otherwise accepted in writing by the Engineer. Horizontal and Vertical Tolerances: Horizontal and vertical deviations shall be less than plus or minus two feet from the design path centerline. Continuously monitor horizontal and vertical position and record the position at least once per drill pipe length, or every 20 feet, whichever is less.
  2. Radius of Curvature: The radius of curvature shall not be less than that shown on the Drawings, unless otherwise accepted in writing by the Engineer:



3. Entry and Exit Tolerances: The location of the entry and exit points shall be in accordance with the accepted HDD Work Plan. Be solely responsible for Work necessary to correct excessive deviations from line and grade, including re-drilling, redesigning connections, and acquiring additional easement, at no additional cost to the Owner and without schedule extension.
  4. Right-of-Way restrictions shall take precedence over the listed tolerances. Regardless of the tolerance achieved, no pilot hole shall be accepted if it will result in any of the pipe being installed in violation of right-of-way permits. Additionally, concern for adjacent utilities and/or structures shall take precedence over the listed tolerances. Listing of tolerances does not relieve the Contractor from responsibility for safe operations or damage to adjacent utilities and structures.
- D. Pre-reaming and Reaming: The pilot bore shall be pre-reamed and reamed using equipment and methods submitted. Pre-ream completely the bore to the final diameter prior to pullback. Multiple reams may be required to achieve the desired borehole diameter.
- E. Low Pressure Pretest: For fused pipe, perform a low-pressure air test in accordance with Paragraph 2.2 J prior to pipe pullback.
- F. Pipe Pullback:
1. A final swabbing of the bore path prior to pullback of the carrier pipe is required.
  2. Pipe shall be installed by pulling it into the reamed bore path in a continuous operation, behind a final reaming tool to be selected. Consideration shall be given that the carrier pipe may not be able to be pulled into the bore path in a continuous operation and that pulling may need to be temporarily suspended during intermediate fusing of the carrier pipe.
  3. Pipe shall be isolated from excessive torsional and axial stresses by a swivel device.
  4. Measurements shall be made, recorded, and submitted on the daily logs during final reaming and pipe pullback.
  5. Pulling Loads: The maximum pull (axial tension force) exerted on the carrier pipeline shall be measured continuously and limited to the maximum allowed by the pipe Manufacturer so that the pipe or joints are not overstressed. A factor of safety over the Manufacturer's maximum allowable is not required. Pipeline Support: The pipelines shall be adequately supported during installation so as to prevent overstressing or buckling. Provide adequate support/rollers along the stringing area to support the required length of the carrier pipe for each bore. Such support/rollers shall be spaced according to the pipe supplier, and the rollers be comprised of a non-abrasive cushioned material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback. The pipe layout area shall be cleared of large stones, construction debris, or other foreign objects that could damage the piping during pullback.
  6. Leading end of the pipe shall be closed during the pullback operation, in accordance with the pipe supplier's recommendations. A pulling head shall be used that is rated at the allowable pull force capability of the pipe section being installed, in accordance with the pipe supplier's recommendations.
  7. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately before joining.
  8. Tracer wire will be attached to the leading end of the pipe pulling head and shall extend the full length of the installed pipe.

9. Handle, at all times, the carrier pipe in a manner that does not overstress or otherwise damage the pipe. Vertical and horizontal curves shall be limited to Manufacturer's recommended bend radius so that wall stresses do not exceed the allowable bending radius as recommended by the pipe supplier. If the pipe is buckled or otherwise damaged due to acts or omissions, the damaged section shall be removed and replaced at his expense. Take appropriate steps during pullback to ensure that the carrier pipe and tracer wires will be installed without damage.
  10. Monitor and inspect pipe rollers and method for suspending pipe at entry during the pullback operation to avoid damage to the pipe.
  11. Cease operations if the pipe is damaged and remove the pipe from the bore and repair the pipe using the Manufacturer's recommended procedure or replace the damaged pipe before resuming installation.
  12. Be responsible for damage to the pipe resulting from installation or contact grouting, including costs for replacement and labor and materials at no cost to the Owner.
  13. After the carrier pipe is completely pulled through the bore, a sufficient period as recommended by the pipe Manufacturer shall be provided before the final pipe tie-in.
  14. Upon completion of pullback and grouting, perform the following cleaning on the completed pipeline.
    - a. After the installation of the carrier pipe, swab inside of pipe with a flexible polyurethane foam swab complete with rear polyurethane drive seal.
    - b. In tandem, swap with a one to two pounds per cubic foot pig for proving, sweeping and sealing and a five to seven pounds per cubic foot pig for wiping.
    - c. The tandem swabs shall make a minimum of two passes through the entire pipeline.
    - d. Cleaning and flushing shall be accomplished by propelling the swab down the pipeline to the exit point with potable water. Flushing shall continue until the water is completely clear.
  15. Final Hydrostatic Test: Conduct a final hydrostatic test of the installed pipeline. Final test shall be in accordance with the applicable pipe material and process specification. Repair defects discovered during the test and repeat until the pipe passes the test.
  16. Flushing: Be responsible for flushing prior to startup in accordance with AWWA C-651 and Section 330531.16 "Polyvinyl Pressure Pipe" or Section 330533.23 "Polyethylene Pressure Pipe".
- G. Obstructions: Notify the Engineer immediately in the event that an obstruction, such as a boulder or rock, is encountered that prevents further advancement of the drill pipe, or pullback of the pre-reamer, reamer, and/or pipe.
1. Notify the Engineer of proposed measures to attempt to advance past the object, prior to initiating the attempt.
  2. Make diligent and reasonable efforts to advance past the object by drilling slowly through the object, pulling back, and drilling along a new bore path that avoids the object, or excavating and exposing and removing the object, and other reasonable attempts to continue the bore.
  3. If attempts to pullback and re-drill are made, adhere to line and grade tolerances established in this Specification Section, unless the Engineer approves variance, in writing, prior to the attempt to re-drill.
  4. The Contractor and Engineer shall investigate the cause and together determine an appropriate response. Appropriate response may include revisions to equipment or methods, retraction and re-drilling of a portion of the bore, or abandonment of the hole.

5. If abandonment is deemed necessary, recover, to the extent practicable, drill pipe, product pipe, and tools in the bore, and properly abandon the bore by contact grouting unless otherwise directed in writing by the Engineer.
  6. If the bore is abandoned, begin a second attempt to install the pipeline at an alternate location subject to approval, in writing, by the Engineer.
  7. Take reasonable actions to complete the installation with minimal delays.
- H. Site Restoration and Demobilization: Remove equipment, materials, drilling fluids, muck, waste, and debris from the site and restore the site to its original condition upon completion of the installation. Restoration and demobilization shall be completed within seven calendar days of the completion of the pipeline installation.
- I. Settlement Monitoring: Visually monitor for settlement or heave before and during drilling operation. The settlement monitoring locations shall be surveyed to the nearest 0.01 foot and recorded prior to drilling operations and each day drilling operations are ongoing. A final record of spot elevations shall be recorded two weeks after pipe installation is complete and presented with the Record Drawings. Areas found to have significantly settled or heaved will require restoration. The Engineer will determine what constitutes significant settlement or heave. Restore these areas at no cost to the Owner.

### 3.8 TOLERANCES

- A. Horizontal and Vertical Tolerances: Horizontal and vertical deviations shall be less than plus or minus two feet from the design path centerline. Continuously monitor horizontal and vertical position and record the position at least once per drill pipe length, or every 20 feet, whichever is less.
- B. Minimum Horizontal and Vertical Clearance from Other Utilities: As indicated.
- C. Deviation:
1. When pipe installation deviates beyond specified tolerances, abandon bore, remove installed pipe, rebore, and reinstall pipe in correct alignment.
  2. Fill abandoned bores greater than 3 inches in diameter with grout or flowable fill material.

### 3.9 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Daily Logs and Records: The position of the drill head and fluid pressures shall be continuously tracked and recorded. A plot of actual locations of the bore path shall be maintained and updated daily, or more frequently, as directed by the Engineer. Pason or approved equal system shall be used for on/off site monitoring. These records shall be maintained and provided daily to the Engineer.
1. Drilling lengths.
  2. Location of drill head.

3. Drilling and Reaming Rates: Submit maximum drilling speeds and reaming rates for pilot bore and each reaming pass and confirm that the pump capacity is adequate for these anticipated drilling rates for the drilling fluid weights and viscosities anticipated.
  4. Drilling fluid pressures and flow rates.
  5. Drilling Fluid Viscosity and Density (Mud Weight): Submit measured mud and/or drilling fluid weights used during pilot boring and reaming of the bore measured at a minimum of three times per shift or at least once per 200-ft of drilled or reamed length, whichever is more frequent, with at least two hours between readings.
  6. Pilot Bore As-Built Profile: Submit the updated pilot bore profile as drilling is underway.
  7. Drilling fluid losses.
  8. Inadvertent returns.
  9. Drilling times required for each pipe joint.
  10. Instances of retraction and re-drilling of the pilot bore or segments thereof.
  11. Other relevant observations, including observed settlement, heave, frac-outs, or surface spills per the approved Protection of Adjacent Structures and Facilities Plan.
  12. Downhole annular drilling fluid pressures shall be measured and recorded throughout the pilot hole drilling.
- C. Construction Records: The following shall be submitted as construction progresses and at the completion of construction. These shall be submitted within 24 hours of completion of each operation or milestone.
1. Pilot Bore As-Built Profile: Submit the updated pilot bore profile as an as-built profile of the pilot bore.
  2. Pulling Force Records: Submit the actual recorded pulling forces during pullback.
  3. Pressure Test Records: Submit pressure test records for both the pre-installation and post-installation tests. Variations in Plan and Profile: Document variations between the actual alignment and profile of the installed pipeline and the location shown on the Contract Drawings. Notify in writing and by telephone the Engineer immediately upon discovery of deviations.
  4. Complete set of Daily Logs and Records.
  5. Pressure Testing Records

### 3.10 CLEANING

- A. Sections 017300 "Execution" and 017700 "Closeout Procedures" for cleaning requirements.
- B. Upon completion of drilling and pipe installation, remove drilling spoils, debris, and unacceptable material from approach trenches and pits. Clean up excess slurry from ground.
- C. Restore approach trenches and pits to original condition.
- D. Remove temporary facilities for drilling operations .

END OF SECTION

## SECTION 330507.25 – JACKING UNDER RAILROAD AND ROADWAYS

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. Furnish all labor, equipment, materials, and incidentals required and install casing pipe by jacking under roadways in locations shown on the Drawings. The work shall be done in strict accordance with the requirements of North Carolina Department of Transportation (NCDOT), as shown on the Drawings and as specified herein and in accordance with all Federal, State, and Local laws, regulations, and requirements.
- B. Trenchless crossings shall not impede the flow of traffic along the road being crossed.
- C. The Contractor shall familiarize themselves with the conditions under which the work will be performed and with all necessary details as to the orderly prosecution of the work. The omission of any details, which may not appear herein, for the satisfactory installation of the work in its entirety shall not relieve the Contractor of full responsibility.
- D. If any movement or settlement occurs which causes or might cause damage to an existing structure, roadway or utility over, along or adjacent to the work, immediately stop any or all work except that which assists in making the work secure and in preventing further movement, settlement or damage. Resume jacking only after all necessary precautions have been taken to prevent further movement, settlement or damage, and repair the damage at the Contractor's own cost and to the satisfaction of the Engineer.
- E. Follow all OSHA regulations regarding confined space for casing installation. Obtain all permits required associated with OSHA regulations and requirements for confined space entry.
- F. Conform to all requirements of the NCDOT permit for work within NCDOT rights-of-way.
- G. Contractor shall notify the Owner and Engineer a minimum of seven (7) days prior to performing any pipe jacking operations. All required permits and approvals necessary for pipe jacking shall be secured by the Owner prior to commencing work. Contractor shall supply all requested information to Owner to support permitting process.
- H. No rescue pits shall be allowed.

#### 1.2 RELATED WORK

- A. Geotechnical Instrumentation and Monitoring is included in Section 310900.
- B. Dewatering is included in Section 312319.
- C. Trenching and Backfilling is included in Section 312333.
- D. Excavation Support and Protection is included in Section 315000.

### 1.3 SUBMITTALS

- A. Shop Drawings: Submit shop drawings and product data for materials to be used for tunneling operations.
- B. Design Calculations: Submit design calculations detailing equipment and construction methods to be used for jacking operations as specified herein and as shown on the contract drawings. The submittal shall specifically include the following and shall be signed and sealed by the Contractor's Design Engineer:
  - 1. Locations, dimensions, elevations and details of the jacking and receiving pits and casing.
  - 2. Equipment and procedures of tunneling operations.
  - 3. Control of groundwater and surface drainage.
  - 4. Method of face excavation.
  - 5. Method of excavation removal.
  - 6. Maintenance of alignment and grade.
  - 7. Materials and installation of casing pipe.
  - 8. Grouting outside of casing pipe.
  - 9. Grouting between casing pipe and carrier pipe.
  - 10. Bulkheads.
  - 11. Schedule.
  - 12. Lubricant for decreased jacking friction and pumping system.
- C. The design calculations are to be submitted for informational purposes.
- D. Submit the Contractor's qualifications as described herein.
- E. Submit the Contractor's North Carolina professional engineer's qualifications as described herein.
- F. Daily surveyor reports of casing pipe position and control point monitoring (per NCDOT requirements), conducted by the Contractor's surveyor, shall be provided in writing to the Engineer.
- G. For crossings within roadway rights-of-way, the Contractor's North Carolina Professional Engineer shall certify the shoring of all excavations as adequate to prevent damage to the roadway.

### 1.4 QUALITY ASSURANCE

- A. Regulations: Perform all work in accordance with current applicable regulations and codes of all Federal, State, and local agencies.
- B. The Contractor shall have at least five 5 years experience with compatible work to the Work shown and specified, employing labor and supervisory personnel who are similarly experienced in this type of work. Compatible work shall include pipe jacking of at least 36-inch-diameter casing pipe at least 100 feet long below roadways.

- C. The Contractor's engineer shall be a Professional Engineer, registered in the State of North Carolina, and shall have at least 5 years experience in the design of pipe jacking, excavation support, dewatering, grouting, and soil stabilization.

## 1.5 DEFINITIONS

- A. Pipe jacking shall mean the use of a thrust shield with hydraulic jacks pushing against the casing pipe with hydraulic jacks located in the jacking pit.
- B. Casing pipe shall mean the outer sleeve that is installed by jacking method.
- C. Carrier pipe shall mean the pipe inserted within the casing pipe and which acts as the conveyor for water.
- D. Jacking pit shall mean the shaft in which the jacking equipment is installed and from which both the casing pipe and carrier pipe are launched.
- E. Receiving pit shall mean the shaft at the point where the carrier pipe emerges from the casing pipe.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. 36-inch O.D. steel casing pipe shall have a minimum yield strength of 35,000 psi. The minimum wall thickness shall be 0.5 inch and be equipped with grout holes as specified herein. The casing pipe shall be designed to withstand HS-20 loading. The casing pipe shall conform to AWWA C200 and ASTM A139.
- B. Steel pipe casing shall be furnished in lengths of the Contractor's choice. The casing shall have beveled ends with a single v-groove and shall be field joined by full-penetration butt welding all around prior to jacking. Butt welding shall be performed in accordance with applicable portions of AWWA C206 and AWS D7.0. The welded joints shall be wire brushed and painted with bitumastic enamel coating in accordance with AWWA C203. Alternatively, Permalok connectors may be used.
- C. Steel pipe casing shall have 2-inch grout holes such that grout ports are provided at 10-foot-maximum intervals along the length of the completed tunnel. The grout holes shall be spaced at 120 degrees on center (three holes at each interval) orientated with one hole at the crown. Two-inch steel half-couplings shall be welded over the holes in the pipe casing and shall have threaded steel plugs.
- D. Removal of material from the casing face shall be by hand-mining or augering. The jacking shield shall be of steel construction with an open face shield and the appropriate configuration to allow for the installation of a breasting system. The breasting system should be removable and replaceable in the event that obstructions are encountered. An auger and cutting head may be utilized in lieu of hand-mining for soil removal during pipe jacking.

- E. Casing braces shall be provided by Pipeline Seal and Insulator, Inc. (P.S.I.) of Gardena CA, or approved equal. Braces shall be made of carbon steel, and runners shall be a minimum of 2 inches wide. Braces shall be placed 3 feet prior and 3 feet after each joint of carrier pipe.
- F. Bulkheads shall be provided to seal the space between the carrier pipe and casing pipe at each end of the casing pipe for grout containment. Bulkheads shall be masonry and a minimum of 8 inches thick
- G. Grout for pressure injection between the casing pipe and the undisturbed earth shall be a uniform mixture of Portland cement and bentonite or similar commercial product that shall harden to a minimum compressive strength of 500 psi. The grout shall be readily pumpable. The shop drawings shall include both the proposed grout design and the pumping system.
- H. Cement grout used to fill the space between the casing and the carrier pipes shall consist of a flowable fill .
- I. Lubricant for decreasing jacking friction between the jacked casing pipe and earth shall be bentonite slurry or similar commercial product.

### PART 3 - EXECUTION

#### 3.1 JACKING AND RECEIVING PITS

- A. Refer to Section 315000 - Excavation Support and Protection for pit requirements.
- B. Trench boxes and trench shields shall not be used as support of excavation for any jacking or receiving pits, unless approved by the Engineer.
- C. Excavation support for jacking pits shall include design and details of thrust block, base support and tunnel opening.

#### 3.2 JACKING OPERATIONS

- A. Casing pipes under existing roads shall be installed to the limits shown in accordance with the approved encroachment agreement or permit.
- B. The Contractor shall provide all material, equipment, and facilities required for installing, positioning, and jacking the casing pipe.
- C. The casing pipe at each location shown on the Drawings shall be jacked in one continuous 24-hour-per-day operation. In no event shall jacking or lubricant injection be discontinued for sufficient period to cause the partially jacked sleeve to "freeze" in place.
- D. Proper alignment and elevation of the casing shall be consistently maintained throughout the jacking operation. Tolerances for installation of the casing pipes shall be as follows:
  - 1. Vertical - plus or minus 0.50 feet.
  - 2. Horizontal - plus or minus 0.50 feet.



- E. Jacking shall not commence until the Contractor's surveyor has verified in writing to the Engineer that the first pipe casing segment is at the correct location and elevation and is oriented at the correct horizontal and vertical direction. After the first segment has been jacked forward, the Contractor's surveyor shall again verify in writing to the Engineer that alignment is correct. If alignment is not correct at this point, or any successive point, the jacked casing operation shall be stopped and shall not resume until the Contractor has modified the jacking operation as required to maintain proper alignment at no additional cost to the Owner.
- F. Establish survey station marks over the entire length of the jacked casing during jacking operations at intervals of not more than 25 feet and to an accuracy of 0.01 feet.
- G. If alignment or elevations exceed the specified tolerances during the jacking operations as indicated by survey reports, the Contractor shall report the situation to the Engineer immediately. The jacked casing operation shall be stopped and shall not resume until the Contractor has submitted to and accepted by the Engineer a modified jacking operation as required to restore and maintain proper alignment. The modified operations shall be implemented at no additional cost to the Owner.
- H. Jacking shall not commence until the Contractor has installed, initialized, and is prepared to record readings from all geotechnical instrumentation as required by Section 310900 - Geotechnical Instrumentation and Monitoring.
- I. The Contractor shall be fully responsible for minimizing the occurrence of voids outside the casing pipe. All voids shall be filled with cement grout.
- J. Removal of material from the casing face shall be by hand-mining or augering. The jacking shield shall be of steel construction with an open face shield and the appropriate configuration to allow for the installation of a breasting system. The breasting system should be removable and replaceable in the event that obstructions are encountered. An auger and cutting head may be utilized in lieu of hand-mining for soil removal during pipe jacking. The auger and cutting head arrangement shall not extend past the leading edge of casing and a soil plug shall be maintained inside the casing at all times to reduce the potential for soil loss above the casing during jacking. The auger and cutting head shall be removable from the pipe in the event an obstruction is encountered.
- K. The Contractor shall excavate only from within the casing to minimize the volume of the voids outside the jacked casing pipe, and to minimize raveling of the soils at the face. The Contractor shall constantly exercise care in the removal of the excavation.
- L. If an obstruction is encountered during the boring operation, the auger shall be withdrawn, the excess casing pipe cut off, capped and the interior and exterior voids shall be completely filled with portland cement grout under pressure. No separate payment shall be made for unsuccessful bores.
- M. Groundwater shall be controlled at all times. If groundwater is expected to be above or within the casing level, a groundwater control system consisting of vertical or horizontal wells or well points shall be installed and operated such that the groundwater level is lowered to at least the casing invert level at the face. Groundwater control along and at the face of the casing pipe shall include grout stabilization as required. Dewatering design and operations shall be in accordance with Section 312319.

- N. The Contractor shall use a jacking ring consisting of either steel or concrete construction. This jacking ring will allow the jacking pressure to be distributed evenly around the wall of the casing pipe.
- O. The Contractor shall also use a jacking frame. The frame shall be fabricated from structural steel members and shall be designed to distribute the stresses from the jacks evenly to the jacking ring.
- P. The Contractor shall use thrust blocks adequately designed to carry the thrust of the jacks to the soil without excessive soil deflection and in such a manner as to avoid any disturbance of adjacent structures or utilities and to jack the casing reliably in the correct alignment. Refer to Section 315000 - Excavation Support and Protection for thrust block design requirements.
- Q. Jacking pressures used shall be uniformly distributed through the jacking frame and parallel to the axis of the pipe. Extreme care shall be taken so that crushing or other damage to the joints of the casing pipe will not occur.
- R. The Contractor shall have a redundant lubricant injection system connected for immediate use in the event the primary system fails during the jacking operation. Lubricant injection shall be continuous until the casing is fully installed.
- S. The alignment of the casing pipe shall be checked at least daily by the Contractor's surveyor as the casing progresses and daily written reports provided to the Engineer. Adjustments shall be made immediately if any misalignment occurs.
- T. If work is stopped for any reason, the exposed face of the excavation shall be fully protected with a bulkhead satisfactory to the Engineer.
- U. The carrier pipe shall not be direct jacked.
- V. The carrier pipe shall not be installed until leakage into the casing pipe, after removal of all dewatering pumping systems, does not exceed 20 gallons per hour/100 linear feet of finished casing pipe.
- W. The Contractor shall be responsible for damages resulting from subsidence, collapsed casings, or ground losses into the jacked pipe casing and for the refilling of voids resulting there from with grout. Where such ground losses are so severe that they result in damage to underground or surface pavement, existing utilities or structures, the Contractor shall be solely responsible for remedying such damage. Where the filling of voids cannot be effectively carried out from below, the Engineer reserves the right to order the Contractor, at no additional cost to the Owner, to make openings from the surface for the purpose of backfilling the voids. If in the judgment of the Engineer, a portion of the casing and/or pipe requires reinforcing because of such collapse, the Engineer may direct the Contractor to furnish and place such reinforcement at no additional cost to the Owner. Reinforcement may also be directed when the stability of the soil adjacent to the casing and/or pipe has been affected by the loss of ground.
- X. The Contractor shall be responsible for all effects on road traffic resulting from such ground loss, including all costs and all coordination with and meeting traffic control requirements of NCDOT and the required traffic control, permit acquisition, fees, fines, etc.

- Y. Maximum allowable deflection of the inside diameter of the casing in any direction from a true circle shall be 1.0 percent of the inside diameter. Deflection shall be measured at not more than 50-foot-intervals.

### 3.3 GROUTING

- A. Immediately following the jacking operation, pressure grout the jacked section to fill all voids existing outside of the casing pipe. Grouting shall be performed from the interior of the casing pipe through grouting holes. Lubricant shall be displaced by the grout. Grouting shall be started in the lowest connections and shall proceed until grout begins to flow from upper connections. The void shall be completely filled. Displaced lubricant shall be disposed of off-site in accordance with applicable regulations and codes of all Federal, State, and local agencies.
- B. Grout pressure shall not exceed one-half of the existing overburden pressure
- C. Apparatus for mixing and placing grout shall be capable of mixing effectively and stirring the grout and then forcing it into the grout connections in a continuous uninterrupted flow.
- D. After grouting is complete, pressure shall be maintained by means of stopcocks or other suitable devices until the grout has set sufficiently in the judgment of the Engineer, or for a minimum of 24 hours, whichever is longer. After the grout is set, grout holes shall be completely filled with dense concrete and finished neatly without evidence of voids or projections.

### 3.4 CARRIER PIPELINE INSTALLATION IN CASING AND FILLING OF ANNULAR SPACE

- A. Casing braces designed and certified by P.S.I., or an approved equal, shall be capable of withstanding the forces to pull the pipe sections into the casing and to support the full weight of the pipe. The casing braces shall prevent any movement or displacement of the pipe during grouting.
- B. Each gasketed air-testable pipe joint shall be air tested immediately after installation per the appropriate pipe specification. Block pipe as necessary to prevent joint separation during testing and reduce pressure to 2.0 psi. There shall be no exceptions to this requirement. No gasketed air-testable pipe will be paid for until it has been successfully air tested.
- C. After the carrier pipe has been installed in the casing, shimmed, blocked, and tested, seal the ends of the casing around the pipeline with bulkheads and completely fill the space between the casing and the pipeline with cement grout or cellular concrete. Cement grout or concrete shall be pumped through 2-inch-minimum unjointed HDPE pipes extending through one bulkhead into the top of the casing at maximum 40-foot intervals. One pipe shall be located so as to be within 10 feet of the opposite bulkhead. This operation shall be performed in at least two stages to help prevent flotation. To ensure that the casing is completely full, two 2-inch-minimum unjointed HDPE pipes shall be installed near the crown of the casing from the midpoint of the casing to each end, and 2-inch openings shall be provided in each bulkhead at the tunnel crown location. Grout or concrete shall be pumped into the casing until it flows from the top of the casing in the HDPE pipe and bulkhead openings at both ends. Leave the HDPE pipe in place and cut off at the end of the casing.

### 3.5 RESTORATION

- A. All areas disturbed by construction shall be restored to existing or better condition and maintained until accepted by the Engineer, the Owner and NCDOT.

END OF SECTION 330507.25

## SECTION 330513 - MANHOLES AND STRUCTURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Monolithic concrete manholes and structures with masonry transition to cover frame, covers, anchorage, and accessories.
  - 2. Modular precast concrete manhole and structures with tongue-and-groove joints with masonry transition to cover frame, covers, anchorage, and accessories.
  - 3. Bedding and cover materials.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for reinforced concrete type for manhole and structures base pad construction.
  - 2. Section 036000 "Grouting" for within manhole and structures.
  - 3. Section 310515 "Soils and Aggregates for Earthwork" for soil and aggregate for backfill in trenches.
  - 4. Section 312333 "Trenching and Backfilling" for excavating backfill for manholes and structures.
  - 5. Section 315000 "Excavation Support and Protection" for deep excavation as required on Drawings.

#### 1.3 ACTION SUBMITTALS

- A. Section 013300 "Submittal Procedures" for submittals requirements.
- B. Product Data: Submit cover and frame construction, features, configuration, and dimensions.
- C. Shop Drawings: Indicate manhole and structure locations, elevations, piping, conduit, and sizes and elevations of penetrations.
- D. Submit for review, structural calculations and drawings for all precast structures
- E. Structural design calculations and Drawings shall be prepared and stamped by a professional engineer registered in the State of North Carolina for manholes greater than 10 feet deep.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Certificate: Products meet or exceed specified requirements.
- B. Manufacturer Instructions: Detailed instructions on installation requirements, including storage and handling procedures.
- C. Field Quality-Control Submittals: Results of Contractor-furnished tests and inspections.
- D. Qualifications Statements: Qualifications for manufacturer.
- E. Concrete design mix data and concrete test cylinder reports from an approved concrete testing laboratory certifying that the concrete used in the precast structures conforms with the strength requirements specified herein.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 "Product Requirements" for transporting, handling, storing, and protecting products requirements.
- B. Unload, store, and handle precast manholes and structures according to manufacturer instructions.
- C. Storage: Store precast concrete manholes and structures as to prevent damage to Owner's property or other public or private property.
  - 1. Repair property damaged from materials storage.

#### 1.6 AMBIENT CONDITIONS

- A. Section 015000 "Temporary Facilities and Controls" for ambient condition control facilities for product storage and installation requirements.
- B. Subsequent Conditions: Maintain materials and surrounding air temperature at minimum 50 degrees F prior to, during, and 48 hours after completion of masonry Work.

#### 1.7 REFERENCE STANDARDS

- A. ASTM International
  - 1. ASTM A48 - Standard Specification for Gray Iron Castings
  - 2. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
  - 3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
  - 4. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).
  - 5. ASTM C150 - Standard Specification for Portland Cement.
  - 6. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.

7. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
  8. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
  9. ASTM D4101 - Standard Specification for Propylene Plastic Injection and Extrusion Materials.
- B. American Concrete Institute (ACI)
1. ACI 318 - Building Code Requirement for Structural Concrete.
- C. American Association of State Highway and Transportation Officials (AASHTO)
- D. Occupational Safety and Health Administration (OSHA)
- E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

## 1.8 QUALITY ASSURANCE

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer, or other representative of the Owner. Such inspection may be made at the place of manufacture, or on the work after delivery, or at both places and the materials shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein; even though samples may have been accepted as satisfactory at the place of manufacture. Material rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All materials which have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.
- B. At the time of inspection, the materials will be carefully examined for compliance with the ASTM standard specified below and this Section and with the approved manufacturer's drawings. All manhole sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.
- C. Imperfections in manhole sections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at seven days and 5,000 psi at 28 days, when tested in 3-in by 6-in cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Equivalent strength: Based on structural design of reinforced concrete as outlined in ACI 318.

- B. Design of Lifting Devices for Precast Components: According to ASTM C913.
- C. Design of Joints for Precast Components:
  - 1. According to ASTM C913.
  - 2. Maximum Leakage: 0.025 gal. per hour per foot of joint at 3 feet of head.
- D. Shaft Construction: Concentric with eccentric cone top section; lipped male/female dry joints; sleeved to receive pipe sections.
- E. Shape: Cylindrical, Square, or Rectangular.
- F. Clear Inside Dimensions: As indicated on Drawings.
- G. Design Depth: As indicated on Drawings.
- H. Clear Cover Opening: As indicated on Drawings.
- I. Pipe Entry: Furnish openings as indicated on Drawings.

## 2.2 MANHOLES AND STRUCTURES

- A. Manhole and Structure Sections: Reinforced precast concrete according to ASTM C478
  - 1. The wall thickness shall not be less than 5-in for 48-in diameter reinforced barrel sections, 6-in for 60-in diameter reinforced barrel sections and 7-in for 72-in diameter reinforced barrel sections.
  - 2. Top sections shall be eccentric except that barrel sections shall be used where shallow pipe cover requires a top section less than 4-ft as shown on the Drawings.
  - 3. Barrel sections shall have tongue and groove joints.
  - 4. All sections shall be cured by an approved method and shall not be shipped nor subjected to loading until the concrete compressive strength has attained 3,000 psi and not before five days after fabrication and/or repair, whichever is longer.
  - 5. Precast concrete barrel sections with precast top slabs and precast concrete transition sections shall be designed for a minimum of a H-20 loading plus the weight of the soil above at 120 pcf.
  - 6. The date of manufacture and the name and trademark of the manufacturer shall be clearly marked on the inside of each precast section.
  - 7. Structural design calculations and Drawings shall be prepared and stamped by a professional engineer registered in the State of North Carolina.
  - 8. The structural design shall take into account discontinuities in the structure produced by openings and joints in the structure.
  - 9. The precast concrete structure's elements shall be designed to support their own weight, the weight of soil above at 120 pcf and shall be capable of withstanding a live load equal to an AASHTO HS-20 highway loading applied to the top slab.
  - 10. The base slab and walls shall be cast together to form a monolithic base section. Manholes shall have a minimum six (6) inch extended base.



11. The structures shall be designed to prevent flotation without the benefit of skin friction when the ground water level is at finished ground surface. Flotation forces shall be resisted by the dead load of the structure and soil directly above the structure. Weight of equipment and piping within the structure and soil frictional forces shall not be considered as being effective in resisting flotation forces.
    - a. If the design of the box structure requires a concrete pad to prevent flotation, the cost of designing, furnishing and installing a reinforced concrete pad shall be included in the price for the structure. Details of the design of the concrete pad (if required) shall be submitted to the Engineer for review.
  - B. Mortar and Grout: As specified in Section 036000 "Grouting."
  - C. All precast concrete shall have a minimum compressive strength of 5000 psi at 28 days. Water shall be kept to a minimum to obtain concrete which is as dense and watertight as possible. The maximum water-to-cement ratio shall be 0.40 by weight and the minimum cement content shall be 600 lbs of cement per cubic yard of concrete. The above ratios shall be revised for sacks of cement weighing different from 94 pounds per sack.
  - D. Exterior joints shall be sealed with a 4" wide butyl rubber wrap.
  - E. Lift holes shall be plugged and filled flush with mortar
  - F. Concentrate discharge manholes shall be coated with coal tar epoxy (or other County approved coating) 20 mils throughout the inside of the manhole
  - G. All manholes shall have a sewer guard insert installed – plastic is allowed in non-traffic areas – stainless steel insert pans are required in traffic areas
  - H. Brushed dampproofing shall be an asphalt emulsion reinforced with fibers conforming to ASTM D1227, Type II, Class 1. The dampproofing shall be Hydrocide 700B by Sonneborn Building Products, Division of ChemRex Inc., Minneapolis, MN; Karnak 220 Asphalt Emulsion by Karnak Corporation, Clark, NJ or equal.
  - I. Pipe to manhole connectors shall conform to ASTM C923. The location of the pipe connectors shall vary from the location shown on the project plans by no more than (1/2) inch vertically and five (5) degrees horizontally. Provide for control of the pipe OD to within the tolerances of the connector on flexible pipes larger than twelve (12) inches.
  - J. When a watertight manhole is to be used as required by Drawings, a vent pipe shall be installed for proper ventilation of the manhole.
- 2.3 ACCESSORIES
- A. Manhole and Structure Steps:
    1. Copolymer Polypropylene Plastic rungs conforming to ASTM D4101
    2. Formed integral with manhole and structure sections.
    3. Diameter: 1/2 inch. Diameter grade 60 steel reinforcing conforming to ASTM A615
    4. Width: 12 inch.
    5. Spacing: 16 inch o.c. vertically, set into manhole and structure wall.

- B. Base Pad: Leveled top surface. Cast-in-place concrete of type as specified in Section 033000 "Cast-in-Place Concrete."
- C. Manhole frame and cover shall be cast iron and flush with grade as shown on Drawings and conform to ASTM A48, Class 35B.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 017300 "Execution" for installation examination requirements.
- B. Verify that items provided by other Sections of Work are properly sized and located.
- C. Verify that built-in items are in proper location and ready for roughing into Work.
- D. Verify correct size of manhole and structure excavation.

### 3.2 PREPARATION

- A. Section 017300 "Execution" for installation preparation requirements.
- B. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on Drawings to indicate its intended use.
- C. Coordinate placement of inlet and outlet pipe or duct sleeves required by other Sections.
- D. Do not install structures where Site conditions induce loads exceeding structural capacity of structures.
- E. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage; remove and replace damaged units.

### 3.3 INSTALLATION

- A. Excavation and Backfill:
  - 1. Excavate manholes and structures as specified in Section 312000 "Earthwork" in location and to indicated depth.
  - 2. Provide clearance around sidewalls of structure for construction operations.
  - 3. When groundwater is encountered, prevent accumulation of water in excavations; place manholes and structures in dry trench.
  - 4. Where possibility exists of watertight structure becoming buoyant in flooded excavation, anchor structure to avoid flotation as approved by Engineer.

- B. Base Pad:
  - 1. Place base pad.
  - 2. Trowel top surface level.
- C. Place manhole and structure sections plumb and level, trim to correct elevations, and anchor to base pad.
- D. Backfill excavations for manholes and structures as specified in Section 312333 "Trenching and Backfill."
- E. Form and place manhole and structures cylinder plumb and level and to correct dimensions and elevations.
- F. Grout base of shaft sections to achieve slope to exit piping, trowel smooth, and contour as indicated on Drawings.
- G. Set cover frames and covers level without tipping and to correct elevations.
- H. Coordinate with other Sections of Work to provide correct size, shape, and location.
- I. Precast concrete barrel sections and structures shall be set plumb and with sections in true alignment with a 1/4-in maximum tolerance to be allowed. The joints of precast barrel sections shall be sealed with either a rubber O-ring set in a recess or the preformed flexible joint sealant used in sufficient quantity to fill 75 percent of the joint cavity. The outside and inside joint shall be filled with non-shrink mortar and finished flush with the adjoining surfaces. Allow joints to set for 24-hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If any leaks appear in the manholes, the inside joints shall be caulked with lead wool to the satisfaction of the Engineer. Install the precast sections in a manner that will result in a watertight joint.
- J. Holes in the concrete barrel sections required for handling or other purposes shall be plugged with a non-shrinking grout or non-shrinking grout in combination with concrete plugs and finished flush on the inside.
- K. Dampproofing
  - 1. Outer surfaces of precast and cast-in-place manholes shall be dampproofed at the rate of 30 to 35 sq ft per gallon as directed by the Engineer and in accordance with manufacturer's instructions.
- L. Precast Concrete Manholes and Structures:
  - 1. Lift precast components at lifting points designated by manufacturer.
  - 2. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
  - 3. Set precast structures bearing firmly and fully on crushed stone bedding, compacted as specified in Section 312333 "Trenching and Excavation" and Section 315000 "Excavation Support and Protection" or on other support system as indicated on Drawings.
  - 4. Assemble multi-section structures by lowering each section into excavation; set level and firmly position base section before placing additional sections.

5. Remove foreign materials from joint surfaces and verify sealing materials are placed properly.
6. Maintain alignment between sections by using guide devices affixed to lower section.
7. Joint sealing materials may be installed on Site or at manufacturer's plant.
8. Verify that installed manholes and structures meet required alignment and grade.
9. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.
10. Cut pipe flush with interior of structure.
11. Shape inverts through manhole and structures as indicated on Drawings.

### 3.4 FIELD QUALITY CONTROL

- A. Section 014000 "Quality Requirements" for inspecting and testing requirements.
- B. Test concrete manhole and structure sections according to ASTM C497.
- C. Test cast-in-place concrete as specified in Section 033000 "Cast-in-Place Concrete."
- D. Vertical Adjustment of Existing Manholes and Structures:
  1. If required, adjust top elevation of existing manholes and structures to finished grades as indicated on Drawings.
  2. Reset existing frames, grates, and covers that were carefully removed and cleaned of mortar fragments to required elevation according to requirements specified for installation of castings.
  3. When removal of existing concrete wall is required, remove concrete without damaging existing vertical reinforcing bars, clean concrete from vertical bars, and bend into new concrete top slab or splice to required vertical reinforcement as indicated on Drawings.
  4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete as specified in Section 033000 "Cast-in-Place Concrete."
- E. Leakage Tests:
  1. Performed on every manhole with Engineer observing.
  2. Preparation:
    - a. Prior to placing the shelf and invert, and pointing the horizontal joints, fill all lifting holes within 6 feet of ground surface with approved non-shrinking mortar.
    - b. Lower groundwater table as required.
    - c. Plug all pipes and other openings into manhole.
  3. Test:
    - a. Fill water to top of cone section.
    - b. Observe for visible water in the excavated area.
    - c. If area around manhole is backfilled or the test is unsatisfactory, repeat the test allowing for suitable time for absorption of water in the excavated area.
    - d. At the end of the absorption period, refill manhole and wait 8 hours.
    - e. Refill the cone at the end of 8 hours, measuring the amount required to refill.
    - f. Extrapolate to determine 24-rate of leakage. Leakage not exceed 1 gallon per vertical foot in a 24-hour period.
    - g. Engineer will perform visual inspection along with the Contractor.

4. Repair:
  - a. If leakage is less than 3 gallons per vertical foot per 24 hours, make approved repairs to the manhole and retest, if it is determined the leakage is due to defects in the joints or sections.
  - b. If leakage is 3 gallons or more, then replace the entire manhole, including all joints and sections at the Contractor's expense. Retest the new manhole as described above.

F. A vacuum test may be substituted for a leakage test as follows:

1. The filling and pointing of exterior joints are not required where the excavation has not been backfilled.
2. Inflate to affect a seal between the vacuum base and the top of the manhole.
3. Connect the vacuum pump to the outlet port with the valve open and a vacuum of 10" Hg (20" of Hg absolute) drawn.
4. Close the valve.
5. The following test criteria shall apply to 4-ft and 5-ft diameter manholes:
6. Allowable drops in pressure:
  - a. Manholes 0 – 10 ft. deep:
    - 1) drop of 1" Hg over 2 minutes.
  - b. Manholes 10 -15 ft. deep:
    - 1) Drop of 1" Hg over 2-1/2 minutes
  - c. Manholes 15 - 30 feet:
    - 1) Drop of 1" Hg over 3 minutes
7. If the pressure drop exceeds the acceptable limits, make necessary repairs as approved by the Engineer, and:
  - a. Re-test the manhole.
  - b. If the manhole fails to meet the minimum requirements of the vacuum test retest using the leakage test.
8. Upon completion of a successful vacuum test, the interior and exterior joints shall be filled and pointed.

### 3.5 CLEANING

- A. Clean all new manholes to be free of silt, debris and foreign matter of any kind, prior to final inspection.

END OF SECTION 330513.00

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## SECTION 330519 - DUCTILE-IRON UTILITY PIPE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Materials, equipment and incidentals required to install, and test ductile iron pipe and fittings for piping as shown on Drawings and as specified.
  - a. The word "pipe" is used to refer to pipe, fittings, or appurtenances unless otherwise noted.
- 2. Outfall Piping: Begins after the discharge manhole approximately 100 lf from Cape Fear River. All piping between the discharge manhole and duckbill check valve diffuser shall be ductile iron.
- 3. Locate piping as shown on the Drawings. The Engineer reserves the right to make modifications in locations as may be found desirable to avoid interference between pipes or for other reasons.

- B. Related Requirements:

- 1. Section 312333, "Trenching and Backfilling"
- 2. Section 312500, "Erosion and Sedimentation Controls"
- 3. Section 331216, "Valves".
- 4. Section 330513, "Manholes and Structures"

#### 1.3 COORDINATION

- A. Section 013100 "Project Management and Coordination" specifies requirements for coordination.

#### 1.4 ACTION SUBMITTALS

- A. Section 013300, "Submittal Procedures" for submittals requirements.

- B. Shop Drawings and Product Data:

- 1. Including piping layouts, design calculations, warranty information, test reports, in accordance with Section 013300 and the referenced standards.
- 2. Design calculations in accordance with the "Pipe Wall Thickness Analysis" Paragraph under Part 2 Products, below, signed by a Professional Engineer, as noted in Section 013300.
- 3. Name of the pipe and fitting suppliers and a list of materials to be furnished.

4. Anticipated production and delivery schedule.

## 1.5 DELEGATED DESIGN SUBMITTALS

- A. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for required thrust.
- B. Tabulated Laying Schedule:
  1. Reference stations and invert elevations as shown on the Drawings
    - a. Include fittings, bends, outlets, restrained joints, tees, special deflection bells, adapters, solid sleeves and specials.
  2. Manufacturer's drawings and specifications providing complete details of all items. Show on the laying schedule:
    - a. Pipe class,
    - b. Class coding,
    - c. Station limits
    - d. Transition stations
    - e. Various pipe classes
    - f. Submit to engineer for approval before manufacture and shipment.
  3. Full length pipe may be supplied from inventory provided that all specification requirements are met. Shop drawings shall include but not be limited to:
    - a. Complete and dimensional working drawings of pipe layouts, including pipe stationing, invert elevation at changes in grade or horizontal alignment, all elements of curves and bends both in horizontal alignment and vertical position.
  4. The grade of material; size, wall thickness, of the pipe and fittings and appurtenances, type and location of fittings, specials, and valves; and the type and limits of the lining, lining reinforcing and coating systems of the pipe and fittings. Methods and procedures recommended by the coating manufacturer to also be documented.
  5. Method of manufacture of pipe; joint details, fittings and any specials.
  6. All other pertinent information for all items to be furnished; product data to show compliance of all couplings, supports, fittings, coatings and related items.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Prior to Pipe Shipment:
  1. 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.
  2. Certified affidavit of compliance from manufacturer stating that pipe, fittings, gaskets, linings and exterior coatings for project have been manufactured and tested in accordance with AWWA and ASTM standards and requirements specified herein.
- B. Copies of shop tests, including hydrostatic tests.



- C. 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.
- D. Test and Evaluation Reports.
- E. Manufacturers' Instructions.
- F. Source Quality Control Submittals: Document results of factory tests and inspections.
- G. Field Quality Control Submittals: Document results of required tests and inspections.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Section 017700 "Closeout Procedures" for closeout procedures requirements.
- B. Project Record Documents: Actual locations of pipe joints.
- C. Operation and Maintenance Data.

#### 1.8 QUALITY ASSURANCE

- A. Perform Work according to Brunswick County Public Utilities standards.
- B. Designed and supplied by a single manufacturer. Pipe and Fitting Connections: Pipe to be supplied by a single manufacturer and fittings may be supplied by a different manufacturer.
- C. Hydrostatically tested at point of manufacture to 500 psi for a duration of 10 seconds per AWWA C151. Testing may be performed prior to machining bell and spigot.
  - 1. Test Failure: Defined as any leak or rupture of pipe wall.
  - 2. Certified test results furnished in duplicate to Engineer 5 days prior to shipment.
- D. Pipe and Fittings:
  - 1. Inspected and tested at foundry as required by specified referenced standards.
  - 2. Certified test results furnished in duplicate to Engineer 5 days prior to shipment.
- E. Inspection of Pipe and Fittings After Delivery: By Engineer or representative of the Owner.
  - 1. Pipe and fittings subject to rejection if failing to meet specified requirements even though pipe may have been accepted as satisfactory at the place of manufacture.
  - 2. Pipe rejected after delivery (including defects from manufacturing or delivery/transport) to be marked for identification and immediately removed from the job.
- F. Pipe and fittings installed under this Contract may be inspected at the factory for compliance with this Section by an independent testing laboratory selected by the Owner at the Owner's expense.

G. Manufacturer's Representative:

1. Made available to the Owner and owner's representative during the manufacturing furnishing, transporting, and unloading of the pipe, as well as during installation and testing of the pipe to assist in insuring that the pipe is properly fabricated, transported, unloaded, stored in the field, joined and tested.
2. Manufacturer's responsibilities relate only to the proper care and treatment of the pipe during these procedures and not the techniques or procedures used during installation and testing.
3. Available at any time the Owner may request. A minimum of 10 working days (time on site) during the project when requested by the Owner.
4. The cost for the services of the factory representative, including expenses, to be considered incidental to the project and will not be paid separately.

H. Pipe and fittings marked in accordance with all applicable AWWA standards. Legibly and permanently mark pipe, fittings, specials and appurtenances to be consistent with the laying schedule and marking drawings (if required) with the following information:

1. Manufacturer
2. Date of manufacture.
3. Size, type, class, or wall thickness.
4. AWWA Standard(s) produced to.
5. Special fittings, bends, and appurtenances requiring specific orientation will be appropriately marked with the words "TOP" in the correct position and in a consistent location.

1.9 QUALIFICATIONS

A. The manufacturer shall meet the following criteria and furnish the necessary project information, which demonstrates the required experience:

1. Experience that includes successful fabrication (followed by installation, acceptance and service) to AWWA C151 standards of at least 50,000 lineal feet of the largest specified diameter or larger ductile iron pipe with similar linings/coatings within the past 5 years.
2. Experience to include the successful fabrication of at least 50 fittings in compliance with AWWA C110 or C153 of the largest specified diameter or larger with similar lining/coatings within the past 5 years.

B. Pipe Origin: Manufactured in the United States. Ductile iron pipe to be supplied by a single manufacturer.

C. Fittings Origin: Manufactured in the United States and supplied by one of the named pipe fitting manufacturers in Part 2 or Engineer approved equal. Ductile iron fittings to be supplied by a single manufacturer. Written certification fittings are compatible with the supplied brand of pipe.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 016000, "Product Requirements" for transporting, handling, storing, and protecting products requirements.

- B. Delivery: Per AWWA C600 and referenced AWWA Standards for shipping, handling and storage procedures.
1. Deliver materials in manufacturer's packaging including application instructions.
  2. Handle to prevent injury to the pipe, pipe linings and pipe coatings.
    - a. Examine pipe and fittings as noted in Division 1. Damage to linings or coatings discovered during examination to be repaired to the satisfaction of the Engineer before proceeding with the work.
  3. Transport pipe to job site on padded bunks or oak timbers and secured with steel banding or nylon tie down straps adequately protecting the pipe and coating.
    - a. Handle pipe using slings, hooks, pipe tongs or other devices acceptable to the Engineer.
    - b. Do not use non-cushioned ropes, chairs, wedges, cables or levers when handling finished pipe, fittings or couplings.
    - c. Do not drop pipe or fittings.
    - d. Do not skid pipe or fittings against each other.
    - e. Do not mar pipe or fitting coatings.
    - f. Utilize padded wooden pipe cradles or chocks suitable for protecting coatings between and beneath finished pipes when pipes are placed upon rough surfaces.
- C. Storage:
1. Do not store pipe on bare ground unless soft sand berms are used to support the pipe and is approved by the Engineer.
  2. Keep materials safe from damage if stored. The interior of pipe, fittings and other appurtenances to be kept free from dirt, excessive corrosion or foreign matter.
  3. Do not stack pipe higher than the limits recommended by manufacturer. Keep the bottom tier off the ground using timbers, rails, or concrete. Stacking to conform to manufacturer's recommendations and/or AWWA C600.
  4. Store gaskets for mechanical and push-on joints in a cool location out of direct sunlight; not in contact with petroleum products. Use gaskets on a first-in, first-out basis.
- D. Protection:
1. Lined and coated pipe: Suitably protected from exposure and heating from the sun. Follow procedures recommended by the coating and lining system manufacturer.
    - a. Exposure will not be allowed except for short periods such as installation, assembly and repairs.
  2. Metal tools or heavy objects are not permitted to come in contact unnecessarily with the finished coating.
    - a. Workers may walk on coated pipe only when necessary, and only when wearing footwear with rubber or composition soles and heels sufficiently free of dirt and mud so coating remains undamaged.
  3. Prevent damage to linings and coatings caused by handling, onsite storage, and exposure to low temperatures (due to embrittlement), high temperatures, or direct sunlight.
- E. Inspection: Accept pipe and fittings on Site. Inspect for damage.

### 1.11 EXISTING CONDITIONS

- A. Field Measurements: Verify field locations and sizes of connections to existing piping and equipment prior to submitting pipe lay drawings.

- 1. Indicate field measurements on Shop Drawings.

### 1.12 WARRANTY

- A. Section 017700 "Closeout Procedures" for warranties requirements.
- B. Furnish one (1) year manufacturer's warranty for ductile iron pipe and fittings.

## PART 2 - PRODUCTS

### 2.1 SYSTEMS

- A. Assure compatibility between joints of all items supplied.

### 2.2 DUCTILE IRON PIPE

- A. Manufacturers: Provide pipe and fittings supplied by:
  - 1. American Cast Iron Pipe Co.
  - 2. U.S. Pipe and Foundry.
  - 3. Griffin Pipe Products.
  - 4. McWane Company; all pipe divisions.
  - 5. An approved equivalent member of the Ductile Iron Pipe Research Association (DIPRA).
- B. Fitting Certification: From fitting manufacturer; written certification that fittings are compatible with supplied brand of pipe.
- C. Ductile Iron Pipe: Per AWWA C151. Provide in standard lengths as much as possible.
- D. Thickness Design: Per AWWA C150:
  - 1. Piping 12 inches and Smaller: Minimum Class 350.
  - 2. Piping 14 inches to 20 inches Minimum Class 250.
  - 3. Piping Larger than 24 inches: Minimum Class 150.
- E. Pipe Wall Thickness Analysis:
  - 1. Tensile strength: 60,000 psi
  - 2. Yield strength of 42,000 psi (per AWWA M-41).
  - 3. Design and analyze external and internal pressures separately. Use the larger of the two to determine the net design thickness.
  - 4. Design additional allowances for service allowance and casting tolerance per AWWA C150.
  - 5. Pipe Classes: The minimum pipe class specified in the Thickness design paragraph above.

6. Design the net thickness for external loading based on the greater of the following conditions:
  - a. Cover: 30 inches with HS-20 wheel loads per AASHTO Standard Specifications for Highway Bridges, with an impact factor of 1.5.
  - b. Depth from existing ground level or future proposed grade, whichever is greater, to top of pipe as shown on the Drawings, with truck load.
  - c. Soil Density: 125 lbs per cu ft.
  - d. Laying Conditions: Per AWWA C150, Type 2.
7. Design the net thickness based upon the following internal pressure conditions:
  - a. Design Pressure: 150 psi.
  - b. Safety Factor: 2.
  - c. Total Internal Pressure Design: 250 psi.
  - d. E': 300 psi.
8. Furnish to the Engineer for approval, copies of design calculations showing pipe meets the specified requirements during shop drawing review in accordance with Section 013300.

## 2.3 END TREATMENTS/JOINTS

1. Unrestrained Pipe and Fitting Joints: Push-on rubber gasket type per AWWA C111, except where flanged joints are required as shown on the drawings.
2. Restrained Pipe and Fitting Joints: Push-on rubber gasket, locking ring type joints per the manufacturer' standard described below, except where flange joints are shown on the Drawings.
3. Gasket materials: Per Table 5-1 of AWWA M-41.
  - a. Rubber-Gasket Joints: Per AWWA C111. Styrene butadiene rubber (SBR).
4. Restraints for push-on joint pipe and fittings to be positive locking, utilizing restraints independent of the joint gasket.
  - a. Joint Test Pressure 150 psig
  - b. Joint Fabrication: Heavy section ductile iron casting.
  - c. Bolts and Nuts: Low carbon steel conforming to ASTM A193, Grade B7.
  - d. Restraint for mechanical joint pipe shall use retainer glands for restraining joint.
5. Provide restrained push on joints from one of the following manufacturers or an Engineer approved equivalent.
  - a. US Pipe and Foundry Company: "TR Flex."
  - b. American Cast Iron Pipe Company: "Lok-Ring" or "Flex Ring (positive locking style)."
  - c. Griffin Pipe Products Company: "Snap Lok."
  - d. Clow Water Systems Company: "Superlok."
6. Determine the minimum number of restrained joints required for resisting forces at fittings and changes in direction of the pipe from the length of restrained pipe on each side of the fittings and changes in direction necessary to develop adequate resistance friction with the soil.
  - a. The required lengths of restrained joints shall be as shown on the Drawings.
7. Restrained pipe joints incorporating cut out sections in the pipe wall must have a minimum wall thickness at the cut out corresponding with the minimum specified wall thickness for the rest of the pipe.

8. Pipe manufacturer proprietary 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 determined by the Engineer.
  - a. 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.
  - b. Restraint Mechanism:
    - 1) Individually activated gripping surfaces maximizing restraint capability.
    - 2) Wedges designed to spread the bearing surfaces on the pipe.
    - 3) Torque limiting twist-off nuts sized same as T bolts for mechanical joints. When the nut is sheared off, standard hex nut shall remain.
  - c. Restraint Device for Ductile Iron Pipe: EBAA Iron Megalug Series 1100, or approved equivalent.
    - 1) Working Pressure: 250 psi and a safety factor of 2:1.
9. Couplings and Adapters Sleeve Type Couplings: Refer to Section 330500
10. Buried Sleeve-Type Couplings: Protective wrapping of "Denso" material by DENSO Inc. of Texas or equivalent.
  - a. Where "Denso" material is used, pack joint with "Densyl mastic" to give an even contour for wrapping with "Densopol" tape.
  - b. Apply a 1/16 inch thick coating of "Denso" paste followed by 4 inch or more wide "Densopol" tape wound spirally around the joint with at least 50 percent overlap.

## 2.4 FITTINGS

1. Pipe Fittings: Ductile iron per AWWA C110 or AWWA C153 as applicable. Fittings to have the same pressure rating, as a minimum, of the connecting pipe.
  - a. Piping 24 inch and smaller: minimum pressure rating of 350 psi
  - b. Piping 30inch and larger: 250 psi.
2. Closures: Made with mechanical joint ductile iron solid sleeves. Locate in straight runs of pipe at minimum cover outside the limits of restrained joint sections; subject to approval of the Engineer.
3. Weld-on Outlets: May be used as an alternative to ductile iron cast fittings. Limited to branch outlets having a nominal diameter not greater than 30 percent of the nominal diameter of the main pipe, or 14 inches diameter, whichever is smaller.
  - a. May be provided as radial tee outlet, tangential outlet, or lateral outlet fabricated at a specific angle to the main pipe (in 1 degree increments between 45 and 90 degrees from the axis of the main pipe).
  - b. Welded onto the pipe under the supervision of a qualified welder at the same facility where the pipe is manufactured. Pipe manufacturer to have 5 years' experience in the fabrication and testing of outlets of similar size and configuration. Field welding of outlets is not acceptable.
  - c. Joints to be compatible with connecting pipe and meet where applicable, requirements of ANSI/AWWA C111/A21.11 and/or ANSI/AWWA C115/A21.15.
  - d. Welding Procedures: As determined by the pipe manufacturer.
    - 1) Parent pipe and branch outlet candidate pipe shall be centrifugally cast ductile iron pipe.
      - a) Designed per ANSI/AWWA C150/A21.50
      - b) Manufactured per ANSI/AWWA C151/A21.51.

- c) Minimum class for sizes 4 through 54 inch; special thickness class 53.
- e. Rated for the working pressure indicated on the Drawings and the connecting pipe.
- f. Prior to application of coating or lining in the outlet area, weldments for branch outlets supplied for this project will be subjected to a hydrostatic test of 500 psi. No leakage is allowed on the hydrostatic test. The hydrostatic test shall be done prior to cutting out the parent pipe. The rating, safety factor and testing must be certified and contained in the manufacturer's submittal package.

## 2.5 LININGS, COATINGS & CORROSION PROTECTION

### A. Interior Lining:

- 1. Ductile iron pipe and fittings shall have the same type of lining.
- 2. Cement Mortar Lining: Per AWWA C104 double thickness. Cement type per ASTM C150.
  - a. Epoxy coating in accordance with AWWA C116

### B. EXTERIOR COATING

- 1. Buried pipe installed with bituminous coating per AWWA C151 and C110 respectively.
- 2. Install buried pipe with polyethylene encasement.
  - a. Polyethylene Encasement: 8 mils thickness meeting standards per AWWA C105.
    - 1) Three layers of co-extruded linear low-density polyethylene (LLDPE), fused into a single thickness not less than eight mils. Infuse the inside surface in contact with the pipe exterior with an antimicrobial compound and volatile corrosion inhibitor blend, mitigating microbiologically influenced corrosion galvanic corrosion.
    - 2) Polyethylene encasement shall be V-Bio, as patented by DIPRA.
  - b. Manufacturers:
    - 1) North Town Company
    - 2) AA Thread and Seal Tape, Inc.
    - 3) Sigma Corp.
    - 4) Approved equal
  - c. Size Requirements: Per TABLE 3, section 2.15 of DIPRA's Installation Guide for Ductile Iron Pipe.
  - d. Test Results: Submitted to Engineer for approval prior to use.
    - 1) Testing: Independent testing agency certifying polyethylene encasement meets criteria established by AWWA C105 associated with tensile strength, elongation, dielectric strength, impact resistance, and propagation tear resistance.
    - 2) Samples: Include with test results.
  - e. Plastic Adhesive Tape: 2 inch for sealing seams, cuts, or tears in polyethylene encasement. Duct tape is not acceptable.
    - 1) Calpico Vinyl
    - 2) Polyken
    - 3) U.P.C.
    - 4) Approved equal

## 2.6 SOURCE QUALITY CONTROL

- A. Section 014000, "Quality Requirements" for testing, inspection, and analysis requirements.
- B. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

2.7 Specified shop tests are not required for Work performed by approved fabricator.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 017300 "Execution" for installation examination requirements.

### 3.2 PREPARATION

- A. Section 017300 "Execution" for installation preparation requirements.
- B. Handle piping and fittings per "Delivery, Storage, and Handling" Article in Part 1 of this specification.
- C. Examine pipe and fittings before laying. Repair any damage to the pipe, lining or coatings per manufacturer's recommendations prior to installation.
- D. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt, excessive corrosion or foreign matter at all times.

### 3.3 INSTALLATION

- A. Installed per requirements of the laying schedule and AWWA C600, unless otherwise specified.
  - 1. Provide firm, even bearing the length of the pipe. Dig bell holes at each joint. Tamp backfill materials on pipe sides to the springline per details on the Drawings.
  - 2. Blocking is not permitted.
  - 3. Replace with sound pipe or fitting, defective pipe or fitting discovered after having been laid.
  - 4. When laid, pipe and fittings shall perform to lines and grades required. When laying is not in progress, close open ends of the pipe with watertight plug or other approved means.
  - 5. Place sufficient backfill to prevent flotation. Joint deflection not to exceed manufacturer's recommendation.
  - 6. Pipe Laid Underground: 3 feet cover unless Drawings show otherwise or otherwise specified.
  - 7. Lay pipe such that the invert elevations shown on Drawings are not exceeded.



8. Provide fittings, in addition to those shown on the Drawings, where required, in crossing utilities which may be encountered upon opening the trench. Install solid sleeve closures at locations approved by the Engineer.
9. Pipe Interior: Maintain dry and broom clean throughout construction period.
10. Field Cutting Pipe: When required, smooth cut by machine perpendicular to pipe axis. Bevel cut pipe ends per manufacturer's recommendations for the spigot end.
  - a. Repair coating removed from cut per manufacturer's recommendation and/or the coating and lining paragraphs of Part 2 above (whichever method is more stringent in the opinion of the Engineer).
  - b. Cement lining shall be undamaged.
  - c. 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.
  - d. Where Field Cuts are Permitted” Pipe supplied by the factory as "gauged full length".
    - 1) Gauged Full Length Pipe is Unavailable: Pipe to 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 tolerances permitted in Table 1 of AWWA C151.

B. Jointing Ductile-Iron Pipe

1. Push-On Joints: Install per manufacturer's instructions, AWWA C600 and Appendix B of AWWA C111. If there is conflict, manufacturer's instructions take precedence.
  - a. Lay pipe with bell ends looking ahead.
  - b. Insert rubber gasket in the groove of bell end of pipe.
  - c. Clean and lubricate joint surfaces
  - d. Align the plain end of the pipe with the bell of the pipe to which it is to be joined and pushed home.
  - e. Metal feeler shall be used to make certain that the rubber gasket is properly seated.
2. Mechanical Joints: Assembled per manufacturer's instructions, AWWA C600 and Appendix A of AWWA C111. If there is conflict, manufacturer's instructions take precedence.
  - a. Lay pipe with bell ends looking ahead.
  - b. Clean and lubricate joint surfaces and rubber gasket.
  - c. Tighten bolts to the specified torques.
  - d. Extension wrenches or pipe over handle of ordinary ratchet wrench are not allowed to secure greater leverage.
  - e. Encapsulate bolts and nuts using wax sealing tape per AWWA Standard C217.
  - f. Install polyethylene encasement as specified.
3. Bolts in Mechanical or Restrained Joints: Tightened alternately and evenly.
4. Restraint for Mechanical Joint Pipe:
  - a. Retainer glands for restraining joint.
  - b. Restrained mechanical joints to be suitable for the specified test pressure.
  - c. Installed according to pipe manufacturer's instructions.
5. Sleeve Couplings: Only installed for closure or as shown on the Drawings. Do not assemble couplings until adjoining joints have been assembled.
  - a. Encapsulate bolts and nuts using wax sealing tape per AWWA Standard C217,
  - b. Install protective wrap recommended by manufacturer or as required herein. Maintain insulating properties of insulating and dielectric couplings.

6. Blowoffs, outlets, valves, fittings and other appurtenances to be set and jointed as indicated on the Drawings and per manufacturer's instructions.

C. Polyethylene Encasement

1. Install polyethylene encasement around ductile iron pipe to limits shown on the Drawings and in accordance with pipe manufacturer's recommendations.
  - a. 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. Use a fabric type or padded sling when handling pipe to prevent damage to the encasement.
3. Seal seams with approved 2 inch wide plastic adhesive tape.
4. Repair encasement rips or tears with tape and film per ANSI/AWWA C105/A21.5.
5. When backfilling does not damage the polyethylene encasement.

3.4 CONNECTIONS TO STRUCTURES

- A. Where pipe 3 inch diameter or larger horizontally passes from concrete to earth, install two flexible joints spaced 2 to 4 feet apart depending on pipe size within 2 feet of exterior wall face, whether shown on Drawings or not.
- B. Utilize wall sleeves for pipes passing through walls designed to pass through the wall via restrained piping unless otherwise specified.
- C. Encase piping underneath structures in reinforced concrete as shown in the Drawings.

3.5 FIELD QUALITY CONTROL

- A. Section 014000, "Quality Requirements" for inspecting and testing requirements.
- B. Replace with sound pipe or fitting, defective pipe or fitting discovered after having been laid.
- C. Thoroughly clean pipe and fittings before laying. Keep clean until used in the Work.
- D. Pipe and fittings, when installed or laid, shall conform to the lines and grades required.

E. FILLING AND TESTING

1. After Installation: Test pipe shall for compliance as specified.
  - a. Furnish necessary equipment and labor for hydrostatic pressure testing the pipelines.
  - b. Submit detailed test procedures and methods per AWWA C600 for Engineer's review and approval at least 10 days prior to testing
2. Pressure Pipelines: Subjected to hydrostatic pressure of 1.25 times the working pressure at the highest point along the test segment.
  - a. Maintained test pressure for 2 hours.
  - b. Hydrostatic testing allowances are not to exceed those indicated in AWWA C600.
  - c. Provide suitable restrained bulkheads as required to complete the specified hydrostatic testing.
  - d. Make taps and furnish necessary caps, plugs, etc., required to conduct testing.
3. Gravity Pipelines: Subjected to hydrostatic pressure test as specified in AWWA C600.
4. Valves and Valve Boxes" Properly located, installed and operable prior to testing.

5. Provide bulkheads with a sufficient number of outlets for filling and draining the line and for venting air.
6. Hydrostatic Pressure Tests: Per Section 5.2 of AWWA C600.
  - a. Furnish gauges, meters, pressure pumps and other equipment required to slowly fill the line and perform the required tests.
7. Owner will provide a source of supply from the existing treated water distribution system for use in filling the lines. An air break shall be maintained at all times between the distribution system and equipment to prevent cross-connection.
  - a. Slowly fill the line with water. Maintain the specified test pressure in the pipe for entire test period. Provide accurate means for measuring the quantity of makeup water required to maintain this pressure.
8. Pressure Test Duration: 2 hours.
  - a. Repair leaks evident at the surface regardless of total leakage as shown by test.
  - b. Repair lines failing to meet tests. Retest as necessary until test requirements are met.
  - c. Defective materials, pipes, valves and accessories shall be removed and replaced.

### 3.6 CLEANING AND DISINFECTION

- A. Sections 017300 "Execution" and 017700 "Closeout Procedures" for cleaning requirements.
- B. At conclusion of the Work, thoroughly clean pipes by flushing with water or other means to remove dirt, stones, pieces of wood, or other material which may have entered during the construction period. Remove all debris from the pipeline. The lowest segment outlet shall be flushed last to assure debris removal.
- C. After pipes have been cleaned and if groundwater level is above the pipes or water in the pipe trench is above the pipe following a heavy rain, the Engineer will examine the pipe for leaks.
  1. Repair and replace defective pipes, fittings or joints that are discovered.

### 3.7 PROTECTION

- A. Section 017300 "Execution" for protecting finished Work requirements.

### 3.8 EXHIBIT A

<u>Use as a reference</u>			
<b>INTERIOR LININGS AVAILABLE FOR DUCTILE IRON PIPE</b>			
<b>Description</b>	<b>Max./ Service (1) Temp. (Degrees F)</b>	<b>Common Uses</b>	<b>Thickness</b>
CEMENT MORTAR (AWWA C104)			
With Sealcoat	150 degrees	Salt water	
Without Sealcoat	212 degrees	Drinking Water Non-Septic Gravity	Standard per AWWA C104 or double

		Sewers Sanitary sewers Force Mains	
GLASS		Scum	10 Mil (nominal)
PETROLEUM ASPHALT COATING	150 degrees	Air	1 Mil
PROTECTOR 401 (CERAMIC-FILLED AMINE-CURED EPOXY)	120-150 degrees (2)	Septic sewers Acids (3) Alkali Waste Pickling brine	40 Mil (nominal)
EPOXIES SUITABLE FOR DRINKING WATER (4)	120-150 degrees (2)	Drinking Water Food Processing	24 Mil (minimum)
POLYETHYLENE	120-150 degrees (5)	Septic Sewers Acids (3) Alkali Waste Pickling Brine	40 Mil (nominal)
<p>(1) Maximum service temperatures listed are intended as general guidelines. For higher service temperatures, consult manufacturer for specific recommendations.</p> <p>(2) Maximum service temperatures for epoxies depends on service conditions and specific formulation. Consult manufacturer for recommendations for elevated temperature service.</p> <p>(3) Consult manufacturer for specific acid service use.</p> <p>(4) All epoxies are not suitable for conveying drinking water. Consult manufacturer for recommendations. Many jurisdictions require NSF 61 certifications for linings in contact with drinking water.</p> <p>(5) Maximum service temperature for polyethylene for acids and alkali waste depends on the specific acid or alkali waste and service condition(s). consult manufacturer for recommendations for elevated temperature service.</p>			

### 3.9 EXHIBIT B

#### EXHIBIT B

Use as a Reference

#### **GASKET MATERIALS USED FOR DUCTILE IRON PIPE IN WATER AND SEWERAGE SERVICE**

Description	Maximum Service(1,2) Temperature (Degrees F)		Common Uses(3)
	Push-On Gaskets Joint Gaskets	Mechanical	
SBR (Styrene Butadiene)	150 Degrees	120 Degrees	Fresh Water Salt Water Sanitary Sewage
EPDM (Ethylene Propylene)	250 Degrees	225 Degrees	Fresh Water Salt Water Sanitary Sewage Hot Water
Nitrile (NBR) (Acrylonitrile Butadiene)	150 Degrees	120 Degrees Fats, Oils Greases Chemicals	Hydrocarbons
Neoprene(R) (CR) (Polychloroprene)	200 Degrees	200 Degrees Salt Water Sanitary Sewage	Fresh Water
Viton(R); Fluorel(R) (FPM) (4) (Fluorocarbon)	300 Degrees	225 Degrees Acids Petroleum Vegetable Oils	Hydrocarbons

- (1) Maximum service temperatures listed are intended as general guidelines for ductile iron pipe gaskets. For service temperatures greater than those listed, consult manufacturers for specific recommendations.
- (2) Minimum service temperature is not usually a meaningful parameter for piping gaskets; however, low temperatures during pipeline installation may necessitate precautions. Consult manufacturer for pertinent recommendations.
- (3) Water, including sanitary sewage, with low levels of the listed contaminants.

END OF SECTION 330519

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## SECTION 330526 - UTILITY IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes utility identification for the concentrate discharge pipeline:
  - 1. Pipeline marker posts.
  - 2. Metal utility markers.
  - 3. Plastic utility markers.
  - 4. Marking flags.
  - 5. Plastic ribbon tape for placement above direct-buried utility.
  - 6. Trace wire for placement above direct-buried utility.
  - 7. Electronic utility marker balls for placement above direct buried utility.
- B. Related Requirements:
  - 1. Section 312333 "Trenching and Backfilling."
  - 2. Section 312000 "Earthwork."
  - 3. Section 330531 "Polyvinyl Chloride Pressure Pipe" for piping, and appurtenances requiring identification marking.
  - 4. Section 330533 "Polyethylene Pressure Pipe" for piping, and appurtenances requiring identification marking.

#### 1.2 SUBMITTALS

- A. Section 013300 "Submittal Procedures" for requirements for submittals.
- B. Product Data: Submit manufacturer's catalog information for each product required.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Qualifications Statement:
  - 1. Submit qualifications for manufacturer.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Section 017700 "Closeout Procedures" for requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged valves.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 017700 "Closeout Procedures" for requirements for maintenance materials.
- B. Extra Stock Materials:
  - 1. Furnish Concentrate Discharge Pipeline pipeline marker posts, Concentrate Discharge Pipeline utility markers Concentrate Discharge Pipeline rolls of trace wire, and Concentrate Discharge Pipeline electronic utility marker balls.

#### 1.5 QUALITY ASSURANCE

- A. Conform to APWA Uniform Color Code, ANSI Z535.1, and ASME A13.1 for color scheme for identification of piping systems and accessories.

#### 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

### PART 2 - PRODUCTS

#### 2.1 MARKER POSTS

- A. Manufacturers:
  - 1. Berntsen International Inc. of Madison, Wisconsin.
  - 2. William Frick & Company, of Libertyville, Illinois.
  - 3. Or Equal
- B. Description:
  - 1. Material: High-density polypropylene.
  - 2. Diameter: 3-1/2 inches
  - 3. Length: 72 inches
  - 4. Color: Green
  - 5. Embedment: T-anchor.

#### 2.2 RIBBON TAPE

- A. Manufacturers:
  - 1. Berntsen International Inc.
  - 2. Pipemarker.com; Brimar Industries, Inc.
  - 3. or Equal



B. Description:

1. Material: Polyethylene
2. Brightly colored, continuously printed.
3. Minimum Size: 3 inches wide by 4 mils thick.
4. Manufactured for direct burial service.
5. Color: Green
6. Imprint: "CAUTION CONCENTRATE PIPELINE BURIED BELOW" in large letters.

2.3 TRACE WIRE

A. Manufacturers:

1. Copperhead SuperFlex
2. Pro Trace High Flex
3. Or Equal
4. Description:
  - a. Wire: 12-AWG high strength copper clad steel conductor (HS – CCS) HDPE insulated copper and rated for direct burial.
  - b. Listed and approved underground connectors shall be used for all splices

2.4 ELECTRONIC UTILITY MARKER BALLS

A. Products:

1. 3M Scotchmark Electronic Marker, Model # 1404-XR
2. Or Approved Equal

B. Marker Balls:

1. Spherical, approximately 4-inch diameter and suitable for continuous buried use above or below the water table.
2. Specifically made for location of buried utilities, Color coded green for concentrate discharge
3. Uniform Color Code and ANSI Z535.1, and operate at a frequency of 121.6 Hz per Brunswick County Standards for Sewer
4. The markers consist of a sealed shell containing a passive antenna with a low frequency resonance circuit tuned to a certain frequency depending upon the associated utility.

C. Locators:

1. Contractor shall coordinate with Brunswick County staff to determine locators utilized.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Pipeline Marker Posts: As recommended by manufacturer.

1. Contractor shall coordinate with Brunswick County to determine spacing requirements for pipeline marker posts

B. Ribbon Tape and Trace Wire:

1. Continuous ribbon tape over top of pipe buried 18 inches below finish grade.
2. Continuous tracer wire shall be taped to the top of the pipe at minimum 10 foot intervals
3. If multiple pipes occur in common trench, locate tape and wire above centerline of trench.
4. Place Ribbon Tape in the correct orientation, and anchor as necessary to prevent dislocation during placement of backfill.
5. Backfill above Ribbon Tape and Tracer Wire taking care to avoid dislocation. Compaction equipment shall not directly contact the Ribbon Tape or Trace Wire.
6. Coordinate with trench Work as specified in Section 312333 Trenching and Backfill.
7. Contractor shall be required to perform a signal strength test of the installed tracer wire at the end of the project with County Engineering and/or Public Utilities staff present.

C. Valve markers shall be installed in accordance with Standard Details

D. Electronic Utility Marker Balls

1. Install marker balls minimum 6-inches over top of pipe and buried minimum 18-inches below finish grade with maximum 48-inches below finished grade
2. Install marker balls at a maximum spacing of 200 feet and minimum distance between markers of 3.5 feet.
3. Place marker ball in the correct orientation, and anchor as necessary to prevent dislocation during placement of backfill.
4. Backfill above marker ball taking care to avoid dislocation. Compaction equipment shall not directly contact the marker ball.
5. Coordinate with trench Work as specified in Section 312333 Trenching and Backfill.
6. Markers shall be installed above any installed marking tape.
7. Marker balls shall be located at all of the below locations. Refer to "Electronic Marker Ball Placement" Standard detail.
  - a. Tees, bends, crosses, all other fittings
  - b. Casing ends
  - c. Arcs
  - d. Utility crossings
  - e. Rail crossings
  - f. Repair points

END OF SECTION 330526

## SECTION 330531.16 - POLYVINYL CHLORIDE PRESSURE PIPE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Polyvinyl chloride (PVC) concentrate discharge pipe and fittings, complete as shown on Drawings and as specified.
  - 1. Pipe or Piping: Refers to all pipe, fittings, material and appurtenances required to construct PVC concentrate discharge pipeline complete, in place.
  - 2. Equipment and materials specified are intended to be standard types used in transporting RO Concentrate.
- B. Related Requirements:
  - 1. Section 310515 "Soils and Aggregates for Earthwork" for granular fill.
  - 2. Section 312333 "Trenching and Backfilling."
  - 3. Section 321216 "Asphalt Paving."
  - 4. Section 330526 "Utility Identification."
  - 5. Section 330513 "Manholes and Structures."
  - 6. Section 330519 "Ductile-Iron Utility Pipe."
  - 7. Section 331216 "Valves"
  - 8. Section 330526 "Utility Identification."

#### 1.3 ACTION SUBMITTALS

- A. Section 013300, "Submittal Procedures" for submittals requirements.
- B. Product Data: Name of pipe and fitting manufacturers, materials list furnished by each manufacturer and catalog information for each product.
- C. Shop Drawings:
  - 1. Piping layouts and schedules including dimensioning, fittings, types and locations of valves and appurtenances, and joint details.
  - 2. Methods and location of supports, anchorage, gasket material, grade of material and all other pertinent technical information.
  - 3. Indicate restrained joint locations.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Section 017700 “Closeout Procedures” for submittals requirements.
- B. Project Record Documents: Document actual locations of Concentrate Discharge Pipeline through alignment.

#### 1.5 QUALITY ASSURANCE

- A. Perform Work according to State of North Carolina Department of Transportation standards and Brunswick County Utility Standards
- B. PVC pipe shall be from a single manufacturer. Supplier is responsible for provisions of test requirements specified in ASTM D 3034 .
- C. PVC pipe installed under this Contract may be inspected at the plant for compliance with this Section by an independent testing laboratory provided by the Owner.
  - 1. Manufacturer's cooperation is required in these inspections.
  - 2. The cost of plant inspection of pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe, will be borne by the Owner.
- D. Inspections of pipe may also be made by the Engineer or other representatives of the Owner after delivery.
  - 1. Pipe is subject to rejection at any time due to failure to meet any of the requirements specified, even though sample pipes may have been accepted as satisfactory at the place of manufacture.
  - 2. Marked for identification, rejected pipe and removed from job at once.

#### 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 5 years' documented experience.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000, “Product Requirements” for transporting, handling, storing, and protecting products requirements.
- B. Delivery:
  - 1. Bundled or package items to provide adequate protection of ends during transportation to site. Pipe damaged in shipment will be replaced as directed by the Engineer.
  - 2. Where applicable, deliver materials in manufacturer's packaging including application instructions.

- C. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
  - 1. Any gouges or scratches that extend 10 percent or more into the pipe wall shall be cause for rejection of that pipe.
  - 2. The undamaged portion may cut off and used.
  - 3. Clearly mark rejected materials as rejected. Segregate and remove from the site.
- D. Storage: Per manufacturer's instructions, referenced standards and as specified
  - 1. Adequately support stored pipe from below, at 3 feet maximum intervals to prevent deformation. Pipe stored in stacks no higher than that given in the following table or the manufacturer's instructions whichever is more restrictive:
    - a. Pipe Diameter 8 inches or Less: Maximum Number of Rows Stacked: 5
    - b. Pipe Diameter 12 to 21: Maximum Number of Rows Stacked: 4
    - c. Pipe Diameter 24 to 30: Maximum Number of Rows Stacked: 3
    - d. Pipe Diameter 33 to 48: Maximum Number of Rows Stacked: 2
  - 2. Do not store plastic manholes, pipe, and fittings in direct sunlight.
  - 3. Store in a manner keeping materials at ambient outdoor temperatures.
  - 4. No pipe or fitting is to be exposed to sunlight for more than 30 days. Any piping obviously "dulled" in color due to prolonged sun exposure shall not be used.
  - 5. Temporary shading as required to meet this requirement shall be provided.
  - 6. Simple covering of the pipe and fittings which allows temperature buildup, or direct or indirect sunlight, will not be permitted.
- E. Protection:
  - 1. Pipe and fittings showing cracks, or which have received a blow that may have caused an incident fracture, even though no such fracture can be seen, are to be marked as rejected and removed at once from the work.
  - 2. Thoroughly clean pipe and fittings before installation. Keep interior clean until testing
  - 3. Handle per manufacturer's written rigging instructions.
    - a. Use special devices and methods as required to achieve results specified. Do not use uncushioned devices in handling.
  - 4. Store gaskets for mechanical and push-on joints in cool and dry location, out of direct sunlight, and not in contact with petroleum products.
  - 5. Provide additional protection according to manufacturer instructions

## 1.8 EXISTING CONDITIONS

### A. Field Measurements:

- 1. Verify field locations and sizes of connections to existing piping and equipment prior to submitting pipe lay drawings.
- 2. Document field measurements on Shop Drawings.

## 1.9 WARRANTY

### A. Section 017700 "Closeout Procedures" for warranty requirements.

- B. Furnish two-year manufacturer's warranty for PVC pipe and fittings.

## PART 2 - PRODUCTS

### 2.1 SYSTEMS

- A. Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.

### 2.2 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC) Pipe:
1. PVC Pressure Pipe: 4 through 12 inch per AWWA C900 requirements minimum DR-18
  2. PVC Pressure Pipe: Larger than 12 inch per AWWA C905 requirements minimum DR-18
  3. Piping Materials: PVC compounds Class 12454 as defined in ASTM D 1784.
    - a. Mark pipe lengths with manufacturer's name or trademark, size, material code, pressure class.
  4. Pipeline shall be in accordance with Standard Dimension Ratios (SDR) and Ductile Iron Pipe Size (DIPS) dimensions.
  5. Fusible PVC (fPVC) shall be ASTM cell classification 12454 requirements minimum DR-18
  6. Fusible PVC force mains shall be joined by thermal butt fusion method in accordance with ASTM D638 and the manufacturer's installation recommendations.
    - a. Fittings and specials for fPVC shall conform to all applicable ASTM D3261 (HDPE) and other ASTM specifications and all manufacturer's recommendations
- B. Polyvinyl Chloride (PVC) Fitting:
1. Bell and Spigot Push-on Joints.
    - a. Bell: Consists of integral wall section with solid cross-section elastomeric gasket securely locked in place to prevent displacement during assembly.
    - b. Installation of elastomeric gasketed joints and joint performance: Per ASTM F477, ASTM D3139. Joint lubricants as recommended by manufacturer.
  2. Fittings: Cast or ductile iron per AWWA C110 mechanical joints. Furnish Adaptors, fittings and transition gaskets necessary to connect cast or ductile iron fittings to PVC. Fittings shall have interior fusion bonded epoxy coating in accordance with AWWA C116.
  3. PVC High Deflection couplings shall be allowed when 75% deflection of manufacturer's recommendations cannot be met at joints
    - a. Couplings shall meet AWWA C900 and C905 requirements
  4. Concentrate Discharge Pipeline: Green in color.
  5. Restrained Joints
    - a. Bell and spigot push on joints shall utilize bell restraint harnesses
      - 1) Constructed of ASTM A536 ductile iron. Provide epoxy coating system. Harness shall conform to AWWA C600, C605, or ASTM D2774. Harnesses shall be EBAA Iron Series 1600 or equal
    - b. Fittings shall have restraining glands for PVC pipe that conform to AWWA C111 and be Megalug by EBAA Iron Sales Inc., or equal.

## 2.3 ACCESSORIES

- A. Provide Plastic ribbon tape Trace wire and electronic utility marker balls for placement above direct buried utility in accordance with Section 330526, "Utility Identification."

## 2.4 SOURCE QUALITY CONTROL

- A. Section 014000, "Quality Requirements" for testing, inspection, and analysis requirements.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Section 017300 "Execution" specifies requirements for installation examination.
- B. Verify that excavation base is ready to receive Work.
- C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.
- D. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/6 inch per foot of length.

## 3.2 PREPARATION

- A. Section 017300 "Execution" for installation preparation requirements.
- B. Pipe and Fittings: Thoroughly cleaned before installation and kept clean until they are used in the Work.
  - 1. When laid, must conform to the lines and grades required.

## 3.3 INSTALLATION

- A. As soon as excavation is complete to normal grade of bottom of trench:
  - 1. Place bedding, compact and grade to provide firm, uniform and continuous support for the pipe.
  - 2. Excavate bell holes so only the barrel of the pipe bears upon the bedding.
  - 3. Lay pipe accurately to lines and grades indicated on Drawings.
  - 4. Blocking under the pipe is not permitted.
- B. Bedding Placement:
  - 1. Place Bedding evenly on each side of pipe to mid-diameter.
    - a. Use hand tools to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe.

2. Place the initial 36 inch of backfill above bedding in 12 inches layers and carefully compacted.
  3. Compaction: Generally done evenly on each side of pipe.
    - a. Compaction Equipment: Do not operate directly over pipe until sufficient backfill has been placed ensuring such compaction equipment will not damage the pipe.
    - b. Equipment used in compacting the initial 36 inch of backfill shall be approved by the pipe manufacturer's representative prior to use.
- C. Piping:
1. Install PVC pipe and fittings per requirements of manufacturer, ASTM D2321 and AWWA C605 or as otherwise specified.
  2. Sound and clean before installation.
  3. When installation is not in progress, including lunchtime, open ends of pipe must be closed by watertight plug or other approved means.
  4. Preserve proper alignment during installation.
  5. Joint Deflection: Not to exceed manufacturer recommendations.
  6. Fittings: Provide in addition to those shown on Drawings, if required, in crossing utilities that may be encountered upon opening the trench.
- D. Defective Pipe Discovered After Installation: Remove and replace with sound pipe in a satisfactory manner.
- E. When Cutting Pipe: By machine, leaving a smooth cut at right angles to the pipe axis.
1. Cut Ends of Pipe Used with Bell: Bevel to conform to manufactured spigot end and a reference mark made at the same distance from the pipe end as measured from a factory marked end from the same manufacturer.
  2. Engineer may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation.
    - a. Reject pipe having defective joint surfaces. Marked as defective and immediately remove from job site.
- F. Pipe lengths must have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints must not be subjected to any applied longitudinal or lateral stresses other than bedding compaction as specified.
- G. Before Joint are Made: Inspect pipe to assure a close joint with the next adjoining pipe has been maintained and that inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.
- H. Precautions shall be taken to prevent flotation of the pipe in the trench.
- I. Moveable Trench Bracing: Trench boxes, moveable sheeting, shoring or plates to support the sides of the trench.
1. Prevent movement of pipe, and disturbance of pipe bedding and backfill, when placing and moving the boxes or supporting bracing.
  2. Do not allow Trench boxes, moveable sheeting, shoring or plates to extend below the top of the pipe.



J. Concrete Thrust Blocks: Installed at fittings and locations as directed by the Engineer.

1. Minimum bearing area shall be as shown on the Drawings.
2. Place blocks against undisturbed material and must not cover joints, bolts or nuts, or interfere with the removal of any joint.
3. Wooden side forms may be provided for thrust blocks.

K. Jointing

1. Restrained joints installed where shown on the Drawings.
2. Jointing PVC Pipe (Push-on type):
  - a. Installed in strict accordance with the manufacturer's instructions.
  - b. Lay pipe with bell ends looking ahead.
  - c. Be sure joint surfaces clean.
  - d. Insert a rubber gasket in the groove of the bell end of the pipe.
  - e. Lubricate with approved lubricant per manufacturer's recommendations.
  - f. Insert the plain end of pipe to be installed into the bell of the pipe to which it is to be joined, and when in alignment pushed home with a come-along or by other means.
  - g. Check that the reference mark on the spigot end is flush with the end of the bell.
3. Jointing Mechanical Joint Fittings:
  - a. Mechanical Joints at Valves, Fittings and Where Designated: Jointed per AWWA C111 and manufacturer detailed instructions.
  - b. PVC Pipe and Fittings: Jointed per recommendations of latest ASTM standards and manufacturer detailed instructions.
  - c. Install Suitable PVC to cast iron adaptors prior to installing fittings.
  - d. Cut PVC beveled spigot flush prior to insertion in mechanical joint pipe.
  - e. Field Assembled Joints: Thoroughly clean joint surfaces and rubber gaskets with soapy water before tightening bolts to specified torques.
    - 1) Under no circumstances are extension wrenches or pipe over handle of ordinary ratchet wrench to be used to secure greater leverage.

L. Pipe Identification: Install plastic ribbon tape Trace wire and electronic utility marker balls above direct buried utility in accordance with Section 330526, "Utility Identification."

3.4 TOLERANCES

- A. Section 014000, "Quality Requirements" for tolerances requirements.

3.5 FIELD QUALITY CONTROL

- A. Section 014000, "Quality Requirements" for inspecting and testing requirements.
- B. After Installation: Test pipe for compliance as specified below. Furnish necessary equipment and labor for hydrostatic pressure test on pipelines.
- C. Submit detailed test procedures and method for Engineer's review. In general, conduct testing per AWWA C605.
1. Hydrostatic pressure test methods and procedures must be approved by the Engineer.

2. Submit testing plan to Engineer 10 days before testing.
- D. Subject pressure pipelines to a hydrostatic pressure of 1.25 times the working pressure at the highest point along the test segment.
  1. Maintain test pressure a minimum of 2 hours.
  2. Hydrostatic testing allowances must not exceed those indicated in AWWA C605.
  3. Provide suitable restrained bulkheads as required to complete the hydrostatic testing specified.
- E. Contractor will make any taps and furnish necessary caps, plugs etc, as required in conjunction with performing the testing.
- F. Gravity Pipelines: Hydrostatic pressure test as specified in AWWA C605.
- G. Valves and Valve Boxes: Properly located and installed and operable prior to testing.
  1. Provide bulkheads with sufficient number of outlets for filling and draining the line and for venting air.
- H. Hydrostatic Pressure Tests: Per Section 7.3 of AWWA C605.
  1. Furnish gauges, meters, pressure pumps and other equipment needed to fill the line slowly and perform the required hydrostatic pressure tests.
- I. Owner will provide a source of supply from the RO facility for Contractor's use in filling the lines. Maintain an air break at all times between the Owner's distribution system and the Contractor's equipment to prevent cross-connection.
  1. Slowly fill lines with concentrate and maintain specified test pressure in the pipe for the entire test period by means of a pump furnished by the Contractor.
  2. Provide accurate means for measuring makeup water volume required to maintain pressure.
  3. Pressure Test Duration: Not less than 2 hours.
    - a. Leaks evident at the surface shall be repaired and leakage eliminated regardless of the total leakage as shown by test.
    - b. Lines Failing to Meet Tests: Repaired and retested as necessary until test requirements are met.
    - c. Remove and replace defective materials, pipes, valves and accessories.

### 3.6 CLEANING

- A. General Procedure for Flushing:
  1. Flush dirty or discolored water from the pipeline.
    - a. Flushing Velocity: Minimum of 3 ft/sec.
    - b. Flushing operations: Conducted without causing erosion, damage, nuisance or interruption of traffic and comply with all regulatory requirements.
- B. Cleaning of concentrate discharge pipeline consists of removal and flushing of dirt and debris from the concentrate discharge pipeline prior to placing in service. Disinfection is not required.

### 3.7 PROTECTION

- A. Section 017300 “Execution” for protecting finished Work requirements.

END OF SECTION 330531.16

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## SECTION 330533.23 - POLYETHYLENE PRESSURE PIPE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes: High density polyethylene pressure pipe (HDPE) and fittings for concentrate discharge pipeline installation using Horizontal Directional Drilling (HDD).
- B. Related Requirements:
  - 1. Section 312319, "Dewatering."
  - 2. Section 312333, "Trenching and Backfilling."
  - 3. Section 310515, "Soils and Aggregates for Earthwork" for granular fill.
  - 4. Section 330507.15, "Utility Horizontal Directional Drilling."
  - 5. Section 331216, "Valves."

#### 1.3 COORDINATION

- A. Section 013100 "Project Management and Coordination" for coordination requirements.
- B. Coordinate Work of this Section with Section 330507.15 Utility Horizontal Directional Drilling

#### 1.4 PREINSTALLATION MEETINGS

- A. Section 013100 "Project Management and Coordination" for preinstallation meeting requirements.

#### 1.5 ACTION SUBMITTALS

- A. Section 013300, "Submittal Procedures" for submittals requirements.
- B. Product Data: Name of pipe and fitting manufacturers. A list of materials to be furnished by each manufacturer and catalog information for each product required.
- C. Shop Drawings:
  - 1. Per Section 013300; piping layouts and schedules including dimensioning, fittings, types and locations of valves and appurtenances, and joint details.
  - 2. Methods and location of supports, anchorage, gasket material, grade of material and other pertinent technical information.

3. Restrained joint locations.
  4. Description of testing methods for pipe and fittings including a complete drawing of mandrel with dimensions for each pipe size.
- D. Complete description of pipe installation methods.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Certificate: Products meet or exceed specified requirements.
- B. Prior to Shipments: Certified test reports that the pipe and fittings for this contract were manufactured and tested per ASTM and AWWA Standards specified herein.
- C. Manufacturer's recommendations for handling, storing and installing the pipe and fittings.
- D. Certification that stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacturing of the pipe for this contract per ASTM D2837.
- E. Name and qualifications of the technician to perform the heat fusion of the pipe joints.

#### 1.7 DELEGATED DESIGN SUBMITTALS

- A. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for required calculations as discussed in Section 330507.15 Utility Horizontal Directional Drill

#### 1.8 CLOSEOUT SUBMITTALS

- A. Section 017700 "Closeout Procedures" for submittals requirements.
- B. Project Record Documents: Document actual locations of installed HDPE piping along HDD alignment.

#### 1.9 QUALITY ASSURANCE

- A. Perform Work according to State of North Carolina Department of Transportation and Brunswick County Utility standards.
- B. HDPE Pipe and Fittings:
  1. Manufactured per ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
  2. Manufactured per ASTM D3261 - Standard Specification for But Heat Fusion Polyethylene (PE) Plastic Fittings for PE Plastic Pipe and Tubing
  3. Supplied by a single manufacturer who is experienced and qualified in the manufacture of the polyethylene pipe and fittings to be furnished

C. HDPE Pipe Supplied and Installed for This contract:

1. Manufacture pipes from a polyethylene resin specifically stress regression tested to provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1600 psi, as determined per ASTM D 2837.
2. Inspect at factory for compliance with this Section by an independent testing laboratory provided by the Owner. The manufacturer's cooperation shall be required in these inspections.
3. Pipe inspection may also be performed by the Engineer or other representatives of the Owner after delivery.
  - a. Pipe is subject to rejection at any time on account of failure to meet any of the specified requirements, even though pipes may have been accepted as satisfactory at the place of manufacture.
  - b. Mark pipe rejected after delivery and immediately remove from the job site.

1.10 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience and approved by manufacturer.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000, "Product Requirements" for transporting, handling, storing, and protecting products requirements. Conform to requirements of AWWA M55 Chapter 7, and the requirements given below.
- B. Delivery: Where applicable, deliver materials in manufacturer's packaging including application instructions.
  1. The delivery, storage, handling and installation of the pipe and fittings shall be done in accordance with the manufacturer's recommendations, referenced standards and as specified herein.
- C. Inspection: The interior of the pipe shall be free of cuts, gouges and scratches.
- D. Storage:
  1. Store pipe on clean, level ground to prevent any scratching or gouging of pipe.
  2. Handle of Pipe:
    - a. Avoid dragging pipe over hard or sharp objects.
    - b. Avoid cutting of pipe's exterior. Any cut or gouge deeper than 5 percent of the pipe's wall thickness shall be removed from the site.
    - c. Avoid undue stress in the pipe caused by bending.
  3. Store gaskets for mechanical and push-on joints in cool and dry location, out of direct sunlight, and not in contact with petroleum products.

4. While stored, adequately support pipe from below at not more than 4 feet intervals to prevent deformation.
  - a. Stored pipe in stacks no higher than that given in AWWA M55 Table 7-1.

#### 1.12 EXISTING CONDITIONS

##### A. Field Measurements:

1. Verify field locations and sizes of connections to existing piping and equipment prior to submitting pipe lay drawings.
2. Document field measurements on Shop Drawings.

#### 1.13 WARRANTY

- A. Section 017700 "Closeout Procedures" for warranty requirements.
- B. Furnish five-year manufacturer's warranty for HDPE Pipe.

### PART 2 - PRODUCTS

#### 2.1 SYSTEMS

- A. Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.

#### 2.2 HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

##### A. General:

1. HDPE pipe is a flexible conduit and shall be designed to transfer imposed loads to the surrounding embedment medium.
2. The pipe and fittings shall be free from all defects including indentations, delaminations, cracks, bubbles and pinholes, which due to their nature, degree, or extent, detrimentally affect the strength and serviceability of the pipe.
3. Any pipe or fittings with such defects which, in the judgement of the Engineer, will affect the strength and serviceability shall be repaired or rejected.
4. HDPE pipe resins shall be high molecular weight, high density polyethylene with a cell classification number of 345464C (or E) or higher cell classification in accordance with ASTM D3350.

##### B. Pipe and Fittings:

1. Pipes will have nominal dimensions shown on Drawings and conform to dimension requirements of IPS Sizing System ANSI B36.10. Piping to meet requirements of Dimension Ratio Minimum DR 9.
2. Polyethylene pipes must meet requirements of ASTM F714 PE 4710 and ASTM D2239.
3. Pipe Laying Lengths: Standard lengths not exceeding 50 ft



4. HDPE Fittings: Fully pressure rated to match the pipe Diameter Ratio pressure rating.
  - a. Fittings joined using butt, heat fusion in accordance with ASTM A2657 and the manufacturer's installation recommendations
  - b. Adhesives and solvent cements shall not be permitted.
  - c. Transition fittings from HDPE to PVC are in Section 330500 "Common Work Results for Utilities"

C. Joining Systems:

1. Joint pipe with heat-fusion butt or electrofusion joints. Electrofusion joints are allowed only where heat-fusion butt joints are impractical
  - a. Joints made per manufacturer's recommendations and ASTM F 2620.
2. Where required, provide mechanical joint connections and butt connections using bolted mechanical couplers from a pipe stub with a polyethylene and steel stiffener. Refer to Specification Section 330500 "Common Work Results for Utilities"

2.3 FINISHES

- A. At 5-foot intervals along the pipe, mark pipe with the name of manufacturer, size and class (pressure and DR), and manufacturing reference to ASTM F714.
- B. A color-coded green strip(s) shall be marked along the entire length of the pipe.

2.4 SOURCE QUALITY CONTROL

- A. Section 014000, "Quality Requirements" for testing, inspection, and analysis requirements.

2.5 Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 "Execution" for installation examination requirements.
- B. Coordinate work with Specification Section 330507.15 Horizontal Directional Drill.
- C. Verify that excavations, dimensions, and elevations are as indicated on Shop Drawings.

3.2 PREPARATION

- A. Section 017300 "Execution" for installation preparation requirements.
- B. Thoroughly clean pipe and fittings before installation. Keep clean until used in the Work and when laid, conform to lines and grades required.

### 3.3 INSTALLATION

- A. Install pipe and fittings per manufacturer's instructions, AWWA M55, applicable portions of the PPI Handbook of HDPE Pipe 2<sup>nd</sup> edition, and the requirements given below.
- B. Fusion Joints: By a factory qualified technician as designated by the manufacturer with a minimum of five years' experience with the fusion equipment used.
  - 1. Heat fusion joining of pipe done per ASTM F2620.
    - a. Prior to start of pipe installation, make and test five joints.
    - b. Test per Plexco. Bulletin No. 106 and ASTM F2620 Appendix X4.
    - c. No joints will be made until five consecutive successful test joints have been made.
- C. Cutting Pipe: When required, by machine specifically designed for cutting HDPE pipe leaving a smooth cut at right angles to the pipe axis.
- D. Fittings: Connected to HDPE pipe per manufacturer's recommendations.

### 3.4 TOLERANCES

- A. Section 014000, "Quality Requirements" for tolerances requirements.

### 3.5 FIELD QUALITY CONTROL

- A. Section 014000, "Quality Requirements" for inspecting and testing requirements
- B. Furnish necessary equipment and labor for cleaning and testing the pipelines. The testing shall be in accordance with AWWA M55, and the procedures and methods shall be approved by the Engineer.
- C. Make taps and furnish necessary caps, plugs, etc., as required in conjunction with testing pipelines.
  - 1. Furnish a test pump, gauges and any other equipment required in conjunction with carrying out the hydrostatic tests.
- D. Pressure and leak test pressure pipelines.
  - 1. Pipelines subjected to hydrostatic pressure no greater than 50 percent above the normal operating pressure in the lowest portion and no less than 25 percent above the normal operating pressure in the highest portion of the pipeline segment being tested.
    - a. Maintain pressure for at least 10 minutes.
    - b. Conduct leakage test at the maximum operating pressure as determined by the Engineer and maintain pressure for two hours.
    - c. Arrange test pump and water supply to allow accurate measurement of water required to maintain the test pressure.
    - d. Where applicable, hydrant branch gate valves remain open during this test.
    - e. Zero leakage will be permitted for HDPE pipelines.
      - 1) Any visual observation of leakage at a joint must be repaired, regardless of hydrostatic pressure and leakage test results.

### 3.6 CLEANING

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

### 3.7 PROTECTION

- A. Section 017300 “Execution” for protecting finished Work requirements.

END OF SECTION 330533.23

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## SECTION 331213 - WATER SERVICE CONNECTIONS

### PART 1 GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Pipe and fittings for 2- inch water service connection temporary replacements due to Concentrate Discharge Pipeline construction including:
  - a. Corporation stop assemblies.
  - b. Curb stop assemblies.
  - c. Water meters.
  - d. Bedding and cover materials.

##### B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Concrete for thrust restraints.
2. Section 310515 - Soils and Aggregates for Earthwork: Backfill soil, bedding and cover material type.
3. Section 312333 – Trenching and Backfilling
4. Section 330513 - Manholes and Structures: Soil backfill type, manholes, and covers.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

##### A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

##### B. Pipe and Fittings:

1. Basis of Measurement: per Each Meter Assembly Replacement
2. Basis of Payment: Includes corporation stop assembly, curb stop assembly, water meter, service saddle replacements, hand trimming excavation, pipe and fittings, bedding, underground pipe markers, concrete thrust restraints, and connection to building service piping and municipal utility water source and all associated restoration as required for replacement of meter.

#### 1.3 SUBMITTALS

##### A. Section 013300 - Submittal Procedures: Requirements for submittals.

##### B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.

##### C. Shop Drawings: Indicate details showing vault and accessories.

- D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Section 017700 "Closeout Procedures": Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### 1.5 QUALITY ASSURANCE

- A. Perform Work according to State of North Carolina Department of Transportation, and Municipality of Brunswick County Standards.

#### 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store products and materials off ground and under protective coverings and away from walls.
- D. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

### PART 2 PRODUCTS

#### 2.1 WATER PIPING AND FITTINGS

- A. Polyethylene Pipe:
  - 1. Comply with AWWA C901 ASTM D2737, SDR 9, for 200 psig
  - 2. pressure rating 200 psi minimum.
  - 3. Fittings: Comply with AWWA C901, molded or fabricated.
  - 4. No joints are allowed on a service line between the main service tap and the meter stop 2-inch or less
  - 5. Name and trademark of the manufacturer shall be stamped along the pipe

## 2.2 CORPORATION STOP ASSEMBLIES

- A. Refer to Section 330500 for Corporation Stops and Tapping Saddles

## 2.3 CURB STOP ASSEMBLIES

- A. Curb Stops:

1. Body: Brass or red brass alloy.
2. Comply with AWWA C800 and ASTM B62.
3. Valve Type: Compression ball type.
4. Sealing: Positive pressure.
5. Working pressure: 200 psig maximum

- B. Curb Boxes and Covers:

1. Body: Cast iron.
2. All boxes must accommodate the Sensus Water Meter with AMI/AMR technology to include the MXU unit and touch read pad
3. Single Meter
  - a. Ford LYL V141-243-TP-NL
  - b. McDonald 776-208PC2G437
  - c. Mueller H-1462-K
  - d. Or Equal
4. Double Meter
  - a. Ford DGHC118-C14439-002-NL
  - b. McDonald 773N208BCGP 434TCX001
  - c. Or Equal
5. Lid:
  - a. Inscription: WATER.

## 2.4 WATER METERS

- A. Furnish materials according to requirements of Brunswick County utility Standards.

- B. Description:

1. Sensus AMR/AMI water meter with the MXU unit and touch read pad
2. Or Equal

## 2.5 UNDERGROUND PIPE MARKERS

- A. Refer to Section 330526 Utility Identification

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 017300 "Execution": Requirements for installation examination.
- B. Verify that building service connections and municipal utility water main sizes, locations, and inverts are as indicated on Drawings.

### 3.2 PREPARATION

- A. Section 017300 "Execution": Requirements for installation preparation.
- B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
- C. Remove scale and dirt from inside and outside of piping before assembly.
- D. Prepare pipe connections to equipment with flanges or unions.

### 3.3 INSTALLATION

- A. Corporation Stop Assemblies:
  - 1. Make connection for each different kind of water main using suitable materials, equipment, and methods as approved by Engineer/Engineer.
  - 2. Provide tapping saddles or mains constructed of materials other than cast iron or ductile iron.
  - 3. Location:
    - a. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock positions along main's circumference.
    - b. Locate and stagger corporation stops at least 12 inches apart longitudinally.
  - 4. Plastic Pipe Mains:
    - a. Provide full support for service clamp for full circumference of pipe, with minimum 2 inches width of bearing area.
    - b. Exercise care against crushing or causing other damage to mains at time of tapping or installation of service clamp or corporation stop.
  - 5. Use proper seals or other devices such that no leaks are present in mains at points of tapping.
  - 6. Do not backfill and cover service connections until installation is approved by Engineer/Engineer.
- B. Disinfection of Water Piping System:
  - 1. Flush and disinfect system as specified in AWWA C651

### 3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Section 017300 "Execution": Requirements for testing, adjusting, and balancing.



C. Pressure test water distribution system according to AWWA C600

D. Pressure test system according to AWWA C600 and following:

1. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
2. Conduct hydrostatic test for at least two hours.
3. Slowly fill with water section to be tested and expel air from piping at high points.
4. Install corporation cocks at high points.
5. Close air vents and corporation cocks after air is expelled.
6. Raise pressure to specified test pressure.
7. Observe joints, fittings, and valves under test.
8. Remove and replace cracked pipes, joints, fittings, and valves that show visible leakage and retest.
9. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate, maintaining test pressure within plus or minus 5.0 psi
10. Leakage is defined as quantity of water supplied to piping as necessary to maintain test pressure during testing period.
11. Compute maximum allowable leakage using following formula:

$L = [SD \times \sqrt{P}]/C$
L = testing allowance, gph (L/hr)
S = length of pipe tested, feet (m)
D = nominal diameter of pipe, inches (mm)
P = average test pressure during hydrostatic test, psig (kPa)
C = 148,000 (794 797)
If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

12. If test of pipe indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
13. Correct visible leaks regardless of quantity of leakage.
14. Perform pressure test on water distribution system according to Brunswick County Utility standards.

END OF SECTION 331213

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## SECTION 331216 - VALVES

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes the below for the Concentrate Discharge Pipeline:
  - 1. Butterfly Valves.
  - 2. Duckbill Check Valves
  - 3. Combination Air Release Valves
  - 4. Valve boxes.
- B. Related Requirements:
  - 1. Section 033000 - Cast-in-Place Concrete: Concrete for thrust restraints
  - 2. Section 31233 - Trenching and Backfilling
  - 3. Section 330531.16 - Polyvinyl Chloride Pressure Pipe
  - 4. Section 330533.23 – Polyethylene Pressure Pipe

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Section 012200 – Unit Prices and Section 012900 - Payment Procedures: Contract Sum/Price modification procedures.
- B. Valves:
  - 1. Basis of Measurement: By each.
  - 2. Basis of Payment: Includes excavation, valve, valve box, accessories, tests, and backfill.

#### 1.3 COORDINATION

- A. Section 013100 “Project Management and Coordination”: Requirements for coordination.

#### 1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's latest published literature. Include illustrations, installation and maintenance instructions, and parts lists.
- C. Shop Drawings: Submit description of proposed installation.
- D. Manufacturer's Certificate: Certify that valves meet or exceed specified requirements.

- E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- G. Qualifications Statements:
  - 1. Submit qualifications for manufacturer and installer.
  - 2. Submit manufacturer's approval of installer.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Section 017700 "Closeout Procedures": Requirements for submittals.
- B. Project Record Documents: Record actual locations of valves.
- C. Operation and Maintenance Data: Submit information for valves.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 017700 "Closeout Procedures": Requirements for maintenance materials.
- B. Tools: Furnish one tee wrench of required length to Owner.

#### 1.7 QUALITY ASSURANCE

- A. Cast manufacturer's name, pressure rating, and year of fabrication into valve body.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 5 years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum 5 years' documented experience.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Prepare valves and accessories for shipment according to applicable AWWA standards.
- C. Seal valve and ends to prevent entry of foreign matter.

- D. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- E. Storage:
  - 1. Store materials in areas protected from weather, moisture, or other potential damage.
  - 2. Do not store materials directly on ground.
  - 3. Protect ARV materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 4. Provide additional protection according to manufacturer instructions.
- F. Handle products carefully to prevent damage to interior or exterior surfaces.
- G. Protect threads and seats from corrosion and damage. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until time of use.

#### 1.10 WARRANTY

- A. Section 017700 "Closeout Procedures": Requirements for warranties.
- B. Furnish three-year manufacturer's warranty for all valves listed in this specification section.

### PART 2 PRODUCTS

#### 2.1 BUTTERFLY VALVES

- A. Manufacturers:
  - 1. Mueller, American Darling, Pratt.
  - 2. Or Approved Equal
- B. Description:
  - 1. Comply with AWWA C504, Class 150. Mechanical Joint end connections per ANSI C111 and ANSI A21.11.
  - 2. Minimum Working Pressure: 150 psig
  - 3. Maximum Process Fluid Temperature: 100 deg. F
  - 4. Body Style: Short Body Mechanical Joint
  - 5. Shaft: One, mechanically secured to disc, capable for mechanical separation from disc without damage to shaft or disc.
    - a. Shafts to be turned, ground and polished, constructed of 18-8 type 304 stainless steel
    - b. Attach disc to shaft with stainless steel tapered pins and locking nuts
  - 6. Bearings: Self-lubricating.
  - 7. Shaft Seals/Packing:

Self compensating V-type- primary means  
Multiple O-rings for up to 24-inch  
Pull down seals using a square braid of graphite fiber for over 24-inch  
Retained by bolted retainer plate or gland, clips not acceptable  
Retained by stuffing box with follower gland for over 24-inch  
Replacement without removal of valve from line.  
Adjustment without disturbing actuator assembly for over 24-inch

8. Seats:

Mounting: On disc.

For disc mounted seats, fasten with a segmented or one piece machined metal retaining ring, and self-locking bolts or set screws, fully adjustable with common tools. Machined metal seat ring installed in the valve body

Type: Resilient and replaceable. Field adjustable and replaceable.

C. Actuator:

1. Provide operators with not less than maximum operator torque, as determined in accordance with Appendix A of AWWA C504, to operate valves under actual line pressures and velocities
  - a. Provide worm and gear, or traveling nut type, self locking to prevent the valve disc from creeping or fluttering when it is in any intermediate position between open and closed
  - b. Gear operators to be permanently lubricated, totally enclosed, with adjustable stops for the open and closed positions
  - c. All exterior fasteners shall be minimum high strength alloy steel

D. Materials:

1. Body: Ductile iron, ASTM A536.
2. Stem: ASTM A276 Type 304 SS
3. Operating stem and nut shall be 2-inch and open left only
4. Disc: Ductile iron, ASTM A536
5. Seats:

Elastomer: EPDM

Retaining Ring: ASTM A276 Type 316 SS

Seat Ring: ASTM A276 Type 316 SS

6. Bearings:

Sleeve: Nylatron

Thrust: Bronze ASTM 763, Alloy C99500.

7. Connecting Hardware: ASTM A276 Type 316 SS.

E. Finishes:

1. Epoxy coated inside and outside conforming to AWWA C550

2.2 DUCKBILL CHECK VALVE

A. Manufacturers:

1. Tideflex Series 35 or Approved Equal by Cla-Val Model RF-DBF, Onyx Valve Series DBF,

B. Description:

1. Flange size drilling conforms to ANSI Class 150#
2. Maximum Process Fluid Temperature: 100 deg. F
3. 316 stainless steel retaining ring
4. Valve shall be integral constructed with single elastomeric material including flange
5. Elastomeric rubber shall be EPDM
6. Valve shall have maximum 3" water column cracking pressure
7. Nuts and bolts shall be 316 stainless steel
8. Diffuser head loss shall not exceed 4.5 feet water column at 5.3 MGD

## WIDE BILL TIDEFLEX DIFFUSER (TFW) SYSTEM DATA ANALYSIS

**MEDIA:**

Density or  
Spec. Gravity

Effluent
1

kg/m<sup>3</sup>

**FLOW RANGE:**

0.7	MGD =	486	gpm
2.7	MGD =	1875	gpm
5.3	MGD =	3681	gpm

**AVAILABLE HEADLOSS@ DIFFUSER:**

Minimum  feet  
Design  feet  
Maximum  feet

**MAX. BACKPRESSURE:**  feet

\* TFW SIZE (IN) **8**      \* HYDRAULIC CODE **989**

\* Wide Bill Tideflex Diffuser

**DATE:**

30-Jan-2019

**CLIENT:**

Brunswick County, NC

**CONTACT:**

**ENGINEER:**

CDM Smith

**CONTACT:**

Ron Miner

**PROJECT:**

Brunswick County Outfall Diffuser, NC

**REP:**

NE3

**CONTACT:**

Bob Mack

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### PER WIDE BILL TIDEFLEX DIFFUSER

* TOTAL QUANTITY	TOTAL FLOW (gpm)	FLOW (gpm)	JET VELOCITY (fps)	HEADLOSS (feet)	EFFECTIVE DIAMETER (in)
1	486.1	486.1	5.7	0.5	5.9
	1875.0	1875.0	11.4	2.0	8.2
	3680.5	3680.5	16.5	4.3	9.5

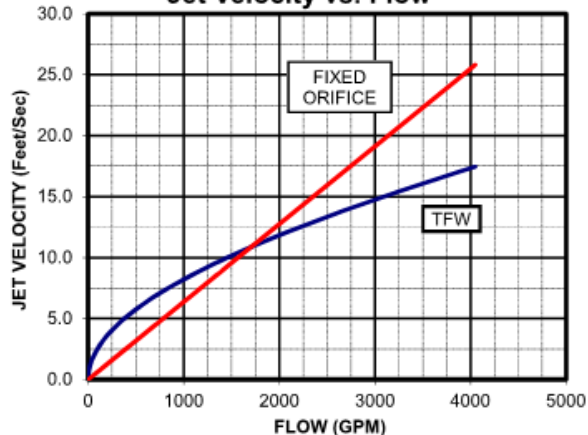
**FIXED**

ORIFICE DIA. \* Cd = 1

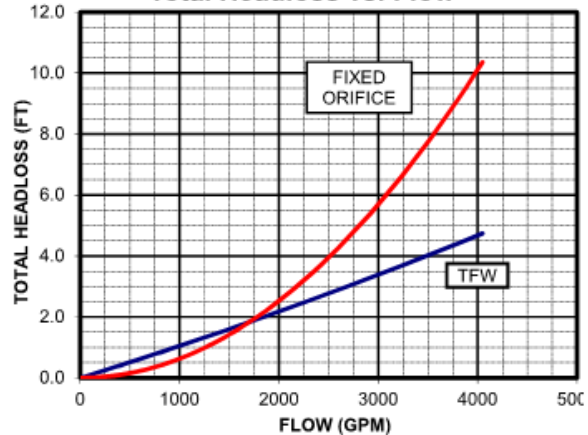
### PER FIXED ORIFICE

8.00	1	486.1	486.1	3.1	0.1	8.0
		1875.0	1875.0	12.0	2.2	8.0
		3680.5	3680.5	23.5	8.6	8.0

**Jet Velocity vs. Flow**



**Total Headloss vs. Flow**



TIDEFLEX TECHNOLOGIES, 600 NORTH BELL AVE., CARNEGIE, PA 15106, (412) 279-0044 phone (412) 279-5410 fax



## 2.3 COMBINATION AIR RELEASE VALVES (CAV)

### A. Manufacturers:

1. ARI D-026 NS (2 holes – non slam)
2. Or Approved Equal

### B. Description:

#### 1. Type:

Fully automatic, float operated.

Body: Single.

2. Size: All CAVs shall be 2" nominal inlet orifice, 1" outlet orifice with throttled discharge. ARV orifice shall be 3/16-inch.
3. Suitable for sewage service.
4. Provide with flushing capabilities.
5. Pressure Rating: 1.5 to 250 psi. The normal working pressure shall be 11 to 40 psi between Station 10+00 to 75+00 and less than 10 psi between 75+00 to 211+23.
6. Combination air valves:  
perform the functions of an air/vacuum valve (exhaust large quantities of air on start-up, admits air on shut-down) and air release valves (release air continuously during operation) to maintain system efficiency and prevent pipeline surges.

### C. Materials:

1. Body and Cover: reinforced nylon body with 316 steel stainless cover.
2. Float: Type polypropylene
3. Seats: Buna-N
4. Seals: EPDM
5. Trim: Type 316 stainless steel
6. Hardware: Type 316 stainless steel
7. All valve components shall be American Iron and Steel (AIS) compliant; listing of manufacturers and models in these specifications is not approval that the valve is AIS compliant

### D. End Connections - Single Body:

1. Size 4 Inches and Smaller:

Threaded, NPT.

2. Provide one (1) inch flushing drain piping to include a one (1) inch flushing ball valve.

### E. Valve Body Connections:

1. Threaded, NPT.
2. Cleanout: 2 inches.
3. Drain: 1 inch.

F. Accessories:

1. Backwash accessories, including inlet shutoff valve, blowoff valve, rubber supply hose, and quick-disconnect couplings.
2. Non-Slam discharge throttling attachment allows for free air intake and throttles air discharge.
  - a. Throttling Device shall be set to 5% open locked in place with a locking nut for Approved Equals

2.4 VALVE BOXES

- A. Valve boxes shall be in accordance with Contract Drawings
- B. Cast Iron or ductile iron, screw type, with flared based, length as required for the buried valve
- C. The Word "Concentrate" shall be cast in the cover
- D. The contractor shall spray paint the cover green after installation
- E. No part of the valve box is to rest on the buried valve bonnet – use masonry support per Contract Drawings
- F. Install precast concrete ring around valve box in unpaved non-traffic areas per Contract Drawings
- G. Valves boxes in traffic areas to be AASHTO H-20 load rated and installed per Contract Drawings

2.5 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type as specified in Section 033000 - Cast-in-Place Concrete
- B. Valve Box Aligner: High-strength plastic device designed to automatically center valve box base and to prevent it from shifting off center during backfilling.

2.6 SURFACE PREPARATION AND SHOP COATINGS

- A. The interior ferrous metal surfaces, except finished or bearing surfaces, shall be blast cleaned in accordance with SSPC SP-10 and painted with two coats of an approved two-component epoxy coating in accordance with the applicable AWWA section.
- B. Exterior ferrous metal surfaces of all buried valve shall be blast cleaned in accordance with SSPC SP-6 and given two shop coats of an approved two-component epoxy paint in accordance with the applicable AWWA section.

## 2.7 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.
- B. Provide shop inspection and testing of completed assembly.
- C. ARV Owner Inspection:
  - 1. Make completed air release valve assembly available for inspection at manufacturer's factory prior to packaging for shipment.
  - 2. Notify Owner at least 7 days before inspection is allowed.
- D. ARV Owner Witnessing:
  - 1. Allow witnessing of factory inspections and test at manufacturer's test facility.
  - 2. Notify Owner at least 7 days before inspections and tests are scheduled.
- E. Certificate of Compliance:
  - 1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
  - 2. Specified shop tests are not required for Work performed by approved fabricator.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 017300 "Execution": Requirements for installation examination.
- B. Determine exact location and size of valves from Drawings.
- C. Verify that invert elevations of existing work prior to excavation and installation of valves are as indicated on Drawings.

### 3.2 PREPARATION

- A. Section 017300 "Execution": Requirements for installation preparation.
- B. Conduct operations to not interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures, utilities, and landscape in immediate or adjacent areas.
- C. Identify required lines, levels, contours, and datum locations.
- D. Locate, identify, and protect from damage utilities to remain.

- E. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

- 1. Notify Engineer/Engineer not less than 3 days in advance of proposed utility interruption.
  - 2. Do not proceed without written permission from Engineer/Engineer.

### 3.3 SOURCE QUALITY CONTROL

- A. Testing: Test valves according with applicable AWWA specification.
- B. Submit an affidavit of compliance stating that the valves have been manufactured and tested in accordance with applicable AWWA specification and specifically list all exceptions.

### 3.4 INSTALLATION

- A. Perform trench excavation, backfilling, and compaction as specified in Section 312333
- B. Install valves in conjunction with pipe laying.
- C. Set valves plumb.
- D. Before backfilling, all exposed portions of all bolts shall be coated with two coats of bituminous paint.
- E. Provide buried valves with valve boxes installed flush with finished grade.
- F. Combination Air Release Valves
  - 1. Contractor shall install the ARVs as shown on the plans and may need to adjust actual ARV locations in the field based upon actual field conditions to ensure the ARVs are installed at the true high points. Actual installed mark up drawings shall be maintained by the contractor so that accurate as built drawings can be prepared for the County Contractor shall approve all locations with Engineer.
  - 2. Maintain adequate cover over concentrate discharge pipeline at ARV installations to ensure top of manhole or polymer concrete box is flush with surrounding ground. The contractor shall adjust the concentrate discharge pipeline depth to ensure adequate cover for the ARV assembly per Contract Drawings. Adjustment of ARVs shall be approved by Engineer.

### 3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Section 017300 "Execution": Requirements for testing, adjusting, and balancing.
- C. Pressure test distribution system according to AWWA C600.

D. Pressure test system according to AWWA C600 and following:

1. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
2. Conduct hydrostatic test for at least two hours.
3. Slowly fill section to be tested with water and expel air from piping at high points.
4. Install corporation cocks at high points.
5. Close air vents and corporation cocks after air is expelled.
6. Raise pressure to specified test pressure.
7. Observe joints, fittings, and valves under test.
8. Remove and replace cracked pipes, joints, fittings, and valves that show visible leakage and retest.
9. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate, maintaining test pressure within plus or minus 5.0 psi.
10. Leakage is defined as quantity of water supplied to piping as necessary to maintain test pressure during testing period.
11. Compute maximum allowable leakage using following formula:

$L = [SD \times \sqrt{P}]/C$
L = testing allowance, gph
S = length of pipe tested, feet
D = nominal diameter of pipe, inches
P = average test pressure during hydrostatic test, psig
C = 148,000
If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

12. If test of pipe indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
13. Correct visible leaks regardless of quantity of leakage.
14. Conduct a functional field test of each valve, including actuators and valve control equipment, in presence of Engineer to demonstrate that each part and all components together function correctly. All testing equipment required to be furnished by the Contractor.

E. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than 4 hours on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

F. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.
3. Repair damaged coatings with material equal to original coating.

G. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

### 3.6 CLEANING

- A. Sections 017300 “Execution” and 017700 “Closeout Procedures”: Requirements for cleaning.
- B. Keep interior of air release valves clean as installation progresses

### 3.7 DEMONSTRATION

- A. Section 017900 “Demonstration and Training”: Requirements for demonstration and training.
- B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 331216.00

## SECTION 331219 - WATER UTILITY DISTRIBUTION FIRE HYDRANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Installation of relocated fire hydrants and potable waterlines associated with construction of concentrate discharge pipeline.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete": Concrete for thrust restraints and concrete collars installed on hydrant barrels.
2. Section 310515 "Soils and Aggregates for Earthwork": Aggregate for hydrant drainage.
3. Section 312333 "Trenching": Trenching, backfilling, and compaction requirements.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 "Price and Payment Procedures": Contract Sum/Price modification procedures.

B. Fire Hydrants:

1. Basis of Measurement: By each.
2. Basis of Payment: Includes excavation, fire hydrant, accessories, testing, and backfilling.

#### 1.3 COORDINATION

A. Section 013100 "Project Management and Coordination": Requirements for coordination.

B. Coordinate Work of this Section with Brunswick County Utility Standards

#### 1.4 PREINSTALLATION MEETINGS

A. Section 013100 "Project Management and Coordination": Requirements for preinstallation meeting.

#### 1.5 ACTION SUBMITTALS

A. Section 013300 "Submittal Procedures": Requirements for submittals.

B. Product Data: Submit manufacturer's latest published literature, including illustrations, installation and maintenance instructions, and parts lists.

C. Shop Drawings: Submit description of proposed installation.

- D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualifications Statements:
  - 1. Submit qualifications for manufacturer and installer.
  - 2. Submit manufacturer's approval of installer.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Section 017700 "Closeout Procedures": Requirements for submittals.
- B. Project Record Documents: Record actual locations of fire hydrants and service valves.
- C. Operation and Maintenance Data: Submit data for hydrants.

#### 1.8 QUALITY ASSURANCE

- A. Perform Work according to Brunswick County Utility standards.
- B. Maintain 2 copies of each standard affecting Work of this Section on Site.

#### 1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience .

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 "Product Requirements": Requirements for transporting, handling, storing, and protecting products.
- B. Prepare hydrants and accessories for shipment according to AWWA standards and seal hydrant and ends to prevent entry of foreign matter.
- C. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- D. Storage:
  - 1. Store materials in areas protected from weather, moisture, or potential damage.



2. Do not store materials directly on ground.
- E. Handle materials in a way that prevents damage to interior and exterior surfaces.

## PART 2 - PRODUCTS

### 2.1 FIRE HYDRANTS

A. Manufacturers:

1. Mueller, Clow, American Darling
2. Or Approved Equal
3. Furnish materials according to Brunswick County standards.

B. Dry-Barrel Breakaway Type:

1. Comply with AWWA C502.
2. Body: Cast iron.
3. Burial Depth: As indicated on Drawings.
4. Inlet Connection Size: 6 inches
5. Valve Opening: Minimum 4-1/2 inches in diameter.
6. End Connections: Mechanical joint
7. Bolts and Nuts: Galvanized steel open left only
8. Hydrant operating nut shall be AWWA Standard pentagonal type measuring 1-1/2-in point to flat.
9. Interior Coating: Comply with AWWA C550.
10. Direction of Opening: Counterclockwise (left)
11. Hydrant shall have breakaway barrel and operating stem with barrel length for 3 foot main cover, six inch bottom hub, and one and one half inch solid operating nut with O-ring seals.
12. Main valve shall have bronze to bronze threads into hydrant shoe. Hydrant shall be grease lubricated with a thrust bearing to reduce operating torque or may be oil lubricated
13. Hydrants shall be rated at 150 psi working pressures and 300 psi test pressure.

C. Hose Connections:

1. One 4-1/2-in pumper, two 2-1/2-in hose nozzles
2. Obtain thread type and size from local fire department.
3. Attach nozzle caps by separate chains.
4. Each hydrant shall be able to deliver 500 gallons minimum through its two 2-1/2-in hose nozzles when opened together with a loss of not more than 2 psi in the hydrant.
5. Hydrants shall be furnished with caps, double galvanized steel hose cap chain, galvanized steel pumper hose cap chain, a galvanized steel chain holder and any other hooks and/or appurtenances required for proper use.

D. Finishes:

1. Primer and two coats of enamel
2. Color: Chrome Yellow (Tnemec) or approved equal
  - a. Hydrant shall be touched up after installation and given one field coat of chrome yellow enamel

2.2 ACCESSORIES

- A. Concrete for Thrust Restraints and barrel collars: Concrete type as specified in Section 033000 "Cast-in-Place Concrete"
- B. Aggregate: Aggregate for hydrant drainage as specified in Section 310515 "Soils and Aggregates for Earthwork".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 "Execution": Requirements for installation examination.
- B. Verify exact location and size of hydrants from Drawings.
- C. Obtain clarification and directions from Engineer prior to execution of Work.
- D. Verify that invert elevations of existing work are as indicated on Drawings prior to excavation and installation of fire hydrants.

3.2 PREPARATION

- A. Section 017300 "Execution": Requirements for installation preparation.
- B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures, utilities, and landscape in immediate or adjacent areas.
- C. Identify required lines, levels, contours, and datum locations.
- D. Locate, identify, and protect from damage utilities to remain.
- E. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
  1. Notify Engineer not less than 3 days in advance of proposed utility interruption.
  2. Do not proceed without written permission from Engineer.

### 3.3 INSTALLATION

- A. Perform trench excavation, backfilling, and compaction as specified in Section 312333 “Trenching”.
- B. Hydrants shall be so arranged that the direction of outlets may be turned 90 degrees without interference with the drip mechanism or obstructing the discharge from any outlet.
- C. The hydrants shall be set upon a slab of concrete not less than 4-in thick and 15-in square. During backfilling, additional screened gravel shall be brought up around and 6-in over the drain port. Each hydrant shall be set in true vertical alignment and properly braced.
- D. Concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the Drawings. Felt roofing paper shall be placed around hydrant elbow before placing concrete. Care shall be taken to ensure that concrete does not plug the drain ports.
- E. The hydrant shall be tied to the pipe with suitable rods or clamps, galvanized, painted, or otherwise rustproof treated or other restraint system. Hydrant paint shall be touched up as required after installation.
- F. Provide support blocking and drainage gravel while installing wet barrel fire hydrants; do not block drain hole.
- G. Set fire hydrants plumb with pumper nozzle facing roadway.
- H. Set fire hydrants with centerline of pumper nozzle 18 inches above finished grade, and with safety flange not more than 6 inches nor less than 2 inches above grade.
- I. After hydrostatic testing, flush hydrants and check for proper drainage.
- J. Installation Standards: Install Work according to Brunswick County Utility standards.
- K. Disinfection of Water Piping System:
  - 1. Flush and disinfect system as specified in AWWA C651

### 3.4 FIELD QUALITY CONTROL

- A. Section 014000 “Quality Requirements”: Requirements for inspecting and testing.
- B. Pressure test water distribution system according to AWWA C600
- C. Confirm test pressure with Owner
- D. Pressure test system according to AWWA C600 and following:
  - 1. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
  - 2. Conduct hydrostatic test for at least two hours.
  - 3. Slowly fill section to be tested with water and expel air from piping at high points.
  - 4. Install corporation cocks at high points.

5. Close air vents and corporation cocks after air is expelled.
6. Raise pressure to specified test pressure.
7. Observe joints, fittings, and valves under test.
8. Remove and replace cracked pipes, joints, fittings, and valves that show visible leakage and retest.
9. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate, maintaining test pressure within plus or minus 5.0 psi.
10. Leakage is defined as quantity of water supplied to piping as necessary to maintain test pressure during testing period.
11. Compute maximum allowable leakage using following formula:

$L = [SD \times \sqrt{P}]/C$
L = testing allowance, gph (L/hr)
S = length of pipe tested, feet (m)
D = nominal diameter of pipe, inches (mm)
P = average test pressure during hydrostatic test, psig (kPa)
C = 148,000 (794 797)
If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

12. If test of pipe indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
13. Correct visible leaks regardless of quantity of leakage.

END OF SECTION 331219

## SECTION 334213.13 - PUBLIC PIPE CULVERTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe culverts and accessories.
  - 2. Drainage structures.
  - 3. Bedding and cover materials.
  - 4. Concrete encasement and cradles.
- B. Related Requirements:
  - 1. Section 033000 "Cast in Place Concrete" for reinforcement of concrete cradles.
  - 2. Section 310515 "Soils and Aggregates for Earthwork" for aggregate for backfill in trenches.
  - 3. Section 312333 "Trenching and Backfill" for excavating and backfill for culvert piping.

#### 1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Section 012000 "Price and Payment Procedures" for Contract Sum/Price modification procedures.
- B. Pipe Culvert:
  - 1. Basis of Measurement: By linear foot from edge of pipe to edge of pipe
  - 2. Basis of Payment: Includes hand trimming, excavating, removing soft subsoil, bedding fill, compacting, pipe including assembled fittings and accessories.

#### 1.4 COORDINATION

- A. Section 013100 "Project Management and Coordination" for coordination requirements.
- B. Coordinate Work of this Section with termination of public storm sewer.

#### 1.5 ACTION SUBMITTALS

- A. Section 013300 "Submittal Procedures" for submittals requirements

- B. Product Data: Manufacturer information regarding pipe, fittings, and accessories.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Certificate: Products meet or exceed specified requirements.
- B. Manufacturer Instructions: Special procedures required to install specified products.
- C. Field Quality-Control Submittals: Results of Contractor-furnished tests and inspections.
- D. Qualifications Statement: Qualifications for manufacturer.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Section 017700 "Closeout Procedures" for requirements for closeout submittals.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### 1.8 QUALITY ASSURANCE

- A. Perform Work according to State of North Carolina Department of Transportation standards and Municipality of Brunswick County standards.

#### 1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 "Product Requirements" for transporting, handling, storing, and protecting products requirements.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Storage:
  - 1. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
  - 2. Do not place pipe flat on ground.
  - 3. Store UV-sensitive materials out of direct sunlight.
- D. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Block individual and stockpiled pipe lengths to prevent moving.

3. Cradle pipe to prevent point stress.
4. Provide additional protection according to manufacturer instructions.

#### 1.11 EXISTING CONDITIONS

##### A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

### PART 2 - PRODUCTS

#### 2.1 PIPE CULVERT

- A. All proposed or replacement public pipe culverts shall be minimum 15" reinforced concrete pipe (RCP). Existing 15" minimum piping in good condition as determined by Engineer is acceptable for reuse.

B. Reinforced Circular Concrete Pipe:

1. Furnish materials according to State of North Carolina Department of Transportation standards and Municipality of Brunswick County standards
2. Comply with ASTM C76, Class IV with Wall Type C.
3. Reinforcement: Bar.
4. End Joints: Bell and spigot
  - a. Comply with ASTM C443
  - b. Gaskets: Rubber, compression
5. Shape: Circular with minimum 15" diameter and nominal diameter as shown on plans.

#### 2.2 DRAINAGE STRUCTURES

- A. Description: As specified in Section 330513.16 "Public Manholes and Structures."

B. Materials: Precast concrete

C. Manholes:

1. Size: Nominal inside diameter as specified on drawings.
2. Eccentric conical top.
3. Covers: Water tight, cast iron, inscribed with STORM SEWER

#### 2.3 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. Description: Reinforced concrete, as specified in Section 033000 "Cast-in-Place Concrete."

2. Compressive Strength: 4,000 psi at 28 days, reinforced concrete, rough troweled finish.
3. Refer to details on Contract Drawings

## 2.4 MATERIALS

### A. Bedding and Cover:

1. Bedding: Fill Type A1 as specified in Section 310515 - Soils and Aggregates for Earthwork.
2. Cover: Fill Type A1 as specified in Section 310515 - Soils and Aggregates for Earthwork.
3. Soil Backfill from above Pipe to Finish Grade: Soil Type S1 as specified in Section 310515 - Soils and Aggregates for Earthwork.
4. Subsoil: No rocks more than 6 inches in diameter, frozen earth, or foreign matter.

## 2.5 ACCESSORIES

### A. Geotextile Filter Fabric:

1. Comply with AASHTO M288 for subsurface drainage.
2. Type:
  - a. Class A, non-biodegradable.
  - b. Non-woven.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 017300 "Execution" for installation examination requirements.
- B. Verify that excavation base is ready to receive Work.
- C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

### 3.2 PREPARATION

- A. Section 017300 "Execution" for installation preparation requirements.
- B. Correct over-excavation with coarse aggregate.
- C. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

### 3.3 INSTALLATION

- A. Excavation and Bedding:



1. Excavate pipe trench as specified in Section 312333 – Trenching and Backfilling.
2. Hand trim excavation for accurate placement of piping to indicated elevations.
3. Place bedding material at trench bottom.
4. Level materials in continuous layers not exceeding 8-inch compacted depth.
5. Maintain optimum moisture content of bedding material to attain required compaction density.

B. Culvert:

1. Positioning: Lift or roll culvert into position; do not drop or drag culvert over prepared bedding.
  - a. Shore culvert to required position and retain in place until after compaction of adjacent fills.
  - b. Ensure that pipe remains in correct position and to required slope.
  - c. Cradle bottom 20 percent of pipe diameter to avoid point load.
2. Repair surface damage to pipe protective coating with two coats of compatible bituminous paint coating.
3. Backfilling and Compaction: As specified in Section 312333 Trenching and Backfill
  - a. Level fill materials in continuous layers not exceeding 8 inches in depth, and compact to 95 percent maximum density.
  - b. Do not displace or damage pipe while compacting.
  - c. Install cover at sides and over top of pipe.
  - d. Install cover to minimum compacted thickness of 12 inches and compact to 95percent maximum density.
  - e. Maintain optimum moisture content of bedding material to attain required compaction density.
  - f. Place geotextile fabric over backfill as indicated on Drawings.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
- B. Maximum Variation from Indicated Pipe Slope: 1/2 inch in 10 feet.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Request inspection by Engineer prior to and immediately after placing aggregate cover over pipe.
- C. Testing:
  1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.

2.     Compaction Test:
  - a.    Comply with ASTM D1557 ASTM D698.

### 3.6     PROTECTION

- A.    Section 017300 “Execution” for protecting installed construction requirements.
- B.    Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION 334213.13

**Division 34-49**  
**(Not Used)**



## **Appendices**



# **Appendix A**

## **Geotechnical Data for Pipeline**





# Open-Cut Geotechnical Data Report





## **Report of Subsurface Exploration**

### ***Brunswick County Public Utilities Discharge Pipeline***

*Leland, North Carolina  
F&R Project No. 66W-0224*

Prepared For:

#### ***CDM Smith***

*5400 Glenwood Avenue, Suite 400  
Raleigh, North Carolina 27612*

Prepared By:

#### **Froehling & Robertson, Inc.**

*310 Hubert Street  
Raleigh, North Carolina 27603*

*May 3, 2019*



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NC Engineering License # F-0266

May 3, 2019

John Briand, P.E.  
Project Engineer  
CDM Smith  
5400 Glenwood Avenue, Suite 400  
Raleigh, North Carolina 27612

**Subject: Report of Subsurface Exploration**  
Brunswick County Public Utilities Discharge Pipeline  
Leland, North Carolina  
F&R Project No. 66W-0224

Dear Mr. Briand:

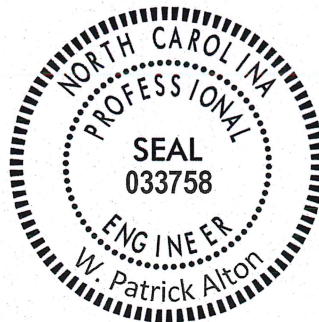
Froehling & Robertson, Inc. (F&R) has completed the authorized subsurface exploration for the Brunswick County Public Utilities Discharge Pipeline project in Leland, North Carolina. Our services were performed in general accordance with F&R's Proposal No. 1966-00156 REV 3 dated October 16, 2018. The attached report reviews our exploration procedures and describes general subsurface conditions.

We have enjoyed working with you on this project. Please contact us if you have any questions regarding this report or if we may be of further service.

Sincerely,

**FROEHLING & ROBERTSON, INC.**

Meredith Arnold, G.I.T.  
Staff Geologist



W. Patrick Alton, P.E.  
Assistant Branch Manager



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## **APPENDICES**

### **APPENDIX I**

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### **APPENDIX II**

Key to Soil Classification  
Unified Soil Classification Chart  
Boring Logs

### **APPENDIX III**

Lab results

### **APPENDIX IV**

GBA Document “Important Information about Your Geotechnical Engineering Report”



## **1.0 SCOPE OF SERVICES**

F&R's scope of services for this project included the following:

- Completion of 14 soil test borings (B-301 through B-314) to depths ranging from 15 to 20 feet below the existing ground surface;
- Preparation of typed boring logs and development of subsurface profiles;
- Performing geotechnical laboratory testing on representative soil samples; and
- Preparation of this data report by a professional engineer.

## **2.0 PROJECT INFORMATION**

The existing water treatment plant is located at 3954 Clearwell Drive NE in Leland, NC. The original southern portion of the proposed discharge pipeline alignment begins at the plant, extends north along Clearwell Drive NE, then approximately parallels the south and east sides of the residences along Heirloom Drive NE. From there, the proposed pipeline extends along an existing power line easement up to its intersection with Mt. Misery Road NE (SR 1426) and then east along Mt. Misery Road NE to its intersection with Hooper Road NE (SR 1427). Due to easement acquisition issues, the revised southern portion of the discharge pipeline alignment begins at the plant, extends north along Clearwell Drive NE and Butler Road NE to the intersection with Mt. Misery Road NE (SR 1426). From there, the pipeline travels east along Mt. Misery Road NE to the intersection with Hooper Road NE. However, the additional open cut borings associated with this revised alignment (B-315, B-316, and B-318) were observed by CDM Smith and are not included in this report. The proposed discharge pipeline then runs north along Hooper Road NE and ends at the Cape Fear River, although F&R's scope of work concludes approximately 800 feet northeast of the intersection with Alfred Lane NE. A majority of the proposed discharge pipeline extends along the shoulder of existing, paved roads, but Hooper Road NE (SR 1427) changes to an unpaved, gravel road approximately 3400 feet (0.65 miles) south of the Cape Fear River, approximately the end of F&R's scope of work.



### **3.0 EXPLORATION PROCEDURES**

#### **3.1 SUBSURFACE EXPLORATION**

F&R advanced a total of 14 soil test borings (B-301 through B-314), at locations selected by CDM Smith, to depths ranging from 15 to 20 feet as part of this exploration. The approximate boring locations are shown on the Boring Location Plan presented as Figure 2 in Appendix I. The test boring locations were established in the field by F&R using a hand-held GPS unit, and the associated coordinates were provided by CDM Smith. Ground surface elevations at the boring locations were interpolated from “NC OneMap” 2016 topography. Given these methods of determination, the boring locations and ground surface elevations should only be considered approximate.

An additional nineteen (19) soil test borings were advanced along the proposed discharge pipeline and an additional twenty-seven (27) soil test borings were advanced at the existing water treatment plant. These borings were performed at varying dates and at locations selected by CDM Smith, to depths ranging from 20 to 100 feet below existing ground surface. The results of these soil test borings are being prepared by CDM Smith under separate cover.

The 14 test borings were advanced by an ATV-mounted drill rig using 2-1/4” inside diameter (I.D.) hollow stem augers for borehole stabilization. Representative soil samples were obtained using a standard, two-inch outside diameter (O.D.) split-barrel sampler in general accordance with ASTM D 1586, Penetration Test and Split-Barrel Sampling of Soils (Standard Penetration Test). The number of blows required to drive the split barrel sampler three, consecutive 6-inch increments with an automatic hammer is recorded and the blows of the last two 6-inch increments are added to obtain the Standard Penetration Test (SPT) N-values representing the penetration resistance of the soil. A fourth 6-inch increment was added to obtain an additional sample of the soils, but is not per ASTM standards and is not used in calculating the N-value. Five (5) continuous SPT samples were collected in the top 10 feet and then at a nominal interval of 5 feet thereafter.



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

Groundwater level measurements were attempted in the test borings at the termination of drilling. Groundwater level measurements were attempted again after a stabilization period of approximately 24-hours had elapsed after completion of drilling. Temporary groundwater observation wells were installed in all of the borings in order to facilitate obtaining stabilized groundwater measurements. The wells consisted of 1-inch diameter, hand-slotted PVC pipes installed into the completed borings.

### 3.2 LABORATORY TESTING

CDM Smith selected eleven representative soil samples, and F&R subjected them to geotechnical index testing consisting of natural moisture content, grain size analysis, Atterberg Limits, and/or organic content determinations. The purpose of the index testing was to aid in our classification of the soil samples. The laboratory testing was performed in general accordance with applicable ASTM standards, and the test results are summarized below and in Appendix III:

Sample No.	Location	Depth (ft)	Natural Moisture	LL	PL	PI	USCS Classification	% GRAVEL	% SAND	% FINES	Organic Content (%)
S-6	B-301	13.0-15.0	14.6	25	18	7	-	-	-	-	1.7
S-3	B-302	4.0-6.0	16.7	-	-	-	-	0.0	71.6	28.4	-
S-4	B-302	6.0-8.0	14.8	-	-	-	-	0.0	62.3	37.7	-
S-6	B-304	13.0-15.0	22.3	32	21	11	CL	0.0	40.1	59.9	-
S-5	B-305	8.0-10.0	15.2	-	-	-	-	1.2	89.7	9.1	-
S-2	B-307	2.0-4.0	5.1	-	-	-	SP	0.0	95.9	4.1	-
S-6	B-308	13.0-15.0	26.5	-	-	-	SP	0.0	96.3	3.7	0.4
S-5	B-309	8.0-10.0	22.8	-	-	-	-	0.0	91.4	8.6	-
S-4	B-311	6.0-8.0	13.5	-	-	-	-	0.0	92.9	7.1	-
S-3	B-313	4.0-6.0	5.3	-	-	-	-	0.0	94.9	5.1	-
S-3	B-314	4.0-6.0	6.0	-	-	-	-	0.0	92.4	7.6	-





The lab results included in this report only pertain to borings B-301 to B-314. It should be noted that additional lab testing was performed for the additional remaining 46 soil test borings logged by CDM Smith along the proposed discharge pipeline and at the existing water treatment plant, and the results were provided to CDM Smith under separate covers as they were completed.

## **4.0 SUBSURFACE CONDITIONS**

### **4.1 SUBSURFACE CONDITIONS**

#### **4.1.1 General**

The subsurface conditions discussed in the following paragraphs and those shown on the attached boring logs represent an estimate of the subsurface conditions based on interpretation of the boring data using normally-accepted geotechnical engineering judgments. Although individual soil test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times. Data from the specific soil test borings are shown on the boring logs presented in Appendix II of this report.

Subsurface profiles have been prepared from the boring data to graphically illustrate the subsurface conditions encountered at the site. The subsurface profiles are presented as Figures 3 and 4 in Appendix I. Strata breaks designated on the boring logs and subsurface profiles represent approximate boundaries between soil types. The transition from one soil type to another may be gradual or occur between soil samples.

#### **4.1.2 Surficial Materials**

Surficial Organic Soils were encountered in all of the borings, except B-304 and B-307, from the ground surface to a depth of approximately 0.1 feet. The Surficial Organic Soils generally consisted of dark-colored soil material containing roots, fibrous matter, and/or other organic components, and is generally unsuitable for engineering purposes. F&R has not performed any laboratory testing to determine the organic content or other horticultural properties of the observed Surficial Organic Soil materials. Therefore, the term *Surficial Organic Soil* is not intended to



indicate suitability for landscaping and/or other purposes. The Surficial Organic Soil depths provided in this report should be considered approximate. We note that the transition from Surficial Organic Soil to underlying materials may be gradual, and therefore the observation and measurement of Surficial Organic Soil depths is subjective. Actual Surficial Organic Soil depths should be expected to vary.

#### **4.1.3 Fill Soils**

Fill soils were encountered below the surficial organic soils at boring B-301. The fill extended to a depth of approximately 11.5 feet. The earth fill consisted of silty sand (USCS-SM), with a layer of sandy clay (USCS-CH) estimated from 3.6 to 4.0 feet below the ground surface, and trace organics present throughout. The SPT N-values of the earth fill ranged from 3 blows per foot (bpf) to 20 bpf.

A layer of Aggregate Base Course (ABC Stone) was observed under the surficial organic soils from 0.1 to 0.3 feet at boring B-314 due to the location being on the shoulder of Hooper Road NE. Although there were additional borings (B-305 to B-313) located on the shoulder of Hooper Road NE, ABC Stone was not observed at these locations.

#### **4.1.4 Coastal Plain Soils**

Coastal plain soils were encountered below the fill in borings B-301 and B-314, at the ground surface in B-304 and B-307, and below surficial organic soils at the remaining borings. The coastal plain soils typically consisted of very loose to medium dense clayey and silty sands (USCS-SC, SM, and SP). Soft sandy clays (USCS-CL and CH) were observed at borings B-301, B-304, and B-308 from 14.4 to 16.5 feet, 14.3 to 15.0 feet, and 19.0 to 20.0 feet, respectively. All borings (B-301 to B-314) had trace amounts of organics (roots and wood fragments) present at varying depths and all were terminated in coastal plain soils.

### **4.2 SOIL MOISTURE AND GROUNDWATER CONDITIONS**

Moist soils were primarily encountered in the upper 5 feet. Wet and saturated soils were encountered in all of borings at depths varying from 2 to 20 feet.



Groundwater level measurements were attempted in the test borings at the termination of drilling and again after a stabilization period of approximately 24-hours had elapsed after completion of drilling. Groundwater was encountered in every boring at the termination of drilling and after the 24-hours had elapsed. Our recorded water level measurements indicated water levels at the termination of drilling at depths ranging from approximately 3.9 to 15.5 feet below the existing ground surface. Temporary groundwater observation wells were installed in all fourteen borings in order to facilitate the obtainment of stabilized groundwater measurements. The wells consisted of 1-inch diameter, hand-slotted PVC pipes installed into the completed borings. Our recorded water level measurements indicated stabilized water levels at depth ranging from approximately 2.9 to 15.0 feet below the existing ground surface.

It should be noted that the groundwater levels fluctuate depending upon seasonal factors such as precipitation and temperature. As such, soil moisture and groundwater conditions at other times may vary from those described in this report.

## **5.0 LIMITATIONS**

This report has been prepared for the exclusive use of CDM Smith and/or their agents, for specific application to the referenced project in accordance with generally-accepted soil and foundation engineering practices. No other warranty, express or implied, is made. Our evaluations are based on the data obtained from the previously-described, subsurface exploration program, and generally-accepted geotechnical engineering practice. The evaluations do not reflect variations in subsurface conditions, which could exist intermediate of the boring locations or in unexplored areas of the site.

There are important limitations to this and all geotechnical studies. Some of these limitations are discussed in the information prepared by GBA, which is included in Appendix IV. We ask that you please review this information.

If this report is copied or transmitted to a third party, it must be copied or transmitted in its entirety, including text, attachments, and enclosures. Interpretations based on only a part of this report may not be valid.

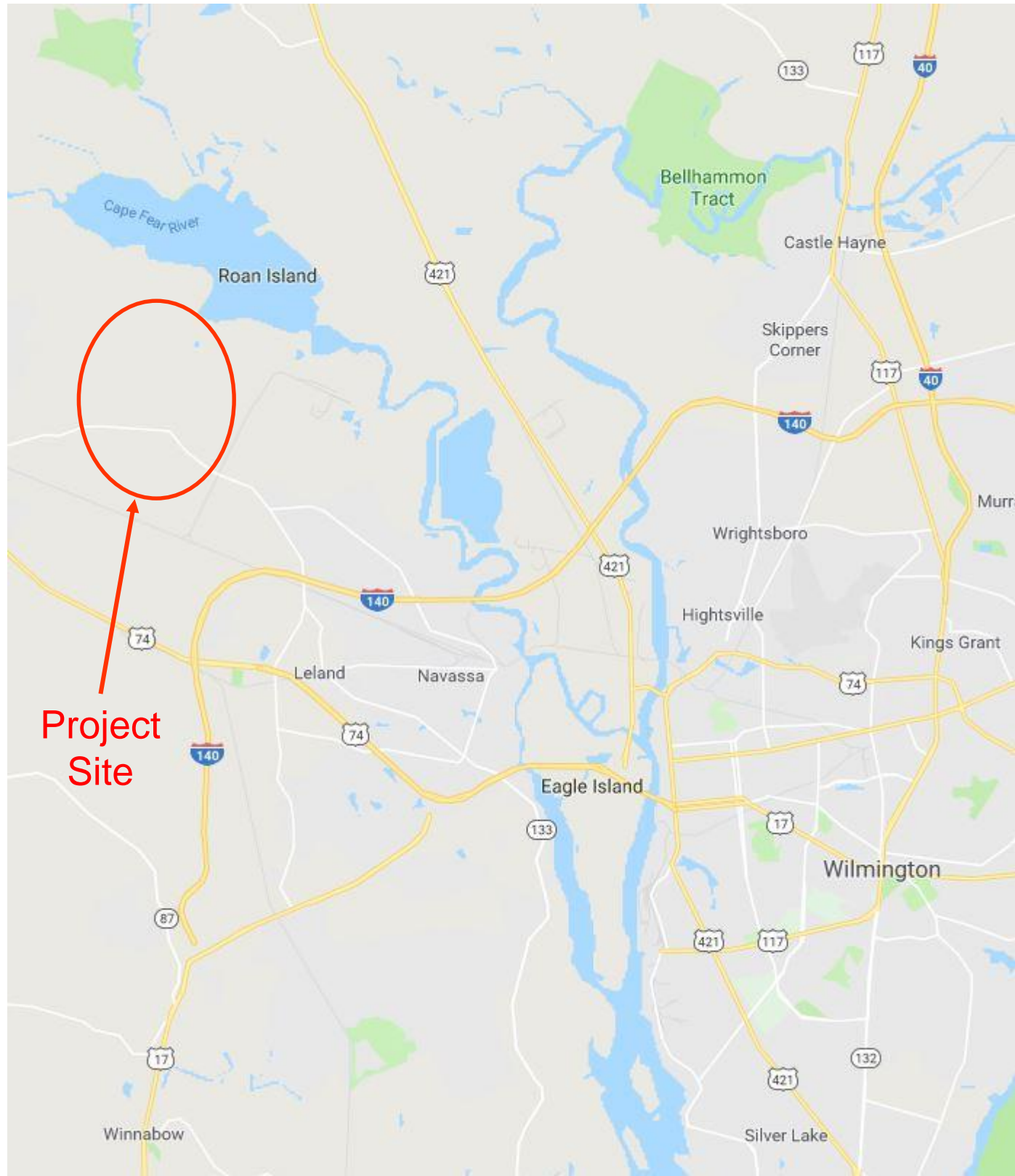




# **APPENDIX I**

## **FIGURES**





## SITE VICINITY MAP

North ↑



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CLIENT: CDM Smith

PROJECT: Brunswick County Public Utilities Discharge Pipeline

LOCATION: Leland, North Carolina

F&R PROJECT No.: 66W-0224

DRAWN BY: M. Arnold

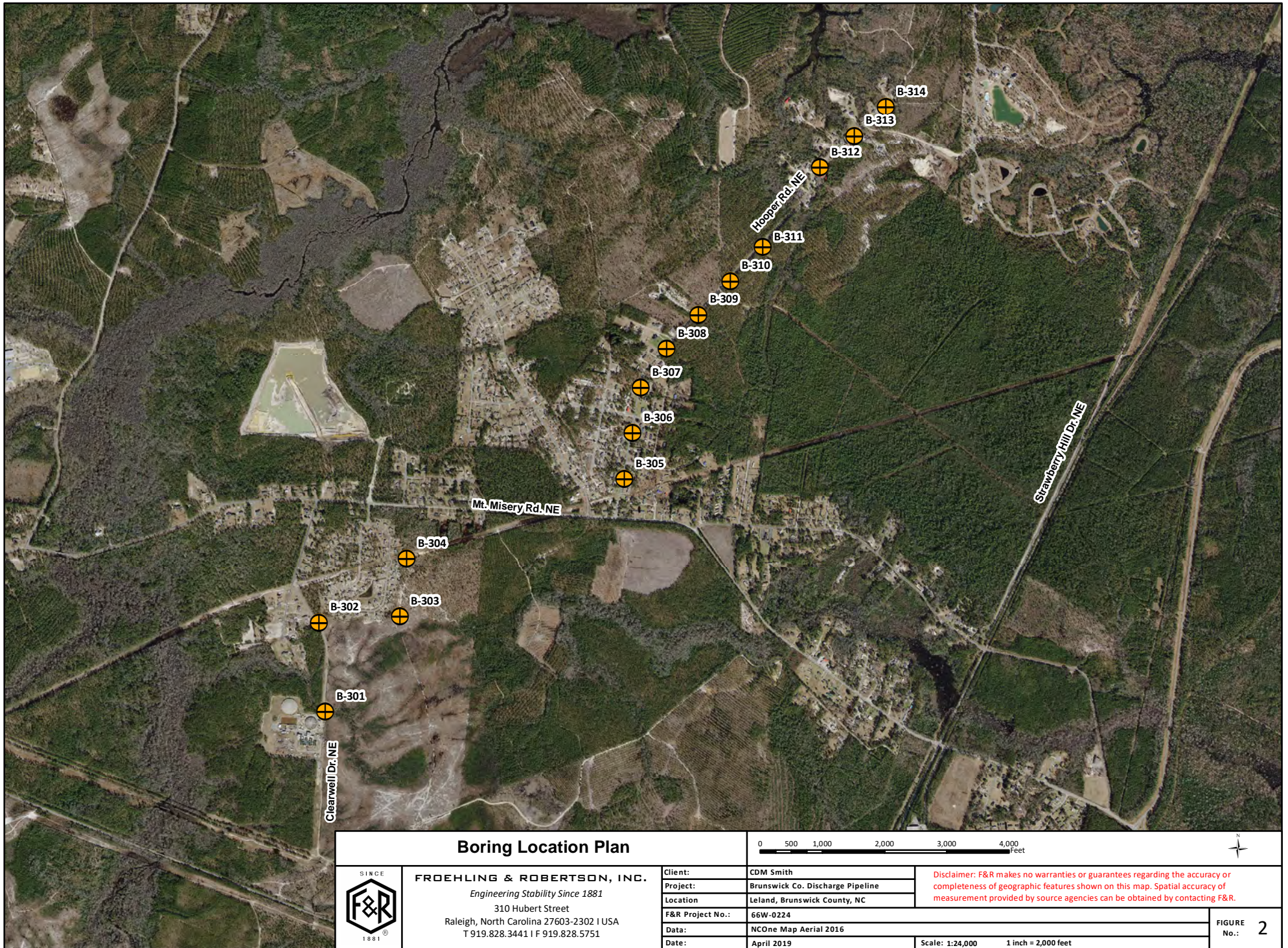
DATE: April 2019

SCALE: Not to scale

FIGURE  
No.:

1







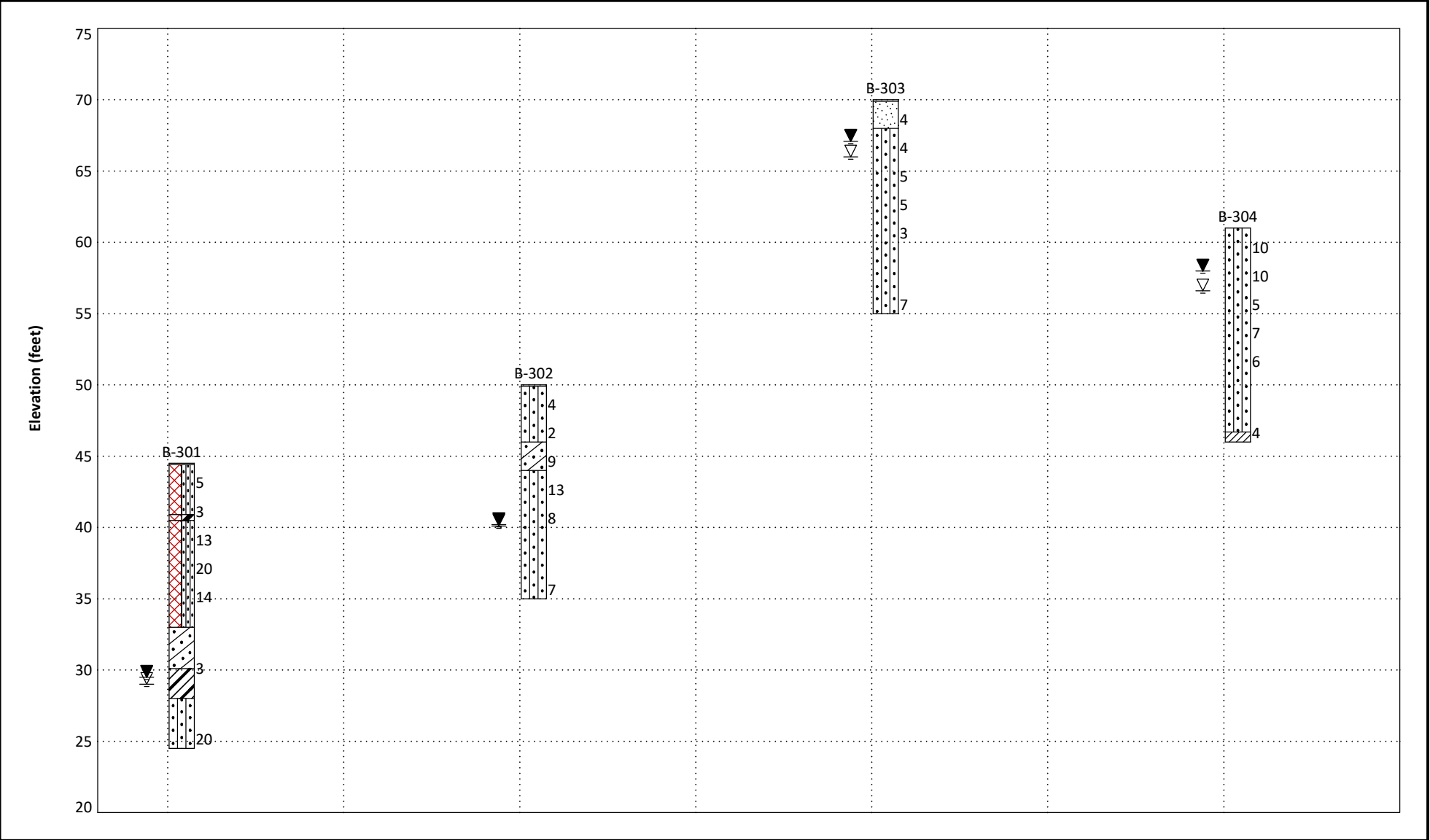


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SUBSURFACE PROFILE

Plot Based on Elevation  
Profile Name: FIGURE 3

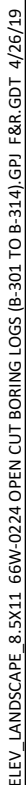
Project No: 66W-0224  
Client: CDM Smith  
Project: Brunswick County Discharge Pipeline  
City/State: Leland, NC





Plot Based on Elevation  
**Profile Name:** FIGURE 4

City/State: Leland, NC





# **APPENDIX II**

## **BORING LOGS**





## KEY TO SOIL CLASSIFICATION

### Correlation of Penetration Resistance with Relative Density and Consistency

#### Sands and Gravels

<u>No. of Blows, N</u>	<u>Relative Density</u>
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium dense
31 - 50	Dense
Over 50	Very dense

#### Silts and Clays

<u>No. of Blows, N</u>	<u>Relative Density</u>
0 - 2	Very soft
3 - 4	Soft
5 - 8	Firm
9 - 15	Stiff
16 - 30	Very stiff
31 - 50	Hard
Over 50	Very hard

### Particle Size Identification (Unified Classification System)

Boulders:	Diameter exceeds 8 inches
Cobbles:	3 to 8 inches diameter
Gravel:	<u>Coarse</u> - 3/4 to 3 inches diameter <u>Fine</u> - 4.76 mm to 3/4 inch diameter
Sand:	<u>Coarse</u> - 2.0 mm to 4.76 mm diameter <u>Medium</u> - 0.42 mm to 2.0 mm diameter <u>Fine</u> - 0.074 mm to 0.42 mm diameter
Silt and Clay:	Less than 0.07 mm (particles cannot be seen with naked eye)

### Modifiers






















The modifiers provide our estimate of the amount of silt, clay or sand size particles in the soil sample.

<u>Approximate Content</u>	<u>Modifiers</u>
≤ 5%:	Trace
5% to 12%:	Slightly silty, slightly clayey, slightly sandy
12% to 30%:	Silty, clayey, sandy
30% to 50%:	Very silty, very clayey, very sandy

<u>Field Moisture Description</u>
Saturated: Usually liquid; very wet, usually from below the groundwater table
Wet: Semisolid; requires drying to attain optimum moisture
Moist: Solid; at or near optimum moisture
Dry: Requires additional water to attain optimum moisture



## UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISION					TYPICAL NAMES
	GRAVELS More than 50% of coarse fraction larger than No. 4 sieve	CLEAN GRAVEL (little or no fines)		GW	Well graded gravels
				GP	Poorly graded gravels
		GRAVELS with fines		GM	Silty gravels
				GC	Clayey gravels
	SANDS More than 50% of coarse fraction smaller than No. 4 sieve	CLEAN SAND (little or no fines)		SW	Well graded sands
				SP	Poorly graded sands
		SAND with fines		SM	Silty sands, sand/silt mixtures
				SC	Clayey sands, sand/clay mixtures
	SILTS AND CLAYS Liquid Limit is less than 50			ML	Inorganic silts, sandy and clayey silts with slightly plasticity
				CL	Sandy or silty clays of low to medium plasticity
				OL	Organic silts of low plasticity
	SILTS AND CLAYS Liquid Limit is greater than 50			MH	Inorganic silts, sandy micaceous or clayey elastic silts
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity
	HIGHLY ORGANIC SOILS				PT
MISCELLANEOUS MATERIALS					PWR (Partially Weathered Rock)
					Rock
					Asphalt
					ABC Stone
					Concrete
					Surficial Organic Soil



# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-301 (1 of 1)

Project No: 66W-0224

Client: CDM Smith

Project: Brunswick County Discharge Pipeline

City/State: Leland, NC

Elevation: 44.5 ±

Total Depth: 20.0'

Boring Location: 202800.56 N, 2270105.27 E

Drilling Method: H.S. Augers

Hammer Type: Automatic

Date Drilled: 1/23/19

Driller: S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
44.4	0.1	SURFICIAL ORGANIC SOILS	2-2-3 -3	0.0		<b>GROUNDWATER DATA:</b> 0 Hr: 15.5' Inside PVC 24 Hr: 15.0' Inside PVC
		FILL: Very Loose to Loose, Gray-Brown to Dark Gray, Moist to Wet, Clayey Silty Fine to Coarse SAND (SM) with Trace Roots(0.0-2.0') Wet @ 2.0'	2-2-1 -3	2.0	5	
					3	
40.9	3.6	FILL: Soft, Gray, Wet, Silty Fine to Coarse Sandy CLAY (CH) with Trace Roots	6-6-7 -8	4.0	13	
40.5	4.0	FILL: Medium Dense, Dark Gray-Brown, Wet, Clayey Silty Fine to Coarse SAND (SM) with Trace Roots	8-9-11 -11	6.0	20	
			6-6-8 -7	8.0	14	
				10.0		
33.0	11.5	COASTAL PLAIN SOILS: Very Loose, Gray-Brown, Wet, Silty Clayey Fine to Coarse SAND (SC) with Trace Roots and Wood Fragments	2-1-2 -2	13.0	3	
30.1	14.4	Soft, Gray-Brown, Wet, Silty Fine to Coarse Sandy CLAY (CL/CH) with Trace Roots and Wood Fragments		15.0		
28.0	16.5	Medium Dense, Brown, Saturated, Silty Fine to Coarse SAND (SM)	8-9-11 -11	18.0	20	<b>NOTE:</b> Wet spoon @ 18.0'
24.5	20.0	Boring terminated at 20.0 feet.		20.0		

BORING LOG 66W-0224 OPEN CUT BORING LOGS (B-301 TO B-314).GPJ F&R.GDT 4/26/19

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-302 (1 of 1)

**Project No:** 66W-0224

**Client:** CDM Smith

**Project:** Brunswick County Discharge Pipeline

**City/State:** Leland, NC

**Elevation:** 50 ±

**Total Depth:** 15.0'

**Boring Location:** 204235.74 N, 2270004.26 E

**Drilling Method:** H.S. Augers

**Hammer Type:** Automatic

**Date Drilled:** 1/23/19

**Driller:** S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
49.9	0.1	SURFICIAL ORGANIC SOILS	1-2-2 -3	0.0	4	<b>GROUNDWATER DATA:</b> 0 Hr: 9.9' Inside PVC 24 Hr: 9.8' Inside PVC
		COASTAL PLAIN SOILS: Very Loose to Loose, Light Brown, Moist, Silty Fine to Medium SAND (SM) with Trace Roots	2-1-1 -2	2.0	2	
46.0	4.0	Loose, Orange-Tan, Moist, Silty Clayey Fine to Coarse SAND (SC)	2-4-5 -7	4.0	9	
44.0	6.0	Loose to Medium Dense, Tan-Brown to Orange-Tan, Moist to Saturated, Clayey Silty Fine to Coarse SAND (SM)	7-7-6 -6	6.0	13	
			4-4-4 -6	8.0	8	
				10.0		
			3-3-4 -6	13.0	7	<b>NOTE:</b> Wet spoon @ 13.0'
35.0	15.0	Boring terminated at 15.0 feet.		15.0		

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.





# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-303 (1 of 1)

**Project No:** 66W-0224

**Client:** CDM Smith

**Project:** Brunswick County Discharge Pipeline

**City/State:** Leland, NC

**Elevation:** 70 ±

**Total Depth:** 15.0'

**Boring Location:** 204330.74 N, 2271301.92 E

**Drilling Method:** H.S. Augers

**Hammer Type:** Automatic

**Date Drilled:** 1/23/19

**Driller:** S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
69.9	0.1	SURFICIAL ORGANIC SOILS	1-2-2 -2	0.0	4	<b>GROUNDWATER DATA:</b> 0 Hr: 4.0' Inside PVC 24 Hr: 2.9' Inside PVC
68.0	2.0	COASTAL PLAIN SOILS: Very Loose, Light Gray, Moist, Slightly Silty Fine to Medium SAND (SP)				
		Very Loose to Loose, Gray to Dark Gray-Black, Wet to Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM) with Trace Roots (2.0-4.0', 13.0-15.0')	2-2-2 -2	2.0	4	<b>NOTE:</b> Wet spoon @ 6.0'
		Saturated @ 4.0'	2-3-2 -3	4.0	5	
			3-2-3 -3	6.0	5	
			3-1-2 -2	8.0	3	
				10.0		
			2-4-3 -4	13.0	7	
55.0	15.0	Boring terminated at 15.0 feet.		15.0		

BORING LOG 66W-0224 OPEN CUT BORING LOGS (B-301 TO B-314).GPJ F&R.GDT 4/26/19

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-304 (1 of 1)

**Project No:** 66W-0224

**Client:** CDM Smith

**Project:** Brunswick County Discharge Pipeline

**City/State:** Leland, NC

**Elevation:** 61 ±

**Total Depth:** 15.0'

**Boring Location:** 205260.61 N, 2271410.61 E

**Drilling Method:** H.S. Augers

**Hammer Type:** Automatic

**Date Drilled:** 1/22/19

**Driller:** S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		COASTAL PLAIN SOILS: Very Loose to Loose, Brown-Orange to Gray to Dark Brown, Moist to Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM) with Trace Roots (0.0-2.0', 13.0-14.3')	3-5-5 -7	0.0	10	<b>GROUNDWATER DATA:</b> 0 Hr: 4.4' Inside PVC 24 Hr: 3.0' Inside PVC
		Wet @ 2.0'	5-5-5 -3	2.0	10	
		Saturated @ 4.0'	3-2-3 -3	4.0	5	<b>NOTE:</b> Wet spoon @ 4.0'
			3-3-4 -5	6.0	7	
			3-2-4 -4	8.0	6	
				10.0		
			1-2-2 -2	13.0	4	
46.7	14.3	Soft, Gray, Wet, Silty Fine to Medium Sandy CLAY (CL)		15.0		
46.0	15.0	Boring terminated at 15.0 feet.				

BORING LOG 66W-0224 OPEN CUT BORING LOGS (B-301 TO B-314).GPJ F&R.GDT 4/26/19

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-305 (1 of 1)

Project No: 66W-0224

Client: CDM Smith

Project: Brunswick County Discharge Pipeline

City/State: Leland, NC

Elevation: 52 ±

Total Depth: 15.0'

Boring Location: 206539.94 N, 2274910.29 E

Drilling Method: H.S. Augers

Hammer Type: Automatic

Date Drilled: 1/22/19

Driller: S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
51.9	0.1	SURFICIAL ORGANIC SOILS	1-1-2 -2	0.0	3	<b>GROUNDWATER DATA:</b> 0 Hr: 5.5' Inside HSA 24 Hr: 3.6' Inside PVC
		COASTAL PLAIN SOILS: Very Loose, Gray-Brown, Moist, Slightly Silty Fine to Medium SAND (SP) with Trace Roots				
50.0	2.0	Very Loose, Brown, Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM)	2-1-1 -2	2.0	2	
48.0	4.0	Very Loose to Loose, Gray-Brown, Saturated, Silty Clayey Fine to Coarse SAND (SC)	1-2-1 -3	4.0	3	
			5-5-5 -6	6.0	10	<b>NOTE:</b> Wet spoon @ 6.0'
44.0	8.0	Very Loose to Medium Dense, Brown, Saturated, Silty Fine to Coarse SAND (SM)	7-13-14 -12	8.0	27	
				10.0		
			WOH-1-2 -2	13.0	3	
37.0	15.0	Boring terminated at 15.0 feet.		15.0		

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-306 (1 of 1)

Project No: 66W-0224

Client: CDM Smith

Project: Brunswick County Discharge Pipeline

City/State: Leland, NC

Elevation: 54.5 ±

Total Depth: 15.0'

Boring Location: 207276.59 N, 2275044.61 E

Drilling Method: H.S. Augers

Hammer Type: Automatic

Date Drilled: 1/22/19

Driller: S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
54.4	0.1	SURFICIAL ORGANIC SOILS	2-1-3 -2	0.0	4	<b>GROUNDWATER DATA:</b> 0 Hr: 8.2' Inside HSA 24 Hr: 5.9' Inside PVC
		COASTAL PLAIN SOILS: Very Loose, Light Brown, Moist, Slightly Silty Fine to Medium SAND (SP) with Trace Roots				
52.5	2.0	Very Loose, Brown to Dark Brown-Black, Moist to Wet, Slightly Clayey Silty Fine to Medium SAND (SM)	2-2-2 -1	2.0	4	
			3-1-1 -4	4.0	2	
		Wet @ 4.9'				
48.5	6.0	Very Loose to Loose, Dark Gray-Dark Brown, Wet, Silty Clayey Fine to Coarse SAND (SC)	2-1-2 -2	6.0	3	
			2-2-3 -4	8.0	5	
				10.0		
43.0	11.5	Loose, Gray, Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM)				
			2-2-5 -9	13.0	7	<b>NOTE:</b> Wet spoon @ 13.0'
39.5	15.0	Boring terminated at 15.0 feet.		15.0		

BORING LOG 66W-0224 OPEN CUT BORING LOGS (B-301 TO B-314).GPJ F&R.GDT 4/26/19

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-307 (1 of 1)

**Project No:** 66W-0224

**Client:** CDM Smith

**Project:** Brunswick County Discharge Pipeline

**City/State:** Leland, NC

**Elevation:** 57 ±

**Total Depth:** 15.0'

**Boring Location:** 208008.75 N, 2275180.07 E

**Drilling Method:** H.S. Augers

**Hammer Type:** Automatic

**Date Drilled:** 1/22/19

**Driller:** S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
53.0	4.0	COASTAL PLAIN SOILS: Very Loose, Gray to Dark Brown, Moist, Slightly Silty Fine to Medium SAND (SP) with Trace Roots (0.0-2.0')	1-2-2 -2	0.0	4	<b>GROUNDWATER DATA:</b> 0 Hr: 13.4' Inside PVC 24 Hr: 8.7' Inside PVC
			3-1-2 -2	2.0	3	
	8.0	Loose, Dark Gray-Black, Moist to Wet, Slightly Clayey Silty Fine to Medium SAND (SM)	2-2-3 -2	4.0	5	
			3-2-3 -2	6.0	5	
49.0	8.0	Wet @ 7.0'				
	8.0	Loose to Medium Dense, Gray-Brown, Saturated, Silty Clayey Fine to Coarse SAND (SC)	4-3-3 -2	8.0	6	<b>NOTE:</b> Wet spoon @ 8.0'
				10.0		
			4-8-8 -8	13.0	16	
42.0	15.0	Boring terminated at 15.0 feet.		15.0		

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-308 (1 of 1)

Project No: 66W-0224

Client: CDM Smith

Project: Brunswick County Discharge Pipeline

City/State: Leland, NC

Elevation: 58.5 ±

Total Depth: 20.0'

Boring Location: 208635.79 N, 2275591.74 E

Drilling Method: H.S. Augers

Hammer Type: Automatic

Date Drilled: 1/22/19

Driller: S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
58.4	0.1	SURFICIAL ORGANIC SOILS	1-2-3 -3	0.0	5	<b>GROUNDWATER DATA:</b> 0 Hr: 4.3' Inside PVC 24 Hr: 5.9' Inside PVC
		COASTAL PLAIN SOILS: Very Loose to Loose, Tan-Brown, Moist, Slightly Silty Fine to Medium SAND (SP) with Trace Roots and Wood Fragments (0.0-2.0', 4.0-6.0')	3-2-2 -1	2.0	4	
			3-1-2 -1	4.0	3	
52.5	6.0	Loose, Dark Brown, Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM)	2-2-4 -5	6.0	6	<b>NOTE:</b> Wet spoon @ 6.0'
50.5	8.0	Loose, Dark Gray, Saturated, Silty Clayey Fine to Coarse SAND (SC)	6-4-3 -2	8.0	7	
				10.0		
47.0	11.5	Very Loose, Dark Brown to Dark Gray, Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM)				
46.5	12.0		Very Loose, Dark Gray, Saturated, Slightly Silty Fine SAND (SP)	13.0	2	
			WOR-WOR-2 -3	15.0		
41.5	17.0	Very Loose, Dark Gray, Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM) with Trace Roots (18.0-19.0')				
			2-1-2 -2	18.0	3	
39.5	19.0	Soft, Gray-Blue, Wet, Silty Fine Sandy CLAY (CH) with Trace Roots				
38.5	20.0	Boring terminated at 20.0 feet.				

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-309 (1 of 1)

**Project No:** 66W-0224

**Elevation:** 57 ±

**Drilling Method:** H.S. Augers

**Client:** CDM Smith

**Total Depth:** 15.0'

**Hammer Type:** Automatic

**Project:** Brunswick County Discharge Pipeline

**Boring Location:** 209179.72 N, 2276108.21 E

**Date Drilled:** 1/22/19

**City/State:** Leland, NC

**Driller:** S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
56.9	0.1	SURFICIAL ORGANIC SOILS	1-1-4 -3	0.0	5	<b>GROUNDWATER DATA:</b> 0 Hr: 3.9' Inside PVC 24 Hr: 3.9' Inside PVC
		COASTAL PLAIN SOILS: Very Loose to Loose, Dark Brown-Black to Dark Gray, Moist to Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM) with Trace Roots Wet @ 2.0'	3-1-1 -1	2.0	2	
		Saturated @ 4.0'	2-1-1 -1	4.0	2	
51.0	6.0	Very Loose to Medium Dense, Dark Gray-Black, Saturated, Silty Clayey Fine to Coarse SAND (SC) with Trace Roots	2-1-1 -3	6.0	2	<b>NOTE:</b> Wet spoon @ 6.0'
48.6	8.4	Medium Dense, Gray to Dark Brown, Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM) with Trace Roots (13.0-15.0')	4-4-6 -5	8.0	10	
				10.0		
			4-4-6 -9	13.0	10	
42.0	15.0	Boring terminated at 15.0 feet.		15.0		

BORING LOG 66W-0224 OPEN CUT BORING LOGS (B-301 TO B-314).GPJ F&R.GDT 4/26/19

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-310 (1 of 1)

**Project No:** 66W-0224

**Client:** CDM Smith

**Project:** Brunswick County Discharge Pipeline

**City/State:** Leland, NC

**Elevation:** 55 ±

**Total Depth:** 15.0'

**Boring Location:** 209724.61 N, 2276621.34 E

**Drilling Method:** H.S. Augers

**Hammer Type:** Automatic

**Date Drilled:** 1/21/19

**Driller:** S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
54.9	0.1	SURFICIAL ORGANIC SOILS	1-2-2 -1	0.0	4	<b>GROUNDWATER DATA:</b> 0 Hr: 5.1' Inside PVC 24 Hr: 4.0' Inside PVC
53.0	2.0	COASTAL PLAIN SOILS: Very Loose, Brown, Moist, Slightly Silty Fine to Medium SAND (SP) with Trace Roots	2-2-1 -2	2.0	3	
		Very Loose to Medium Dense, Dark Brown to Dark Gray-Black, Wet to Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM) with Trace Roots (4.0-6.0', 8.0-9.4')	2-2-2 -3	4.0	4	
		Saturated @ 4.0'	6-5-6 -9	6.0	11	<b>NOTE:</b> Wet spoon @ 6.0'
			5-8-7 -4	8.0	15	
45.6	9.4	Medium Dense, Dark Brown-Dark Gray, Saturated, Silty Clayey Fine to Medium SAND (SC)		10.0		
43.5	11.5	Medium Dense, Dark Gray-Brown, Saturated, Slightly Clayey Silty Fine to Medium SAND (SM)	5-12-18 -22	13.0	30	<b>NOTE:</b> Wood fragments observed in cuttings when drilling to 13.0'
40.0	15.0	Boring terminated at 15.0 feet.		15.0		

BORING LOG 66W-0224 OPEN CUT BORING LOGS (B-301 TO B-314).GPJ F&R.GDT 4/26/19

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.





# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-311 (1 of 1)

**Project No:** 66W-0224

**Client:** CDM Smith

**Project:** Brunswick County Discharge Pipeline

**City/State:** Leland, NC

**Elevation:** 47 ±

**Total Depth:** 15.0'

**Boring Location:** 210266.83 N, 2277139.30 E

**Drilling Method:** H.S. Augers

**Hammer Type:** Automatic

**Date Drilled:** 1/21/19

**Driller:** S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
46.9	0.1	SURFICIAL ORGANIC SOILS	1-0-3 -2	0.0	3	<b>GROUNDWATER DATA:</b> 0 Hr: 12.0' Inside PVC 24 Hr: 9.6' Inside PVC
		COASTAL PLAIN SOILS: Very Loose, Tan-Light Brown, Moist, Slightly Silty Fine to Coarse SAND (SP-SM) with Trace Roots	2-2-2 -2	2.0	4	
43.0	4.0	Very Loose, Black-Dark Gray, Moist, Slightly Clayey Silty Fine to Coarse SAND (SM)	4-2-2 -3	4.0	4	
41.0	6.0	Loose, Dark Gray, Moist, Silty Clayey Fine to Coarse SAND (SC)	3-3-4 -6	6.0	7	
			4-4-5 -5	8.0	9	
				10.0		
35.5	11.5	Medium Dense, Brown, Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM)				
			7-13-16 -17	13.0	29	<b>NOTE:</b> Wet spoon @ 13.0'
32.0	15.0	Boring terminated at 15.0 feet.			15.0	

BORING LOG 66W-0224 OPEN CUT BORING LOGS (B-301 TO B-314).GPJ F&R.GDT 4/26/19

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



# Froehling & Robertson, Inc.

## BORING LOG

Boring: B-312 (1 of 1)

**Project No:** 66W-0224

**Client:** CDM Smith

**Project:** Brunswick County Discharge Pipeline

**City/State:** Leland, NC

**Elevation:** 42.5 ±

**Total Depth:** 15.0'

**Boring Location:** 211547.08 N, 2278061.18 E

**Drilling Method:** H.S. Augers

**Hammer Type:** Automatic

**Date Drilled:** 1/22/19

**Driller:** S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
42.4	0.1	SURFICIAL ORGANIC SOILS  COASTAL PLAIN SOILS: Very Loose to Very Dense, Brown to Black to Dark Brown, Moist to Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM) with Trace Roots (0.0-2.0', 4.0-6.0', 6.0-8.0')	2-3-3 -4	0.0	6	<b>GROUNDWATER DATA:</b> 0 Hr: 12.0' Inside HSA 24 Hr: 11.1' Inside PVC
			3-2-2 -1	2.0	4	
			3-1-2 -2	4.0	3	
			3-1-2 -3	6.0	3	
			3-3-5 -4	8.0	8	
				10.0		
			14-33-40 -49	13.0	73	<b>NOTE:</b> Wet spoon @ 13.0'
27.5	15.0	Boring terminated at 15.0 feet.				

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



**Project No:** 66W-0224

**Client:** CDM Smith

**Project:** Brunswick County Discharge Pipeline

**City/State:** Leland, NC

**Elevation:** 46 ±

**Total Depth:** 15.0'

**Boring Location:** 212053.31 N, 2278612.95 E

**Drilling Method:** H.S. Augers

**Hammer Type:** Automatic

**Date Drilled:** 1/21/19

**Driller:** S. Davis

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
45.9	0.1	SURFICIAL ORGANIC SOILS	1-1-2 -2	0.0	3	<b>GROUNDWATER DATA:</b> 0 Hr: 7.7' Inside HSA 24 Hr: 6.7' Inside PVC
		COASTAL PLAIN SOILS: Very Loose, Light Brown, Moist, Slightly Silty Fine to Medium SAND (SP) with Trace Roots	2-2-2 -2	2.0	4	
43.0	3.0	Very Loose, Orange-Brown, Moist, Silty Clayey Fine to Coarse SAND (SC)				
42.0	4.0	Very Loose to Medium Dense, Light Brown to Dark Brown, Moist to Saturated, Slightly Clayey Silty Fine to Coarse SAND (SM)	3-2-2 -3	4.0	4	
		Wet @ 6.0'	3-2-3 -3	6.0	5	<b>NOTE:</b> Wet spoon @ 8.0'
		Saturated @ 8.0'	3-3-8 -12	8.0	11	
				10.0		
			10-9-14 -20	13.0	23	
31.0	15.0	Boring terminated at 15.0 feet.		15.0		

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



**Boring: B-314 (1 of 1)**

**Driller:** S. DavisBORING\_LOG 66W-0224 OPEN CUT BORING LOGS (B-301 TO B-314).GPJ F&R.GDT 4/26/19

\*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



# **APPENDIX III**

## **LAB RESULTS**





FROEHLING & ROBERTSON

Engineering Stability Since 1881

# ASTM LABORATORY TEST SUMMARY SHEET

Sheet: 1 of 1

**Project No:** 66W-0224

**Client:** CDM Smith

**Project:** Brunswick Co. NW WTP

**City/State:** Leland, NC

Sample No.	Location	Depth (ft)	Natural Moisture (%)	LL	PL	PI	USCS Class.	% GRAVEL	% SAND	% FINES	Organic Content (%)	-
S-6	B-301	13.0' - 15.0'	14.6	25	18	7					1.7	
S-3	B-302	4.0' - 6.0'	16.7					0.0	71.6	28.4		
S-4	B-302	6.0' - 8.0'	14.8					0.0	62.3	37.7		
S-6	B-304	13.0' - 15.0'	22.3	32	21	11	CL	0.0	40.1	59.9		
S-5	B-305	8.0' - 10.0'	15.2					1.2	89.7	9.1		
S-2	B-307	2.0' - 4.0'	5.1				SP	0.0	95.9	4.1		
S-6	B-308	13.0' - 15.0'	26.5				SP	0.0	96.3	3.7	0.4	
S-5	B-309	8.0' - 10.0'	22.8					0.0	91.4	8.6		
S-4	B-311	6.0' - 8.0'	13.5					0.0	92.9	7.1		
S-3	B-313	4.0' - 6.0'	5.3					0.0	94.9	5.1		
S-3	B-314	4.0' - 6.0'	6.0					0.0	92.4	7.6		

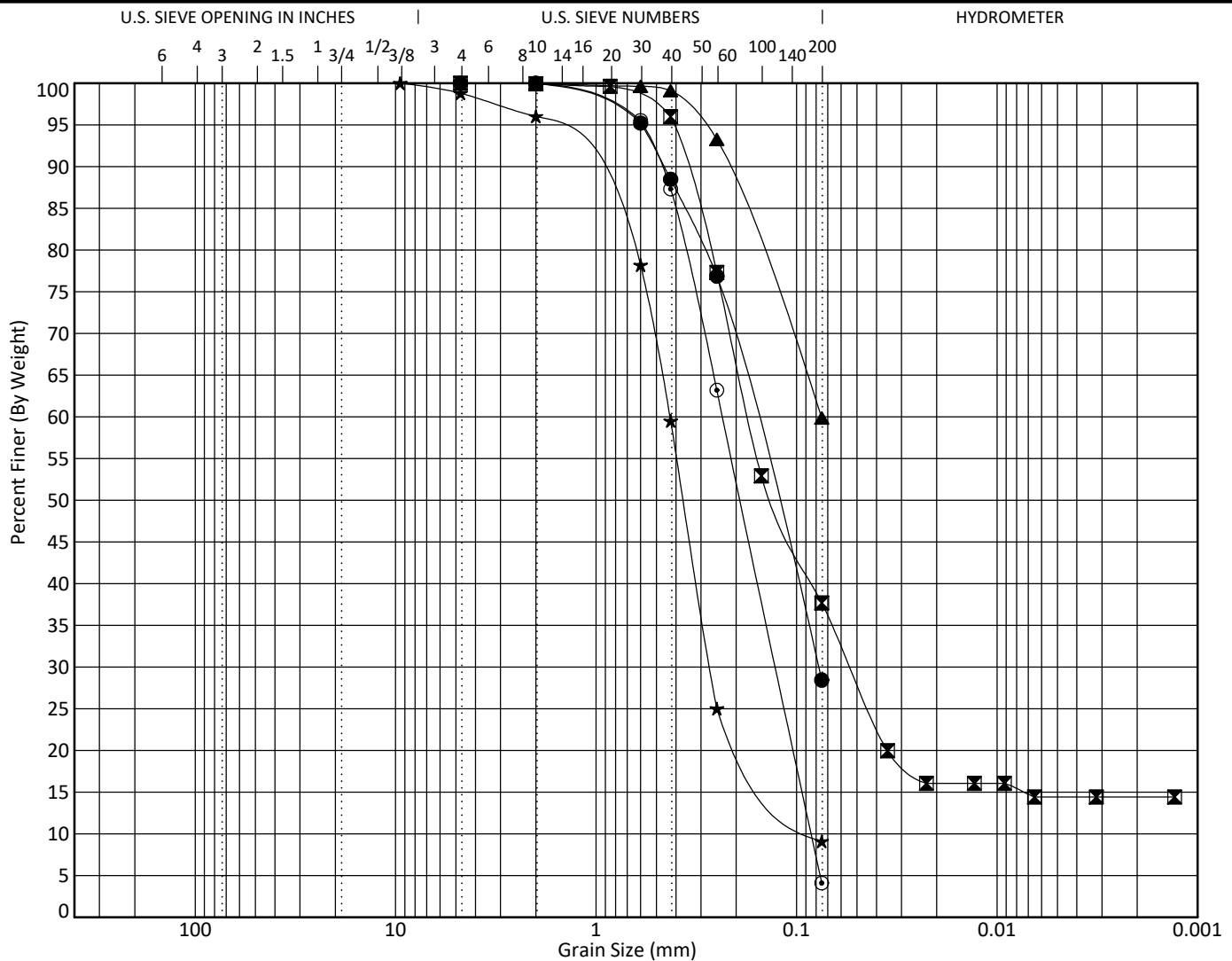


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES		GRAVEL		SAND			SILT OR CLAY				
		coarse	fine	coarse	medium	fine					
Boring No.	Depth	Classification					LL	PL	PI	Cc	Cu
● B-302	4.0' - 6.0'	()									
☒ B-302	6.0' - 8.0'	()									
▲ B-304	13.0' - 15.0'	SANDY LEAN CLAY (CL)					32	21	11		
★ B-305	8.0' - 10.0'	()								2.12	5.34
⊙ B-307	2.0' - 4.0'	POORLY GRADED SAND (SP)								0.82	2.77
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
● B-302	4.0' - 6.0'	4.75	0.164	0.078		0.0	71.6	28.4		16.7	
☒ B-302	6.0' - 8.0'	4.75	0.174	0.054		0.0	62.3	23.3	14.4	14.8	
▲ B-304	13.0' - 15.0'	2	0.075			0.0	40.1	59.9		22.3	
★ B-305	8.0' - 10.0'	9.5	0.429	0.27	0.08	1.2	89.7	9.1		15.2	
⊙ B-307	2.0' - 4.0'	2	0.234	0.127	0.085	0.0	95.9	4.1		5.1	





FROEHLING & ROBERTSON

Engineering Stability Since 1881

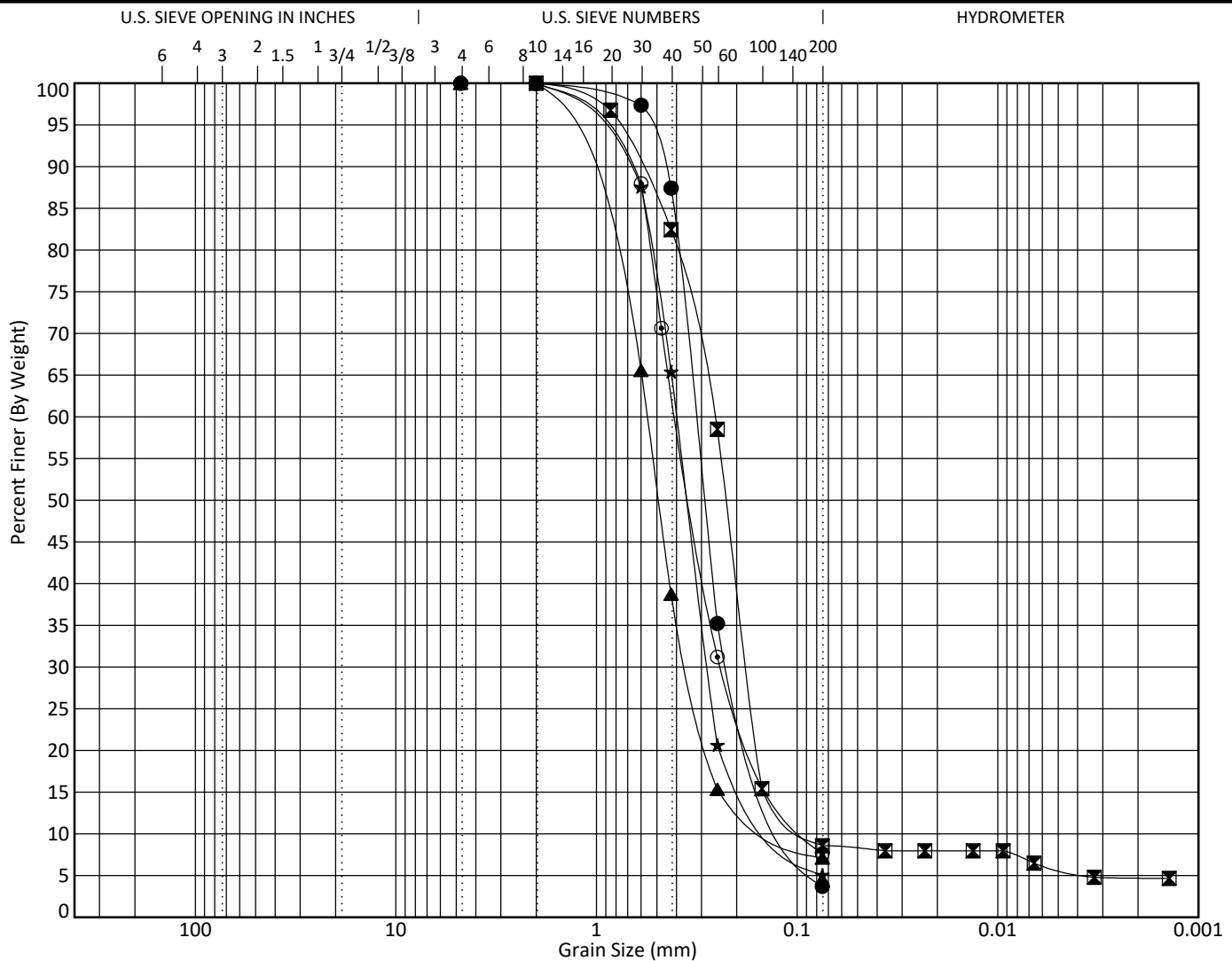
# GRAIN SIZE DISTRIBUTION

Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification					LL	PL	PI	Cc	Cu
● B-308	13.0' - 15.0'	POORLY GRADED SAND (SP)								1.37	3.37
☒ B-309	8.0' - 10.0'	()								1.42	2.98
▲ B-311	6.0' - 8.0'	()								1.90	4.88
★ B-313	4.0' - 6.0'	()								1.78	3.63
⊙ B-314	4.0' - 6.0'	()								1.63	4.72
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
● B-308	13.0' - 15.0'	4.75	0.322	0.205	0.095	0.0	96.3	3.7		26.5	
☒ B-309	8.0' - 10.0'	2	0.259	0.178	0.087	0.0	91.4	2.8	5.8	22.8	
▲ B-311	6.0' - 8.0'	4.75	0.558	0.349	0.114	0.0	92.9	7.1		13.5	
★ B-313	4.0' - 6.0'	4.75	0.399	0.279	0.11	0.0	94.9	5.1		5.3	
⊙ B-314	4.0' - 6.0'	4.75	0.4	0.235	0.085	0.0	92.4	7.6		6.0	

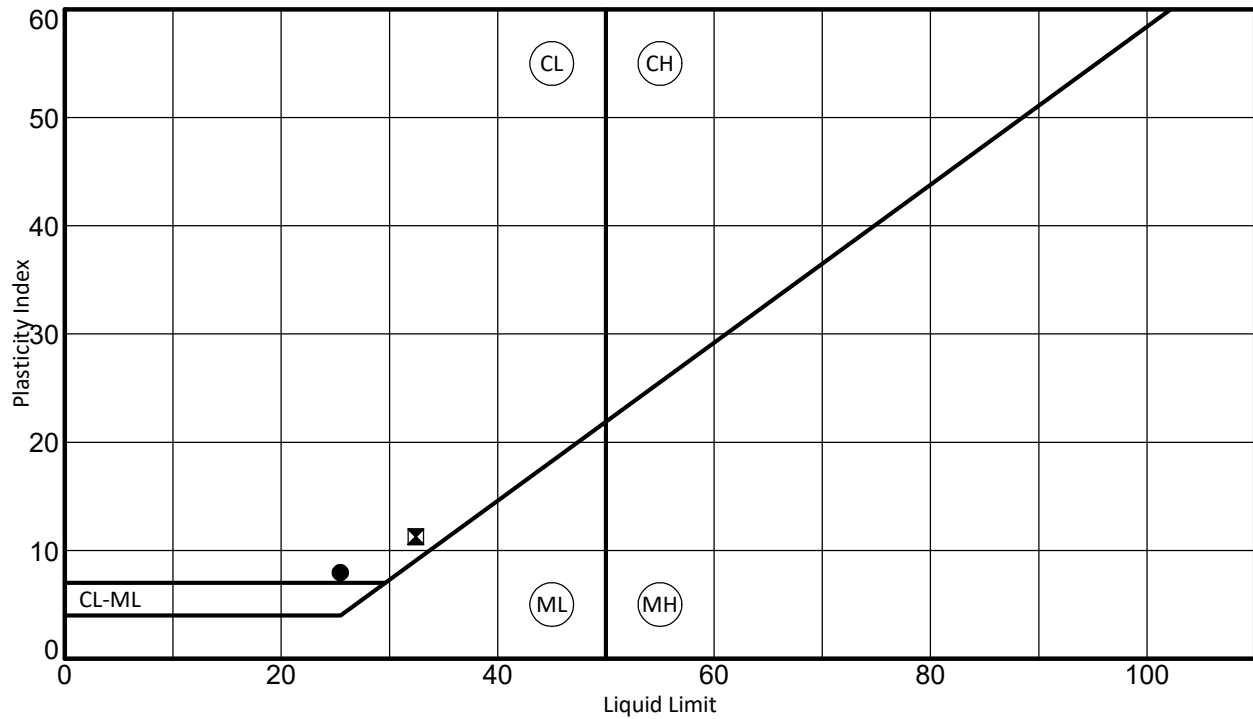


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



Sample No.	Location	Depth	LL	PL	PI	Fines	Classification	% Natural Water Content
● S-6	B-301	13.0' - 15.0'	25	18	7		()	14.6
⊠ S-6	B-304	13.0' - 15.0'	32	21	11	59.9	SANDY LEAN CLAY (CL)	22.3



# **APPENDIX IV**

## **GBA DOCUMENT**



# Important Information about This Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

**The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

## **Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects**

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

## **Read this Report in Full**

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

## **You Need to Inform Your Geotechnical Engineer about Change**

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

## **This Report May Not Be Reliable**

*Do not rely on this report* if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

## **Most of the "Findings" Related in This Report Are Professional Opinions**

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

## This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

## This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

## Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

## Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

## Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

## Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



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# Test Boring Logs





# Boring Number: B-201

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** F&R, Inc. / Shawn Davis

**Surface Elevation (ft.):** 38.5

**Drilling Method/Casing/Core Barrel Size:** 3 1/4 HSA & Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 30

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.3057298, W 78.1054032

Depth	Date	Time
NR	NR	NR

**Drilling Date: Start:** 1/29/2019 **End:** 1/29/2019

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
38.5 0	SS	S-1	24	5 8 9 11	2	17		Fill	Moist, medium dense, gray, fine to medium SAND and fine to coarse GRAVEL, trace silt.	
	SS	S-2	24	10 11 13 14	0	24			No recovery.	
33.5 5	SS	S-3	24	6 7 12 12	23	19			Moist, medium dense, grayish brown, fine to medium SAND, little silt & clay.	
	SS	S-4	24	10 12 13 14	24	25		Sand	Moist, medium dense, brown, fine to medium SAND, little silt & clay.	
	SS	S-5	24	7 9 9 10	21	18			Moist, medium dense, brown, fine to medium SAND, little silt & clay.	
28.5 10										
	SS	S-6	24	3 4 1 5	22	5			Top 18": Wet, loose, very light brown, fine to coarse SAND, little silt.	
23.5 15									Bottom 4": Wet, medium stiff, gray, CLAY, some fine to coarse sand.	
	SS	S-7	24	1 4 9 9	24	13			Wet, medium dense, white, fine to coarse SAND, trace silt.	
18.5										

**Sample Types**

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

**Consistency vs Blowcount/Foot**

Granular (Sand):		
V. Loose:	0-4	Dense: 30-50
Loose:	4-10	V. Dense: >50
M. Dense:	10-30	

Fine Grained (Clay):		
V. Soft:	<2	Stiff: 8-15
Soft:	2-4	V. Stiff: 15-30
M. Stiff:	4-8	Hard: >30

**Burmister Classification**

and	35-50%
some	20-35%
little	10-20%
trace	<10%
moisture, density, color	

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-201



# Boring Number: B-201

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
18.5 20								Sand	Wet, loose, gray, fine to coarse SAND, trace silt.	Switched to mud rotary at 20 feet below ground surface.
	SS	S-8	24	3 2 7 10	16	9				
13.5 25										
	SS	S-9	24	6 9 7 9	10	16				
8.5 30									Test boring terminated at 30 feet below ground surface.	
3.5 35										
-1.5 40										
-6.5 45										



# Boring Number: B-202

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** F&R, Inc. / Shawn Davis

**Surface Elevation (ft.):** 39.6

**Drilling Method/Casing/Core Barrel Size:** 3 1/4 HSA & Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 30

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.3059986, W 78.1054729

Depth	Date	Time
NR	NR	NR

**Drilling Date: Start:** 1/29/2019 **End:** 1/29/2019

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
39.6 0	SS	S-1	24	5 6 7 9	17	13		Fill	6" Subbase. Moist, medium dense, light brown, fine to medium SAND, little silt & clay.	PP = pocket penetrometer TSF = tons per square foot
	SS	S-2	24	8 8 5 9	10	13			Moist, medium dense, light brown, fine to medium SAND, little silt & clay.	
34.6 5	SS	S-3	24	4 7 8 9	20	15			Top 12": Moist, medium dense, very dark brown, Organic fine to medium SAND, trace silt.	Trace roots.
	SS	S-4	24	6 7 9 4	24	16		Sand	Bottom 8": Wet, medium dense, brown, fine to coarse SAND, trace silt. Wet, medium dense, light brown, fine to coarse SAND, trace silt.	
	SS	S-5	24	1 1 2 6	20	3			Top 14": Wet, soft, gray, CLAY, trace fine sand.	PP = 0.5 TSF
29.6 10								Clay	Bottom 6": Wet, very loose, light brown, fine to coarse SAND, some clay & silt.	Switched to mud rotary at 10 feet below ground surface.
	SS	S-6	24	4 7 3 3	22	10			Top 6": Wet, stiff, reddish yellow, Silty CLAY, trace fine sand. Middle 12": Wet, medium dense, very light brown, fine to coarse SAND, trace clay & silt.	PP = 0.5 TSF
24.6 15									Bottom 4": Wet, medium stiff, gray, Silty CLAY, little fine to medium sand.	
	SS	S-7	24	6 6 6 5	9	12		Sand	Wet, medium dense, very light brown, fine to coarse SAND, trace silt.	
19.6										

**Sample Types**

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

**Consistency vs Blowcount/Foot**

Granular (Sand):		
V. Loose:	0-4	Dense: 30-50
Loose:	4-10	V. Dense: >50
M. Dense:	10-30	

Fine Grained (Clay):		
V. Soft:	<2	Stiff: 8-15
Soft:	2-4	V. Stiff: 15-30
M. Stiff:	4-8	Hard: >30

**Burmister Classification**

and some little trace moisture, density, color	35-50% 20-35% 10-20% <10%
--	------------------------------------

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-202



# Boring Number: B-202

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
19.6 20								Sand	Wet, medium dense, very light brown, fine to coarse SAND, trace silt.	
	SS	S-8	24	6 6 13 10	12	19				
14.6 25										
	SS	S-9	24	6 7 7 8	10	14				
9.6 30									Test boring terminated at 30 feet below ground surface.	
4.6 35										
-0.4 40										
-5.4 45										



# Boring Number: B-203

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** F&R, Inc. / Shawn Davis

**Surface Elevation (ft.):** 50.1

**Drilling Method/Casing/Core Barrel Size:** 3 1/4 HSA & Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 50

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**




**Bore Hole Location:** N 34.3109682, W 78.0995930

**Depth**      **Date**      **Time**  
NR              NR              NR

**Drilling Date:** Start: 1/29/2019 End: 1/29/2019

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks	
50.1 0	SS	S-1	24	2 2 2 2	9	4		Fill	Moist, loose, dark brown, slightly Organic fine to medium SAND, trace silt.	WOH = weight of hammer PP = pocket penetrometer TSF = tons per square foot  Trace roots.	
	SS	S-2	24	2 3 2 3	21	5			Moist, loose, light brown, fine to medium SAND, trace silt.		
45.1 5	SS	S-3	24	2 1 3 3	20	4			Clay	Moist, medium stiff, gray, CLAY & SILT and fine to medum SAND.	PP = 1.25 TSF
	SS	S-4	24	5 5 5 7	22	10	Moist, stiff, gray, CLAY & SILT and fine to medum SAND.			PP = 2.5 TSF	
	SS	S-5	24	4 6 8 9	24	14	Moist, stiff, gray, CLAY & SILT and fine to medum SAND.			PP = 3.0 TSF	
40.1 10									Sand		Switched to mud rotary at 10 feet below ground surface.
	SS	S-6	24	10 11 13 11	18	24				Wet, medium dense, white, fine to medium SAND, trace silt.	
35.1 15											
	SS	S-7	24	12 14 16 18	11	30			Moist, medium dense, reddish yellow, fine to coarse SAND, trace silt.		
30.1											

## Sample Types

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

## Consistency vs Blowcount/Foot

**Granular (Sand):**  
V. Loose: 0-4 Dense: 30-50  
Loose: 4-10 V. Dense: >50  
M. Dense: 10-30

**Fine Grained (Clay):**  
V. Soft: <2 Stiff: 8-15  
Soft: 2-4 V. Stiff: 15-30  
M. Stiff: 4-8 Hard: >30

## Burmister Classification

and 35-50%  
some 20-35%  
little 10-20%  
trace <10%  
moisture, density, color

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-203



# Boring Number: B-203

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
30.1 20								Sand		
	SS	S-8	24	11 17 13 7	10	30			Moist, medium dense, very light brown, fine to coarse SAND, trace silt.	
25.1 25										
	SS	S-9	24	8 12 10 4	9	22			Moist, medium dense, very light brown, fine to coarse SAND, trace silt.	
20.1 30								Sand		
	SS	S-10	24	5 5 10 11	9	15			Moist, medium dense, very light brown, fine to coarse SAND, trace silt.	
15.1 35										
	SS	S-11	24	6 10 10 10	10	20			Moist, medium dense, very light brown, fine to coarse SAND, trace silt.	
10.1 40								Silty Sand		
	SS	S-12	24	1 WOH WOH WOH	24	0			Wet, very loose, dark gray, fine SAND, some clayey silt.	
5.1 45										

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-203**

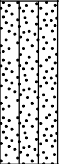




# Boring Number: B-203

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
0.1 50	SS	S-13	24	6 6 10 14	24	16		Silty Sand	Wet, medium dense, dark gray, fine SAND, some clayey silt.	
-4.9 55									Test boring terminated at 50 feet below ground surface.	
-9.9 60										
-14.9 65										
-19.9 70										

## Boring Number: B-204

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** F&R, Inc. / Shawn Davis

**Surface Elevation (ft.):** 49.4

**Drilling Method/Casing/Core Barrel Size:** 3 1/4 HSA & Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 50

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.3114898, W 78.0973887










**Depth Date Time**

**Drilling Date: Start:** 1/30/2019 **End:** 1/30/2019

NR NR NR

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
49.4 0	SS	S-1	24	1 8 5 4	6	13		Fill	Moist, medium dense, black, fine SAND, some silt & clay.	WOH = weight of hammer PP = pocket penetrometer TSF = tons per square foot
	SS	S-2	24	4 4 3 4	24	7		Clay	Moist, medium stiff, gray, Silty CLAY and fine to medium SAND.	
	SS	S-3	24	2 3 7 7	24	10			Moist, stiff, gray, Silty CLAY and fine to coarse SAND.	PP = 3.0 TSF
44.4 5	SS	S-4	24	6 8 8 9	24	16			Moist, very stiff, gray, Silty CLAY, some fine sand.	PP = 1.0 TSF
	SS	S-5	24	4 7 13 14	19	20			Top 12": Moist, very stiff, gray, Silty CLAY, little fine sand.	PP = 1.0 TSF
39.4 10								Sand	Bottom 8": Moist, medium dense, light gray, fine to medium SAND, little silt.	Switched to mud rotary at 10 feet below ground surface.
	SS	S-6	24	8 8 10 12	12	18			Wet, medium dense, white, fine to medium SAND, little silt.	
34.4 15										
	SS	S-7	24	11 14 15 15	13	29			Wet, medium dense, white, fine to coarse SAND, trace silt.	
29.4										

### Sample Types

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

### Consistency vs Blowcount/Foot

**Granular (Sand):**  
V. Loose: 0-4 Dense: 30-50  
Loose: 4-10 V. Dense: >50  
M. Dense: 10-30

**Fine Grained (Clay):**  
V. Soft: <2 Stiff: 8-15  
Soft: 2-4 V. Stiff: 15-30  
M. Stiff: 4-8 Hard: >30

### Burmister Classification

and 35-50%  
some 20-35%  
little 10-20%  
trace <10%  
moisture, density, color

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-204



# Boring Number: B-204

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
29.4 20										
	SS	S-8	24	8 11 11 9	14	22			Wet, medium dense, very light gray, fine to coarse SAND, trace silt.	
24.4 25										
	SS	S-9	24	6 6 6 8	15	12			Wet, medium dense, very light gray, fine to coarse SAND, trace silt.	
19.4 30										
	SS	S-10	24	1 2 2 1	11	4			Wet, loose, very light gray, fine to coarse SAND, trace silt.	
14.4 35										
	SS	S-11	24	WOH 1 3 5	14	4			Wet, loose, reddish yellow, fine to coarse SAND, trace silt.	
9.4 40										
	SS	S-12	24	15 16 21 23	23	37			Wet, dense, dark gray, fine SAND, some clayey silt.	
4.4 45										

BL BRUNSWICK WTP.GPJ - 7/10/19

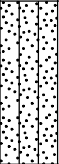
**Boring Number: B-204**



# Boring Number: B-204

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
-0.6 50	SS	S-13	24	8 9 13 19	24	22		Silty Sand	Wet, medium dense, dark gray, fine SAND, some clayey silt.	
-5.6 55									Test boring terminated at 50 feet below ground surface.	
-10.6 60										
-15.6 65										
-20.6 70										

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-204**



# Boring Number: B-205

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** F&R, Inc. / Shawn Davis

**Surface Elevation (ft.):** 59.2

**Drilling Method/Casing/Core Barrel Size:** 3 1/4 HSA & Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 50

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.3118654, W 78.0956006

**Depth**      **Date**      **Time**  
NR            NR            NR

**Drilling Date: Start:** 1/30/2019 **End:** 1/30/2019

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
59.2 0	SS	S-1	24	1 1 2 2	10	3		Fill	Moist, very loose, brown, fine to medium SAND, trace silt.	
	SS	S-2	24	2 2 1 2	21	3			Moist, very loose, brown, fine to medium SAND, trace silt.	
54.2 5	SS	S-3	24	1 2 2 2	17	4			Moist, very loose to loose, brown, fine to medium SAND, trace silt.	
	SS	S-4	24	2 2 2 3	21	4			Moist, very loose to loose, dark brown, fine to medium SAND, trace silt.	
	SS	S-5	24	2 2 3 2	19	5			Moist, loose, brown, fine to medium SAND, trace silt.	
49.2 10								Sand		Switched to mud rotary at 10 feet below ground surface.
	SS	S-6	24	3 4 5 5	17	9			Wet, loose, gray, fine to medium SAND, little clay & silt.	
44.2 15										
	SS	S-7	24	6 4 5 7	8	9			Wet, loose, light gray, fine to medium SAND, little clay & silt.	
39.2										

**Sample Types**

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

**Consistency vs Blowcount/Foot**

**Granular (Sand):**  
V. Loose: 0-4    Dense: 30-50  
Loose: 4-10    V. Dense: >50  
M. Dense: 10-30

**Fine Grained (Clay):**  
V. Soft: <2    Stiff: 8-15  
Soft: 2-4    V. Stiff: 15-30  
M. Stiff: 4-8    Hard: >30

**Burmister Classification**

and 35-50%  
some 20-35%  
little 10-20%  
trace <10%  
moisture, density, color

**Reviewed by:** J. Briand, P.E.











**Date:** 6/19/2019

**Boring Number:** B-205



**Boring Number:  
B-205**

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
39.2 20										
	SS	S-8	24	7 6 7 9	10	13			Wet, medium dense, light gray, fine to coarse SAND, trace silt.	
34.2 25										
	SS	S-9	24	5 9 5 9	12	14			Wet, medium dense, gray, fine to coarse SAND, little silt.	
29.2 30										
	SS	S-10	24	6 5 13 18	15	18			Wet, medium dense, very light gray, fine to coarse SAND, little silt.	
24.2 35										
	SS	S-11	24	11 14 11 11	14	25			Wet, medium dense, very light gray, fine to coarse SAND, little silt.	
19.2 40										
	SS	S-12	24	6 9 12 16	14	21			Wet, medium dense, very light gray, fine to coarse SAND, little silt.	
14.2 45										

3BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-205**

**Boring Number:  
B-205**

**Client:** Brunswick County NC  
**Project Location:**Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

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# Boring Number: B-206

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** F&R, Inc. / Shawn Davis

**Surface Elevation (ft.):** 49.4

**Drilling Method/Casing/Core Barrel Size:** 3 1/4 HSA & Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 50

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.3123337, W 78.0933320

Depth	Date	Time
NR	NR	NR

**Drilling Date: Start:** 1/30/2019 **End:** 1/30/2019

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
49.4 0	SS	S-1	24	1 2 1 2	13	3		Fill	Moist, very loose, gray, fine to medium SAND, trace silt.	PP = pocket penetrometer TSF = tons per square foot
	SS	S-2	24	2 8 5 5	19	13			Moist, medium dense, gray, fine to medium SAND, little silt & clay.	
44.4 5	SS	S-3	24	3 3 5 5	20	8		Clay	Moist, stiff, gray, Silty CLAY and fine to medium SAND.	PP = 3.0 TSF
	SS	S-4	24	4 4 6 4	20	10			Moist, stiff, gray, Silty CLAY and fine to medium SAND.	PP = 2.0 TSF
	SS	S-5	24	2 1 4 12	20	5			Top 14": Moist, medium stiff, gray, Silty CLAY and fine to medium SAND.	
39.4 10								Sand	Bottom 6": Wet, loose, very light gray, fine to coarse SAND, little silt.	Switch to mud rotary at 10 feet below ground surface.
	SS	S-6	24	10 13 19 18	18	32			Wet, dense, very light gray, fine to coarse SAND, little silt.	
34.4 15										
	SS	S-7	24	8 12 12 9	16	24			Wet, medium dense, very light gray, fine to coarse SAND, trace silt.	
29.4										

Sample Types			Consistency vs Blowcount/Foot			Burmister Classification	
AS - Auger/Grab Sample	HP - Hydro Punch		Granular (Sand):			Fine Grained (Clay):	
CS - California Sampler	SS - Split Spoon		V. Loose: 0-4	Dense: 30-50		V. Soft: <2	Stiff: 8-15
BQ - 1.5" Rock Core	ST - Shelby Tube		Loose: 4-10	V. Dense: >50		Soft: 2-4	V. Stiff: 15-30
NQ - 2" Rock Core	WS - Wash Sample		M. Dense: 10-30			M. Stiff: 4-8	Hard: >30
	GP - Geoprobe						
						and 35-50% some 20-35% little 10-20% trace <10% moisture, density, color	

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-206





# Boring Number: B-206

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
29.4 20										
	SS	S-8	24	6 12 15 15	17	27			Wet, medium dense, very light gray, fine to coarse SAND, trace silt.	
24.4 25										
	SS	S-9	24	10 11 15 15	12	26			Wet, medium dense, very light gray, fine to coarse SAND, trace silt.	
19.4 30										
	SS	S-10	24	5 9 11 13	14	20			Wet, medium dense, very light gray, fine to coarse SAND, trace silt.	
14.4 35										
	SS	S-11	24	2 2 4 7	18	6			Wet, loose, gray, fine to coarse SAND, some clayey silt, trace fine gravel.	
9.4 40										
	SS	S-12	24	7 13 18 21	20	31			Wet, dense, dark gray, fine SAND, some clayey silt.	Cemented layer at 41.3 to 42.0 feet below ground surface.
4.4 45										

BL BRUNSWICK WTP.GPJ - 7/10/19

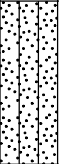
**Boring Number: B-206**



# Boring Number: B-206

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
-0.6 50	SS	S-13	24	6 8 12 17	22	20		Silty Sand	Wet, medium dense, dark gray, fine SAND, some clayey silt.	
-5.6 55									Test boring terminated at 50 feet below ground surface.	
-10.6 60										
-15.6 65										
-20.6 70										

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-206**



# Boring Number: B-207

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** F&R, Inc. / Shawn Davis

**Surface Elevation (ft.):** 52.1

**Drilling Method/Casing/Core Barrel Size:** 3 1/4 HSA & Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 30

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.3121618, W 78.0902429

Depth	Date	Time
NR	NR	NR

**Drilling Date: Start:** 1/31/2019 **End:** 1/31/2019

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
52.1 0	SS	S-1	24	1 2 2 3	12	4		Fill	4" Topsoil. Moist, loose, gray, slightly Organic fine to medium SAND, trace silt.	WOH = weight of hammer Trace organics.
	SS	S-2	24	2 4 6 4	20	10			Moist, loose, dark brown, fine to medium SAND, trace silt.	
47.1 5	SS	S-3	24	1 1 2 WOH	24	1			Wet, very loose, grayish brown, fine to medium SAND and SILT & CLAY.	Switched to mud rotary at 10 feet below ground surface.
	SS	S-4	24	1 2 4 5	19	6			Wet, loose, gray, fine to medium SAND and SILT & CLAY.	
	SS	S-5	24	2 3 4 8	21	7			Wet, loose, grayish brown, fine to medium SAND and SILT & CLAY.	
42.1 10										
	SS	S-6	24	9 13 14 16	18	27		Sand	Wet, medium dense, very light gray, fine to medium SAND, trace silt.	
37.1 15										
	SS	S-7	24	6 9 9 11	13	18			Wet, medium dense, very light gray, fine to medium SAND, trace silt.	
32.1										

## Sample Types

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

## Consistency vs Blowcount/Foot

**Granular (Sand):**  
V. Loose: 0-4 Dense: 30-50  
Loose: 4-10 V. Dense: >50  
M. Dense: 10-30

**Fine Grained (Clay):**  
V. Soft: <2 Stiff: 8-15  
Soft: 2-4 V. Stiff: 15-30  
M. Stiff: 4-8 Hard: >30

## Burmister Classification

and 35-50%  
some 20-35%  
little 10-20%  
trace <10%  
moisture, density, color

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-207



# Boring Number: B-207

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
32.1 20								Sand	Wet, medium dense, very light gray, fine to medium SAND, trace silt.	
	SS	S-8	24	5 8 10 11	16	18				
27.1 25										
	SS	S-9	24	7 7 8 9	16	15				
22.1 30									Test boring terminated at 30 feet below ground surface.	
17.1 35										
12.1 40										
7.1 45										



# Boring Number: B-208

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** F&R, Inc. / Shawn Davis

**Surface Elevation (ft.):** 51.0

**Drilling Method/Casing/Core Barrel Size:** 3 1/4 HSA & Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 30

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.3124165, W 78.0899723

Depth	Date	Time
NR	NR	NR

**Drilling Date: Start:** 1/31/2019 **End:** 1/31/2019

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
51.0 0	SS	S-1	24	3 4 5 6	16	9		Fill	8" Road Subbase. Moist, loose, black, fine to medium SAND, trace silt.	
	SS	S-2	24	2 2 2 2	24	4			Moist, very loose, brown, fine to medium SAND, trace silt.	
46.0 5	SS	S-3	24	2 2 2 2	24	4			Wet, very loose, grayish brown, fine to medium SAND, some clay & silt.	
	SS	S-4	24	1 1 2 2	24	3			Wet, very loose, grayish brown, fine to medium SAND and CLAY & SILT.	
	SS	S-5	24	2 5 7 11	17	12		Sand	Wet, medium dense, grayish brown, fine to coarse SAND, little silt.	
41.0 10										Switched to mud rotary at 10 feet below ground surface.
	SS	S-6	24	9 12 11 7	11	23			Wet, medium dense, very light gray, fine to coarse SAND, trace silt.	
36.0 15										
	SS	S-7	24	3 8 9 9	18	17			Wet, medium dense, very light gray, fine to coarse SAND, trace silt.	
31.0										

**Sample Types**

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

**Consistency vs Blowcount/Foot**

Granular (Sand):			
V. Loose:	0-4	Dense:	30-50
Loose:	4-10	V. Dense:	>50
M. Dense:	10-30		

Fine Grained (Clay):			
V. Soft:	<2	Stiff:	8-15
Soft:	2-4	V. Stiff:	15-30
M. Stiff:	4-8	Hard:	>30

**Burmister Classification**

and	35-50%
some	20-35%
little	10-20%
trace	<10%
moisture, density, color	

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-208



# Boring Number: B-208

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
31.0 20								Sand	Wet, medium dense, very light gray, fine to coarse SAND, trace silt.	
	SS	S-8	24	11 11 14 14	17	25				
26.0 25										
	SS	S-9	24	7 7 9 10	16	16				
21.0 30									Test boring terminated at 30 feet below ground surface.	
16.0 35										
11.0 40										
6.0 45										



# Boring Number: B-209

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** F&R, Inc. / Shawn Davis

**Surface Elevation (ft.):** 29.7

**Drilling Method/Casing/Core Barrel Size:** 3 1/4 HSA & Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 28.8

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.3257218, W 78.0803583

**Depth**      **Date**      **Time**  
NR              NR              NR

**Drilling Date: Start:** 1/31/2019 **End:** 1/31/2019

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
29.7										
0	SS	S-1	24	1 2 3 5	4	5		Fill	Moist, loose, dark gray, fine to medium SAND, some silt & clay.	WOH = weight of hammer
	SS	S-2	24	4 3 4 2	3	7			Moist, loose, very dark brown, fine to medium SAND, trace silt.	
24.7	SS	S-3	24	1 1 1	3	2			Moist, very loose, brown, fine to medium SAND, trace silt.	
5	SS	S-4	24	1 1 WOH WOH	13	1			Wet, very loose, gray, fine to coarse SAND, trace silt.	
	SS	S-5	24	WOH 1 1 WOH	19	2		Sand	Wet, very loose, black, Organic fine to medium SAND, trace silt & clay.	Trace roots.
19.7										
10										
	SS	S-6	24	3 4 1 1	10	5		Silty Sand	Wet, loose, reddish yellow, fine to coarse SAND, little silt.	
14.7										
15										
	SS	S-7	24	14 17 20 16	24	37			Wet, dense, dark gray, fine SAND, some clayey silt.	
9.7										

Sample Types			Consistency vs Blowcount/Foot				Burmister Classification	
AS - Auger/Grab Sample	HP - Hydro Punch		Granular (Sand):		Fine Grained (Clay):		and	35-50%
CS - California Sampler	SS - Split Spoon		V. Loose: 0-4	Dense: 30-50	V. Soft: <2	Stiff: 8-15	some	20-35%
BQ - 1.5" Rock Core	ST - Shelby Tube		Loose: 4-10	V. Dense: >50	Soft: 2-4	V. Stiff: 15-30	little	10-20%
NQ - 2" Rock Core	WS - Wash Sample		M. Dense: 10-30		M. Stiff: 4-8	Hard: >30	trace	<10%
	GP - Geoprobe						moisture, density, color	

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-209



# Boring Number: B-209

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
9.7 20										
	SS	S-8	24	4 8 18 21	24	26		Silty Sand	Wet, medium dense, dark gray, fine SAND, some clayey silt.	
4.7 25										
	SS	S-9	9	44 50/3"	8	>50			Wet, very dense, dark gray, fine SAND, some clayey silt. Test boring terminated at 28.8 feet below ground surface.	Cemented layer at 28.8 feet below ground surface.
-0.3 30										
-5.3 35										
-10.3 40										
-15.3 45										





# Boring Number: B-210

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** F&R, Inc. / Shawn Davis

**Surface Elevation (ft.):** 29.0

**Drilling Method/Casing/Core Barrel Size:** 3 1/4 HSA & Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 30

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.32588056, W 78.08021389

Depth	Date	Time
NR	NR	NR

**Drilling Date: Start:** 1/31/2019 **End:** 1/31/2019

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
29.0 0	SS	S-1	24	1 2 2 1	17	4		Fill	4" Topsoil. Moist, very loose, brown, fine to medium SAND, trace silt, trace fine gravel.	WOH = weight of hammer
	SS	S-2	24	2 1 1 1	24	2			Moist, very loose, brown, fine to medium SAND, little silt.	
24.0 5	SS	S-3	24	1 1 WOH WOH	18	1			Wet, very loose, brown, slightly Organic fine to coarse SAND, little silt & clay.	Trace roots.
	SS	S-4	24	1 WOH WOH 1	0	0			No recovery.	
	SS	S-5	24	1 1 WOH WOH	20	1			Wet, very loose, grayish brown, slightly Organic fine to coarse SAND, little silt & clay.	Trace roots.
19.0 10										Switched to mud rotary at 10 feet below ground surface.
	SS	S-6	24	4 3 2 1	10	5		Sand	Wet, loose, reddish yellow, fine to coarse SAND, little silt.	
14.0 15										
	SS	S-7	24	WOH 1 1 1	17	2		Silty Sand	Wet, very loose, dark gray, fine SAND, some clayey silt.	
9.0										

Sample Types			Consistency vs Blowcount/Foot				Burmister Classification	
AS - Auger/Grab Sample	HP - Hydro Punch		Granular (Sand):		Fine Grained (Clay):		and	35-50%
CS - California Sampler	SS - Split Spoon		V. Loose:	0-4	Dense:	30-50	some	20-35%
BQ - 1.5" Rock Core	ST - Shelby Tube		Loose:	4-10	V. Dense:	>50	little	10-20%
NQ - 2" Rock Core	WS - Wash Sample		M. Dense:	10-30			trace	<10%
	GP - Geoprobe						moisture, density, color	

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-210



# Boring Number: B-210

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
9.0 20										
	SS	S-8	24	11 15 13 13	21	28		Silty Sand	Wet, medium dense, dark gray, fine SAND, some clayey silt.	
4.0 25										
	SS	S-9	24	11 14 24 31	24	38			Wet, dense, dark gray, fine SAND, some clayey silt.	
-1.0 30									Test boring terminated at 30 feet below ground surface.	
-6.0 35										
-11.0 40										
-16.0 45										



# Boring Number: B-211

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** Bridger Drilling Enterprises, Inc / Mike Radford

**Surface Elevation (ft.):** 46.1

**Drilling Method/Casing/Core Barrel Size:** Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 30

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.31308056, W 78.10609444




**Depth Date Time**

**Drilling Date: Start:** 3/28/2019 **End:** 3/28/2019

8.3 3/28/2019 12:15

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** J. Briand

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks	
46.1 0	SS	S-1	24	1 1 1 2	20	2		Fill	Moist, very loose, gray, slightly Organic fine to medium SAND, little silt.	WOH = weight of hammer  Trace roots.	
	SS	S-2	24	2 1 2 2	24	3			Moist, very loose, light brown mottled with brown, fine to medium SAND, little silt.		
41.1 5	SS	S-3	24	WOH 1 1 1	20	2			Clay	Top 6": Moist, soft, light gray, Silty CLAY, trace fine sand. Bottom 14": Moist, very loose, light brown, fine to medium SAND, little silt.	
	SS	S-4	24	1 3 4 5	24	7	Moist, medium stiff, light gray, Silty CLAY, little fine sand.				
▼	SS	S-5	24	5 9 10 14	18	19			Sand	Top 6": Moist, very stiff, light gray, Silty CLAY, little fine sand. Bottom 12": Wet, medium dense, light brown, fine to medium SAND, trace silt.	
36.1 10											
	SS	S-6	24	7 9 11 16	16	20		Top 12": Wet, medium dense, white, fine to coarse SAND, trace silt. Bottom 8": Wet, medium dense, light brown, fine to coarse SAND, trace silt.			
31.1 15											
	SS	S-7	24	6 5 5 6	18	10		Wet, medium dense, white, fine to coarse SAND, trace silt.			
26.1											

## Sample Types

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

## Consistency vs Blowcount/Foot

**Granular (Sand):**  
V. Loose: 0-4 Dense: 30-50  
Loose: 4-10 V. Dense: >50  
M. Dense: 10-30

**Fine Grained (Clay):**  
V. Soft: <2 Stiff: 8-15  
Soft: 2-4 V. Stiff: 15-30  
M. Stiff: 4-8 Hard: >30

## Burmister Classification

and 35-50%  
some 20-35%  
little 10-20%  
trace <10%  
moisture, density, color

**Reviewed by:** D. Neamtu, P.E.

**Date:** 6/19/2019


**Boring Number:** B-211



# Boring Number: B-211

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
26.1 20								Sand		
	SS	S-8	24	7 10 12 12	13	22			Wet, medium dense, white, fine to coarse SAND, trace silt, trace fine gravel.	
21.1 25										
	SS	S-9	24	9 12 9 10	15	21			Wet, medium dense, white, fine to coarse SAND, trace silt.	
16.1 30									Test boring terminated at 30 feet below ground surface.	
11.1 35										
6.1 40										
1.1 45										



# Boring Number: B-212

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** Bridger Drilling Enterprises, Inc / Mike Radford

**Surface Elevation (ft.):** 50.3

**Drilling Method/Casing/Core Barrel Size:** Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 30

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.31326111, W 78.10558889

**Depth Date Time**

**Drilling Date: Start:** 3/27/2019 **End:** 3/27/2019

8 3/27/2019 NR

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** J. McMahon

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
50.3 0	SS	S-1	24	1 1 1 1	18	2		Fill	Moist, very loose, gray, slightly Organic fine to medium SAND, little silt & clay.	NR = not recorded Trace roots.
	SS	S-2	24	1 1 1 1	12	2			Moist, very loose, light brown, fine to medium SAND, trace silt & clay.	
45.3 5	SS	S-3	24	1 2 5	12	3			Moist, very loose, light reddish brown, fine SAND, trace silt & clay.	
	SS	S-4	24	5 4 4 5	12	8		Clay	Wet, stiff, light gray, Silty CLAY and fine to medium SAND.	Rig chatter at 11 feet below ground surface.
▼	SS	S-5	24	2 5 8 11	24	13			Wet, stiff, light gray, Silty CLAY, trace fine to medium sand.	
40.3 10										
	SS	S-6	24	8 10 10 10	18	20		Sand	Top 6": Wet, very stiff, light gray, Silty CLAY, trace fine to medium sand. Bottom 14": Wet, medium dense, white, fine to medium SAND, trace silt.	Rig chatter at 16 feet below ground surface.
35.3 15										
	SS	S-7	24	10 15 20 22	12	35			Wet, dense, light brown, fine to medium SAND, trace silt.	
30.3										

**Sample Types****Consistency vs Blowcount/Foot****Burmister Classification**

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

**Granular (Sand):**

V. Loose: 0-4 Dense: 30-50  
Loose: 4-10 V. Dense: >50  
M. Dense: 10-30

**Fine Grained (Clay):**

V. Soft: <2 Stiff: 8-15  
Soft: 2-4 V. Stiff: 15-30  
M. Stiff: 4-8 Hard: >30

and 35-50%  
some 20-35%  
little 10-20%  
trace <10%  
moisture, density, color

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-212



# Boring Number: B-212

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
30.3 20								Sand	Wet, medium dense, white, fine to medium SAND, trace silt.	
	SS	S-8	24	3 6 12 10	18	18				
25.3 25										
	SS	S-9	24	1 2 2 2	6	4				
20.3 30									Test boring terminated at 30 feet below ground surface.	
15.3 35										
10.3 40										
5.3 45										



# Boring Number: B-213

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** Bridger Drilling Enterprises, Inc / Mike Radford

**Surface Elevation (ft.):** 42.7

**Drilling Method/Casing/Core Barrel Size:** Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 75

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.33391389, W 78.07419444

**Depth Date Time**

**Drilling Date: Start:** 3/27/2019 **End:** 3/27/2019

8 3/27/2019 NR

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** J. McMahon

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
42.7 0	SS	S-1	24	1 2 4 3	24	6		Sand	Top 12": Moist, medium stiff, gray, SILT & CLAY and fine to medium SAND.	WOH = weight of hammer
	SS	S-2	24	2 1 2 3	18	3			Bottom 12": Moist, loose, light brown, fine to medium SAND, trace silt & clay. Moist, very loose, light reddish brown, fine to medium SAND, trace silt.	
37.7 5	SS	S-3	24	WOH 1 1 2	12	2			Moist, very loose, brown, fine to coarse SAND, trace silt.	
	SS	S-4	24	2 2 2 3	12	4			Moist, very loose, reddish brown, fine to coarse SAND, trace silt.	
▼	SS	S-5	24	2 5 6 9	18	11			Wet, medium dense, light reddish brown, fine to coarse SAND, trace silt.	
32.7 10										
	SS	S-6	24	8 10 6 6	12	16			Wet, medium dense, light brown, fine to coarse SAND, trace silt.	
27.7 15								Sand		
	SS	S-7	24	7 8 10 12	18	18			Wet, medium dense, light brown, fine to coarse SAND, trace silt.	
22.7										

Sample Types				Consistency vs Blowcount/Foot				Burmister Classification	
AS - Auger/Grab Sample	HP - Hydro Punch			Granular (Sand):		Fine Grained (Clay):		and	35-50%
CS - California Sampler	SS - Split Spoon			V. Loose: 0-4	Dense: 30-50	V. Soft: <2	Stiff: 8-15	some	20-35%
BQ - 1.5" Rock Core	ST - Shelby Tube			Loose: 4-10	V. Dense: >50	Soft: 2-4	V. Stiff: 15-30	little	10-20%
NQ - 2" Rock Core	WS - Wash Sample			M. Dense: 10-30		M. Stiff: 4-8	Hard: >30	trace	<10%
	GP - Geoprobe							moisture, density, color	

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-213

## Boring Number: B-213

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
22.7 20								Sand		
	SS	S-8	24	1 WOH WOH 1	24	0			Top 6": Wet, very loose, dark reddish brown, fine to coarse SAND, trace silt. Bottom 18": Wet, very loose, dark gray, fine SAND, some clayey silt, trace gravel.	Trace shell fragments.
17.7 25								Silty Sand		
	SS	S-9	24	5 6 10 15	24	16			Wet, medium dense, dark gray, fine SAND, some clayey silt.	
12.7 30										
	SS	S-10	24	4 7 10 20	24	17			Wet, medium dense, dark gray, fine SAND, some clayey silt.	Cemented layer at 32.0 to 33.0 feet below ground surface.
7.7 35										
	SS	S-11	24	10 18 32 50	24	50			Wet, dense, dark gray, fine SAND, some clayey silt.	
2.7 40										
	SS	S-12	24	7 24 26 45	24	50			Wet, dense, dark gray, fine SAND, some clayey silt.	Cemented layer at 42.0 to 43.0 feet below ground surface.
-2.3 45										

BL BRUNSWICK WTP.GPJ - 7/10/19





# Boring Number: B-213

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
-7.3 50	SS	S-13	24	11 15 15 23	24	30		Silty Sand	Wet, dense, dark gray, fine SAND, some clayey silt.	Trace shell fragments.
-12.3 55	SS	S-14	24	3 3 4 8	24	7			Wet, loose, dark gray, fine SAND, some clayey silt.	Cemented layer at 52.0 to 53.0 feet below ground surface.
-17.3 60	SS	S-15	11	11 50/5"	11	>50			Wet, hard, dark gray, Clayey SILT and fine SAND.	
-22.3 65	SS	S-16	24	3 3 3 7	24	6			Wet, medium stiff, dark gray, Clayey SILT and fine SAND.	
-27.3 70	SS	S-17	24	3 3 4 13	24	7			Wet, medium stiff, dark gray, Clayey SILT and fine SAND.	
	SS	S-18	24	20 16	24	26			Wet, very stiff, dark gray, Clayey SILT and fine SAND.	

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-213**



# Boring Number: B-213

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
-32.3 75	SS	S-18	24	10 17	24	26				
-37.3 80										
-42.3 85										
-47.3 90										
-52.3 95										
-57.3 100										
									Boring Number: B-213	



# Boring Number: B-214

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** Bridger Drilling Enterprises, Inc / Mike Radford

**Surface Elevation (ft.):**

**Drilling Method/Casing/Core Barrel Size:** Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 75

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.33546944, W 78.07408056

**Depth Date Time**

**Drilling Date: Start:** 3/27/2019 **End:** 3/27/2019

6 3/27/2019 NR

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** J. McMahon

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks	
0	SS	S-1	24	3 4 4 4	12	8		Sand	Moist, loose, light brown, slightly Organic fine to medium SAND, trace silt.	WOH = weight of hammer  Trace roots.	
	SS	S-2	24	2 2 3 3	12	5			Moist, loose, light brown, slightly Organic fine to medium SAND, trace silt.	Trace roots.	
5	SS	S-3	24	1 3 2 2	18	5			Moist, loose, light brown, slightly Organic fine to medium SAND, little silt.	Trace roots.	
▼	SS	S-4	24	2 2 3 4	12	5			Wet, loose, reddish brown, fine to coarse SAND, trace silt.		
	SS	S-5	24	4 5 5 6	12	10			Wet, loose, reddish brown, fine to coarse SAND, trace silt, trace fine gravel.		
10											
	SS	S-6	24	5 8 12 14	12	20			Wet, medium dense, light brown, fine to medium SAND, little silt.		
15											
	SS	S-7	24	1 1 WOH 3	24	1			Top 6": Wet, very loose, light gray, fine to medium SAND, some silt, trace fine gravel. Bottom 18": Wet, very loose, dark gray, fine SAND, some clayey silt.		

## Sample Types

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

## Consistency vs Blowcount/Foot

**Granular (Sand):**  
V. Loose: 0-4 Dense: 30-50  
Loose: 4-10 V. Dense: >50  
M. Dense: 10-30

**Fine Grained (Clay):**  
V. Soft: <2 Stiff: 8-15  
Soft: 2-4 V. Stiff: 15-30  
M. Stiff: 4-8 Hard: >30

## Burmister Classification

and 35-50%  
some 20-35%  
little 10-20%  
trace <10%  
moisture, density, color

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-214



# Boring Number: B-214

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
20										
	SS	S-8	24	4 4 3 2	24	7			Wet, loose, dark gray, fine SAND, some clayey silt.	
25										Cemented layer at 25.0 to 27.0 feet below ground surface.
	SS	S-9	23	7 20 48 50/5"	23	68			Wet, very dense, dark gray, fine SAND, some clayey silt, little fine gravel.	Trace shell fragments.
30										
	SS	S-10	5	50/5"	4	>50			Wet, very dense, dark gray, fine SAND, some clayey silt.	
35										
	SS	S-11	24	7 5 6 14	24	11			Wet, medium dense, dark gray, fine SAND, some clayey silt.	
40										
	SS	S-12	24	2 2 3 6	24	5			Wet, loose, dark gray, fine SAND, some clayey silt.	
45										

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-214**

## Boring Number: B-214

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
50	SS	S-13	4	50/4"	4	>50			Wet, very dense, dark gray, fine SAND, some clayey silt.	Cemented layer at 47.0 to 48.5 feet below ground surface.
55	SS	S-14	24	3 3 3 6	24	6			Wet, loose, dark gray, fine SAND, some clayey silt.	
60	SS	S-15	24	5 5 8 21	24	13			Wet, stiff, dark gray, SILT & CLAY and fine SAND.	Cemented layer at 56.0 to 57.0 feet below ground surface.
65	SS	S-16	24	3 3 4 7	24	7			Wet, medium stiff, dark gray, SILT & CLAY and fine SAND.	
70	SS	S-17	24	3 5 4 10	24	9			Wet, stiff, dark gray, SILT & CLAY and fine SAND.	
	SS	S-18	24	3 3	24	15			Wet, stiff, dark gray, SILT & CLAY and fine SAND.	

BL BRUNSWICK WTP.GPJ - 7/10/19


**Boring Number: B-214**



# Boring Number: B-214

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
75	SS	S-18	24	12 50	24	15				
80										
85										
90										
95										
100										

BL BRUNSWICK WTP.GPJ - 7/10/19

Boring Number: B-214



# Boring Number: B-215

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** Bridger Drilling Enterprises, Inc / Mike Radford

**Surface Elevation (ft.):** 27.6

**Drilling Method/Casing/Core Barrel Size:** Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 50

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.33681389, W 78.07551389

**Depth Date Time**

**Drilling Date: Start:** 3/26/2019 **End:** 3/26/2019

2 3/26/2019 NR

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** J. McMahon

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
27.6										
0	SS	S-1	24	3 6 6 5	18	12			Moist, medium dense, gray, slightly Organic fine to coarse SAND, little silt.	WOH = weight of hammer
	SS	S-2	24	3 3 3 4	24	6			Wet, loose, brown, slightly Organic fine to coarse SAND, little silt.	Trace roots.
	SS	S-3	24	3 6 8 3	12	14			Wet, medium dense, brown, fine to medium SAND, trace silt.	Trace roots.
22.6	SS	S-4	24	1 1 1 2	12	2			Wet, very loose, light brown, fine to coarse SAND, little silt.	
5	SS	S-5	24	1 WOH WOH 3	18	0			Wet, very loose, dark gray, fine SAND, little silt.	
17.6										
10										
	SS	S-6	24	20 12 22 15	18	34			Wet, dense, dark gray, fine to medium SAND, some fine gravel, trace silt.	
12.6										
15										
	SS	S-7	24	5 7 11 16	24	18			Top 12": Wet, medium dense, dark gray, fine to medium SAND, little fine gravel, trace silt.	
7.6									Bottom 12": Wet, medium dense, dark gray,	

Sample Types			Consistency vs Blowcount/Foot			Burmister Classification	
AS - Auger/Grab Sample	HP - Hydro Punch		Granular (Sand):			Fine Grained (Clay):	
CS - California Sampler	SS - Split Spoon		V. Loose: 0-4	Dense: 30-50		V. Soft: <2	Stiff: 8-15
BQ - 1.5" Rock Core	ST - Shelby Tube		Loose: 4-10	V. Dense: >50		Soft: 2-4	V. Stiff: 15-30
NQ - 2" Rock Core	WS - Wash Sample		M. Dense: 10-30			M. Stiff: 4-8	Hard: >30
	GP - Geoprobe						

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-215



# Boring Number: B-215

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
7.6 20									fine SAND, some clayey silt.	
	SS	S-8	24	3 2 3 5	24	5			Wet, loose, gray, fine SAND, some clayey silt.	
2.6 25										
	SS	S-9	24	2 3 4 7	24	7			Wet, loose, gray, fine SAND, some clayey silt.	
-2.4 30										
	SS	S-10	24	3 3 5 32	24	8		Silty Sand	Wet, loose, gray, fine SAND, some clayey silt.	
-7.4 35										
	SS	S-11	24	3 3 4 7	24	7			Wet, loose, gray, fine SAND, some clayey silt	
-12.4 40										
	SS	S-12	24	3 4 15 40	24	19			Wet, very stiff, dark gray, Clayey SILT and fine SAND.	
-17.4 45										

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-215**





# Boring Number: B-215

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
-22.4 50	SS	S-13	24	4 4 6 10	24	10		Silty Sand	Wet, stiff, dark gray, Clayey SILT and fine SAND.	
-27.4 55									Test boring terminated at 50 feet below ground surface.	
-32.4 60										
-37.4 65										
-42.4 70										



# Boring Number: B-216

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** Bridger Drilling Enterprises, Inc / Mike Radford

**Surface Elevation (ft.):** 28.0

**Drilling Method/Casing/Core Barrel Size:** Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 75

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.33746111, W 78.07523056

**Depth Date Time**

**Drilling Date: Start:** 3/26/2019 **End:** 3/26/2019

8 3/26/2019 NR

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** J. McMahon

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
28.0 0	SS	S-1	24	1 1 2 2	18	3		Sand	Moist, very loose, light brown, fine to medium SAND, trace silt.	
	SS	S-2	24	2 2 2 3	12	4			Moist, very loose, light brown, fine to medium SAND, trace silt.	
23.0 5	SS	S-3	24	1 2 3 4	18	5			Moist, loose, light brown, fine to coarse SAND, trace silt.	
	SS	S-4	24	3 3 5 5	18	8			Moist, loose, reddish brown, fine to medium SAND, little silt, trace fine gravel.	
▼	SS	S-5	24	1 1 2 2	18	3			Wet, very loose, reddish brown, fine SAND, little silt.	
18.0 10								Silty Sand		
	SS	S-6	18	1 1 3	18	4			Wet, loose, dark gray, fine SAND, some clayey silt.	Cemented layer at 15.0 to 16.0 feet below ground surface.
13.0 15										
	SS	S-7	24	13 10 6 6	24	16			Wet, medium dense, dark gray, fine SAND, some clayey silt.	
8.0										

**Sample Types****Consistency vs Blowcount/Foot****Burmister Classification**

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

**Granular (Sand):**

V. Loose: 0-4 Dense: 30-50  
Loose: 4-10 V. Dense: >50  
M. Dense: 10-30

**Fine Grained (Clay):**

V. Soft: <2 Stiff: 8-15  
Soft: 2-4 V. Stiff: 15-30  
M. Stiff: 4-8 Hard: >30

and 35-50%  
some 20-35%  
little 10-20%  
trace <10%  
moisture, density, color

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-216



# Boring Number: B-216

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
8.0 20										
	SS	S-8	24	2 3 3 3	24	6			Wet, loose, dark gray, fine SAND, some clayey silt.	
3.0 25										
	SS	S-9	24	3 4 4 9	24	8			Wet, loose, dark gray, fine SAND, some clayey silt.	
-2.0 30										
	SS	S-10	24	4 6 8 18	24	14		Silty Sand	Wet, medium dense, dark gray, fine SAND and Clayey SILT.	
-7.0 35										
	SS	S-11	24	4 4 4 13	24	8			Wet, loose, dark gray, fine SAND and Clayey SILT.	
-12.0 40										
	SS	S-12	24	5 5 6 9	24	11			Wet, medium dense, dark gray, fine SAND and Clayey SILT.	
-17.0 45										

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-216**



# Boring Number: B-216

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
-22.0 50	SS	S-13	24	3 4 5 8	24	9		Silty Sand	Wet, loose, dark gray, fine SAND and Clayey SILT.	Cemented layer at 51.0 to 52.0 feet below ground surface.
-27.0 55	SS	S-14	24	4 4 5 8	24	9			Wet, loose, dark gray, fine SAND and Clayey SILT.	
-32.0 60	SS	S-15	24	4 5 4 8	24	9			Wet, loose, dark gray, fine SAND and Clayey SILT.	
-37.0 65	SS	S-16	24	3 4 5 7	24	9			Wet, loose, dark gray, fine SAND and Clayey SILT.	
-42.0 70	SS	S-17	24	4 4 5 9	24	9			Wet, loose, dark gray, fine SAND and Clayey SILT.	
	SS	S-18	24	4 4	24	10			Wet, loose, dark gray, fine SAND and Clayey SILT.	

BL BRUNSWICK WTP.GPJ - 7/10/19


**Boring Number: B-216**



# Boring Number: B-216

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
-47.0 75	SS	S-18	24	6 10	24	10				
-52.0 80										
-57.0 85										
-62.0 90										
-67.0 95										
-72.0 100										
									Boring Number: B-216	

Test boring terminated at 75 feet below  
ground surface.

**Boring Number:  
B-315**

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:**Bridger Drilling Enterprises, Inc / Mike Radford

**Surface Elevation (ft.):**47.6

**Drilling Method/Casing/Core Barrel Size:** Mud Rotary / 3 1/4 in /

**Total Depth (ft.): 15**

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.31036111, W 78.10706111

Depth	Date	Time
-------	------	------

**Drilling Date: Start: 3/28/2019 End: 3/28/2019**

13 3/28/2019 1140

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** J. Briand

[illegible]

Sample Types		Consistency vs Blowcount/Foot				Burmister Classification	
AS - Auger/Grab Sample	HP - Hydro Punch	Granular (Sand):		Fine Grained (Clay):		and	35-50%
CS - California Sampler	SS - Split Spoon	V. Loose:	0-4 Dense:	30-50	V. Soft:	<2 Stiff:	8-15
BQ - 1.5" Rock Core	ST - Shelby Tube	Loose:	4-10 V. Dense:	>50	Soft:	2-4 V. Stiff:	15-30
NQ - 2" Rock Core	WS - Wash Sample	M. Dense:	10-30		M. Stiff:	4-8 Hard:	>30
	GP - Geoprobe						moisture, density, color

Reviewed by: D. Neamtu, P.E.

Date: 6/19/2019

**Boring Number: B-315**



# Boring Number: B-316

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** Bridger Drilling Enterprises, Inc / Mike Radford

**Surface Elevation (ft.):** 46.7

**Drilling Method/Casing/Core Barrel Size:** Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 15

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.31312778, W 78.10316944

**Depth Date Time**

**Drilling Date: Start:** 3/27/2019 **End:** 3/27/2019

6 3/27/2019 NR

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** J. McMahon

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
46.7 0	SS	S-1	24	3 5 6 7	18	11		Fill	Moist, medium dense, dark brown, slightly Organic fine SAND, some silt.	Trace organics.
	SS	S-2	24	6 4 4 5	12	8			Moist, loose, light brown, fine to medium SAND, some silt.	
41.7 5	SS	S-3	24	2 2 4 3	24	6		Sand	Moist, loose, reddish brown, fine to medium SAND, little silt.	
	SS	S-4	24	3 6 6 8	18	12			Wet, medium dense, reddish brown, fine to medium SAND, little silt.	
	SS	S-5	24	4 5 7 10	18	12			Wet, medium dense, light reddish brown, fine to medium SAND, little silt.	
36.7 10										
	SS	S-6	24	9 13 15 17	18	28			Wet, medium dense, white, fine to coarse SAND, little silt.	
31.7 15									Test boring terminated at 15 feet below ground surface.	
26.7										

Sample Types		Consistency vs Blowcount/Foot				Burmister Classification	
AS - Auger/Grab Sample	HP - Hydro Punch	Granular (Sand):		Fine Grained (Clay):		and	35-50%
CS - California Sampler	SS - Split Spoon	V. Loose: 0-4	Dense: 30-50	V. Soft: <2	Stiff: 8-15	some	20-35%
BQ - 1.5" Rock Core	ST - Shelby Tube	Loose: 4-10	V. Dense: >50	Soft: 2-4	V. Stiff: 15-30	little	10-20%
NQ - 2" Rock Core	WS - Wash Sample	M. Dense: 10-30		M. Stiff: 4-8	Hard: >30	trace	<10%
	GP - Geoprobe					moisture, density, color	

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-316



# Boring Number: B-318

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** Bridger Drilling Enterprises, Inc / Mike Radford

**Surface Elevation (ft.):** 50.6

**Drilling Method/Casing/Core Barrel Size:** Mud Rotary / 3 1/4 in /

**Total Depth (ft.):** 15

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.31270278, W 78.09656111

**Depth Date Time**

**Drilling Date: Start:** 3/27/2019 **End:** 3/27/2019

6 3/27/2019 NR

**Abandonment Method:** Backfill with bentonite pellets

**Logged By:** J. McMahon

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
50.6 0	SS	S-1	24	1 2 1 2	18	3		Fill	Moist, very loose, brown, fine SAND, some silt.	
	SS	S-2	24	1 1 2 2	12	3			Moist, very loose, light brown, fine SAND, some silt.	
45.6 5	SS	S-3	24	1 2 2 3	12	4		Clay	Moist, medium stiff, brown, Silty CLAY, some fine to medium sand.	
	SS	S-4	24	2 2 3 4	18	5			Wet, medium stiff, gray, Silty CLAY and fine to medium SAND.	
	SS	S-5	24	1 2 1 2	18	3			Wet, soft, gray, Silty CLAY and fine to medium SAND.	
40.6 10								Sand		
	SS	S-6	24	5 9 12 12	18	21			Wet, medium dense, light brown, fine to medium SAND, little silt.	
35.6 15									Test boring terminated at 15 feet below ground surface.	
30.6										

**Sample Types****Consistency vs Blowcount/Feet****Burmister Classification**

AS - Auger/Grab Sample  
CS - California Sampler  
BQ - 1.5" Rock Core  
NQ - 2" Rock Core  
HP - Hydro Punch  
SS - Split Spoon  
ST - Shelby Tube  
WS - Wash Sample  
GP - Geoprobe

**Granular (Sand):**

V. Loose: 0-4 Dense: 30-50  
Loose: 4-10 V. Dense: >50  
M. Dense: 10-30

**Fine Grained (Clay):**

V. Soft: <2 Stiff: 8-15  
Soft: 2-4 V. Stiff: 15-30  
M. Stiff: 4-8 Hard: >30

and 35-50%  
some 20-35%  
little 10-20%  
trace <10%  
moisture, density, color

**Reviewed by:** J. Briand, P.E.

**Date:** 6/19/2019

**Boring Number:** B-318





# Boring Number: B-401

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** Mid-Atlantic Drilling, Inc. / Bobby Fowler

**Surface Elevation (ft.):** 0

**Drilling Method/Casing/Core Barrel Size:** Mud Rotary / 3 in /

**Total Depth (ft.):** 75.5

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 & 1.5 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.3379165, W 78.0756048

**Depth Date Time**

**Drilling Date: Start:** 5/20/2019 **End:** 5/20/2019

NR NR NR

**Abandonment Method:** N/A

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
0.0 0									22.4 feet of water above mudline.	NR = not recorded N/A = not applicable
-5.0 5										
-10.0 10								Water		
-15.0 15										
-20.0										

Sample Types			Consistency vs Blowcount/Foot				Burmister Classification	
AS - Auger/Grab Sample	HP - Hydro Punch		Granular (Sand):		Fine Grained (Clay):		and	35-50%
CS - California Sampler	SS - Split Spoon		V. Loose: 0-4	Dense: 30-50	V. Soft: <2	Stiff: 8-15	some	20-35%
BQ - 1.5" Rock Core	ST - Shelby Tube		Loose: 4-10	V. Dense: >50	Soft: 2-4	V. Stiff: 15-30	little	10-20%
NQ - 2" Rock Core	WS - Wash Sample		M. Dense: 10-30		M. Stiff: 4-8	Hard: >30	trace	<10%
	GP - Geoprobe						moisture, density, color	

**Reviewed by:** J. Briand, P. E.


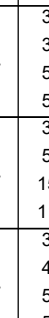

**Date:** 6/19/2019

**Boring Number:** B-401

## Boring Number: B-401

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
-20.0 20								Water		NR = not recorded N/A = not applicable  Test boring conducted in Cape Fear River.
	SS	S-1	24	3 3 5 5	23	8		Sand and Clay	Wet, loose, dark gray, fine SAND and Silty CLAY.	
-25.0 25	SS	S-2	24	3 5 15 11	24	20			Wet, medium dense, dark gray, fine SAND and Silty CLAY.	
	SS	S-3	24	3 4 5 5	24	9			Wet, loose, dark gray, fine SAND and Silty CLAY.	
	SS	S-4	24	3 4 6 6	24	10			Wet, loose, dark gray, fine SAND and Silty CLAY.	
-30.0 30	SS	S-5	24	4 3 5 5	24	8			Wet, loose, dark gray, fine SAND and Silty CLAY.	
-35.0 35										
	SS	S-6	18	4 3 5	18	8			Wet, loose, dark gray, fine SAND and Silty CLAY.	
-40.0 40										
	SS	S-7	18	4 4 5	18	9			Wet, loose, dark gray, fine SAND and Silty CLAY.	
-45.0 45										
	SS	S-8	18	4	18	11			Wet, stiff, dark gray, Silty CLAY and fine	

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-401**



# Boring Number: B-401

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
	SS	S-8	18	5 6	18	11			SAND.	
-50.0 50										
	SS	S-9	18	4 5 6	18	11			Wet, stiff, dark gray, Silty CLAY and fine SAND.	
-55.0 55										
	SS	S-10	18	4 6 9	18	15			Wet, stiff, dark gray, Silty CLAY and fine SAND.	
-60.0 60										
	SS	S-11	18	5 5 7	18	12			Wet, stiff, dark gray, Silty CLAY and fine SAND.	
-65.0 65										
	SS	S-12	18	5 5 7	18	12			Wet, stiff, dark gray, Silty CLAY and fine SAND.	
-70.0 70										
	SS	S-13	18	5 7 9	18	16			Wet, medium dense, dark gray, fine SAND and CLAY & SILT.	

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-401**

## Boring Number: B-401

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
-75.0 75										
	SS	S-14	18	5 6 8	18	14		Sand and Clay	Wet, stiff, dark gray, CLAY & SILT and fine SAND.	
-80.0 80										
	SS	S-15	18	7 10 13	18	23		Marine Clay	Wet, very stiff, dark gray, Silty CLAY, some fine sand.	
-85.0 85										
	SS	S-16	18	6 7 10	18	17			Wet, very stiff, dark gray, CLAY, trace fine sand.	
-90.0 90										
	SS	S-17	18	6 8 9	18	17		Marine Clay	Wet, very stiff, dark gray, CLAY, little fine sand.	
-95.0 95										
	SS	S-18	18	8 9 12	18	21			Wet, very stiff, dark gray, CLAY, little fine sand.	
-100.0 100									Test boring terminated at 75.5 feet below the mudline.	

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-401**



# Boring Number: B-402

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

**Drilling Contractor/Driller:** Mid-Atlantic Drilling, Inc. / Bobby Fowler

**Surface Elevation (ft.):** 0

**Drilling Method/Casing/Core Barrel Size:** Mud Rotary / 3 in /

**Total Depth (ft.):** 74.5

**Hammer Weight/Drop Height/ Spoon Size:** 140 lb / 30 in / 2 & 1.5 in O.D.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:** N 34.3377930, W 78.0749742

**Depth Date Time**

**Drilling Date: Start:** 5/21/2019 **End:** 5/21/2019

NR NR NR

**Abandonment Method:** N/A

**Logged By:** Z. Mickel

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
0.0 0									19.2 feet of water above mudline.	NR = not recorded N/A = not applicable
-5.0 5										
-10.0 10										
-15.0 15										
-20.0	SS	S-1	24	2	20	6			Wet, loose, dark gray, fine SAND and Silty	
<b>Sample Types</b>			<b>Consistency vs Blowcount/Foot</b>				<b>Burmister Classification</b>			
AS - Auger/Grab Sample CS - California Sampler BQ - 1.5" Rock Core NQ - 2" Rock Core			HP - Hydro Punch SS - Split Spoon ST - Shelby Tube WS - Wash Sample GP - Geoprobe				Granular (Sand): V. Loose: 0-4 Dense: 30-50 Loose: 4-10 V. Dense: >50 M. Dense: 10-30			
							Fine Grained (Clay): V. Soft: <2 Stiff: 8-15 Soft: 2-4 V. Stiff: 15-30 M. Stiff: 4-8 Hard: >30			
							and 35-50% some 20-35% little 10-20% trace <10% moisture, density, color			
<b>Reviewed by:</b> J. Briand, P. E.					<b>Date:</b> 6/19/2019			<b>Boring Number:</b> B-402		



# Boring Number: B-402

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
-20.0 20	SS	S-1	24	3 3 4	20	6		Sand and Clay	CLAY.	Trace shells.
	SS	S-2	24	2 4 4 5	24	8			Wet, loose, dark gray, fine SAND and Silty CLAY.	
	SS	S-3	24	2 6 5 5	24	11			Wet, medium dense, dark gray, fine SAND and Silty CLAY.	
-25.0 25	SS	S-4	24	3 3 4 5	24	7			Wet, loose, dark gray, fine SAND and Silty CLAY.	
	SS	S-5	24	4 4 4 6	24	8			Wet, loose, dark gray, fine SAND and Silty CLAY.	
-30.0 30										
	SS	S-6	18	3 4 5	16	9			Wet, loose, dark gray, fine SAND and Silty CLAY.	
-35.0 35										
	SS	S-7	18	3 4 5	18	9			Wet, loose, dark gray, fine SAND and CLAY & SILT.	
-40.0 40										
	SS	S-8	18	4 4 7	18	11			Wet, medium dense, dark gray, fine SAND and CLAY & SILT.	
-45.0 45										

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-402**



# Boring Number: B-402

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
	SS	S-9	18	4 5 5	18	10			Wet, stiff, dark gray, CLAY & SILT and fine SAND.	
-50.0 50										
	SS	S-10	18	4 5 5	18	10			Wet, stiff, dark gray, CLAY & SILT and fine SAND.	
-55.0 55										
	SS	S-11	18	5 5 7	18	12			Wet, stiff, dark gray, CLAY & SILT and fine SAND.	
-60.0 60										
	SS	S-12	18	5 6 8	18	14			Wet, stiff, dark gray, Silty CLAY and fine SAND.	
-65.0 65										
	SS	S-13	18	5 6 8	18	14			Wet, stiff, dark gray, Silty CLAY and fine SAND.	
-70.0 70										
	SS	S-14	18	5 6 8	18	14			Wet, medium dense, dark gary, fine SAND and Silty CLAY.	

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-402**



# Boring Number: B-402

**Client:** Brunswick County NC  
**Project Location:** Leland, NC

**Project Name:** NW WTP Expansion and Upgrades  
**Project Number:** 250459-232662

Elev. Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	Graphic Log	Strata	Material Description	Remarks
-75.0 75										
	SS	S-15	18	5 6 8	18	14		Sand and Clay	Wet, very stiff, dark gary, Silty CLAY and fine SAND.	
-80.0 80										
	SS	S-16	18	7 9 11	18	20			Wet, very stiff, dark gary, CLAY, little fine sand.	
-85.0 85										
	SS	S-17	18	6 7 9	18	16		Marine Clay	Wet, very stiff, dark gary, CLAY, little fine sand.	
-90.0 90										
	SS	S-18	18	7 8 11	18	19			Wet, very stiff, dark gary, CLAY, little fine sand.	
-95.0 95									Test boring terminated at 74.5 feet below the mudline.	
-100.0 100										

BL BRUNSWICK WTP.GPJ - 7/10/19

**Boring Number: B-402**



# Geotechnical Laboratory Test Results





FROEHLING & ROBERTSON

Engineering Stability Since 1881

# ASTM LABORATORY TEST SUMMARY SHEET

Sheet: 1 of 2

Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC

Sample No.	Location	Depth (ft)	Natural Moisture (%)	LL	PL	PI	USCS Class.	% GRAVEL	% SAND	% FINES	Organic Content (%)	-
S-4	B-201	6.0' - 8.0'	9.5					0.0	89.2	10.8		
S-7	B-201	18.0' - 20.0'	21.2				SP	0.0	99.0	1.0		
S-5	B-202	8.0' - 10.0'	71.0	138	39	99						
S-6	B-202	13.0' - 15.0'	61.5					0.0	15.3	84.7		
S-5	B-203	8.0' - 10.0'	18.7	38	22	16	CL	0.0	46.0	54.0		
S-8	B-203	23.0' - 25.0'	19.4					0.0	91.3	8.7		
S-7	B-204	18.0' - 20.0'	19.8				SP	0.0	95.4	4.6		
S-9	B-204	28.0' - 30.0'	23.3				SP	0.0	96.0	4.0		
S-6	B-205	13.0' - 15.0'	16.8					0.0	81.7	18.3		
S-11	B-205	38.0' - 40.0'	18.7									
S-8	B-206	23.0' - 25.0'	16.0									
S-11	B-206	38.0' - 40.0'	34.0					8.3	68.6	23.1		
S-3	B-207	4.0' - 6.0'	16.8	21	15	6	SC-SM	0.0	61.3	38.7		
S-7	B-207	18.0' - 20.0'	20.7					0.0	93.9	6.1		
S-6	B-208	13.0' - 15.0'	23.8					0.0	93.8	6.2		
S-5	B-209	8.0' - 10.0'	53.6					0.0	93.5	6.5	9.3	
S-8	B-209	23.0' - 25.0'	27.2					0.0	68.2	31.8		
S-5	B-210	8.0' - 10.0'	23.4								1.2	
S-6	B-210	13.0' - 15.0'	24.9					0.0	89.5	10.5		
S-6	B-301	13.0' - 15.0'	14.6	25	18	7					1.7	
S-3	B-302	4.0' - 6.0'	16.7					0.0	71.6	28.4		
S-4	B-302	6.0' - 8.0'	14.8					0.0	62.3	37.7		
S-6	B-304	13.0' - 15.0'	22.3	32	21	11	CL	0.0	40.1	59.9		
S-5	B-305	8.0' - 10.0'	15.2					1.2	89.7	9.1		
S-2	B-307	2.0' - 4.0'	5.1				SP	0.0	95.9	4.1		
S-6	B-308	13.0' - 15.0'	26.5				SP	0.0	96.3	3.7	0.4	
S-5	B-309	8.0' - 10.0'	22.8					0.0	91.4	8.6		
S-4	B-311	6.0' - 8.0'	13.5					0.0	92.9	7.1		



**Sheet: 2 of 2**

City/State: Leland, NC

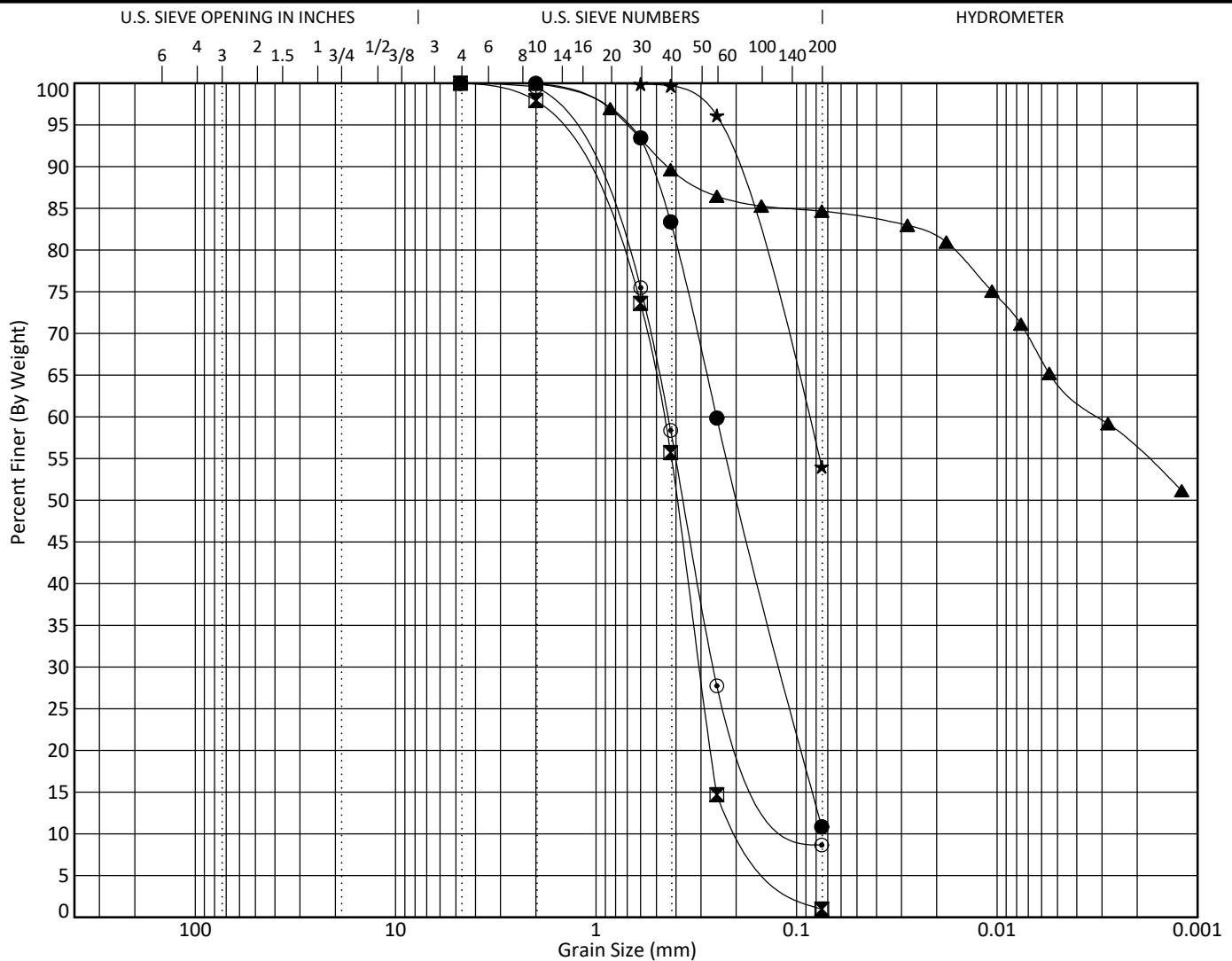


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.      Depth			Classification					LL	PL	PI	Cc	Cu
●	B-201	6.0' - 8.0'	()								0.78	3.41
☒	B-201	18.0' - 20.0'	POORLY GRADED SAND (SP)								1.22	2.79
▲	B-202	13.0' - 15.0'	()									
★	B-203	8.0' - 10.0'	SANDY LEAN CLAY (CL)					38	22	16		
⊙	B-203	23.0' - 25.0'	()								1.88	5.38
	Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
●	B-201	6.0' - 8.0'	4.75	0.251	0.12		0.0	89.2	10.8		9.5	
☒	B-201	18.0' - 20.0'	4.75	0.462	0.305	0.165	0.0	99.0	1.0		21.2	
▲	B-202	13.0' - 15.0'	4.75	0.003			0.0	15.3	20.3	64.4	61.5	
★	B-203	8.0' - 10.0'	2	0.089			0.0	46.0	54.0		18.7	
⊙	B-203	23.0' - 25.0'	4.75	0.439	0.26	0.082	0.0	91.3	8.7		19.4	



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Engineering Stability Since 1881

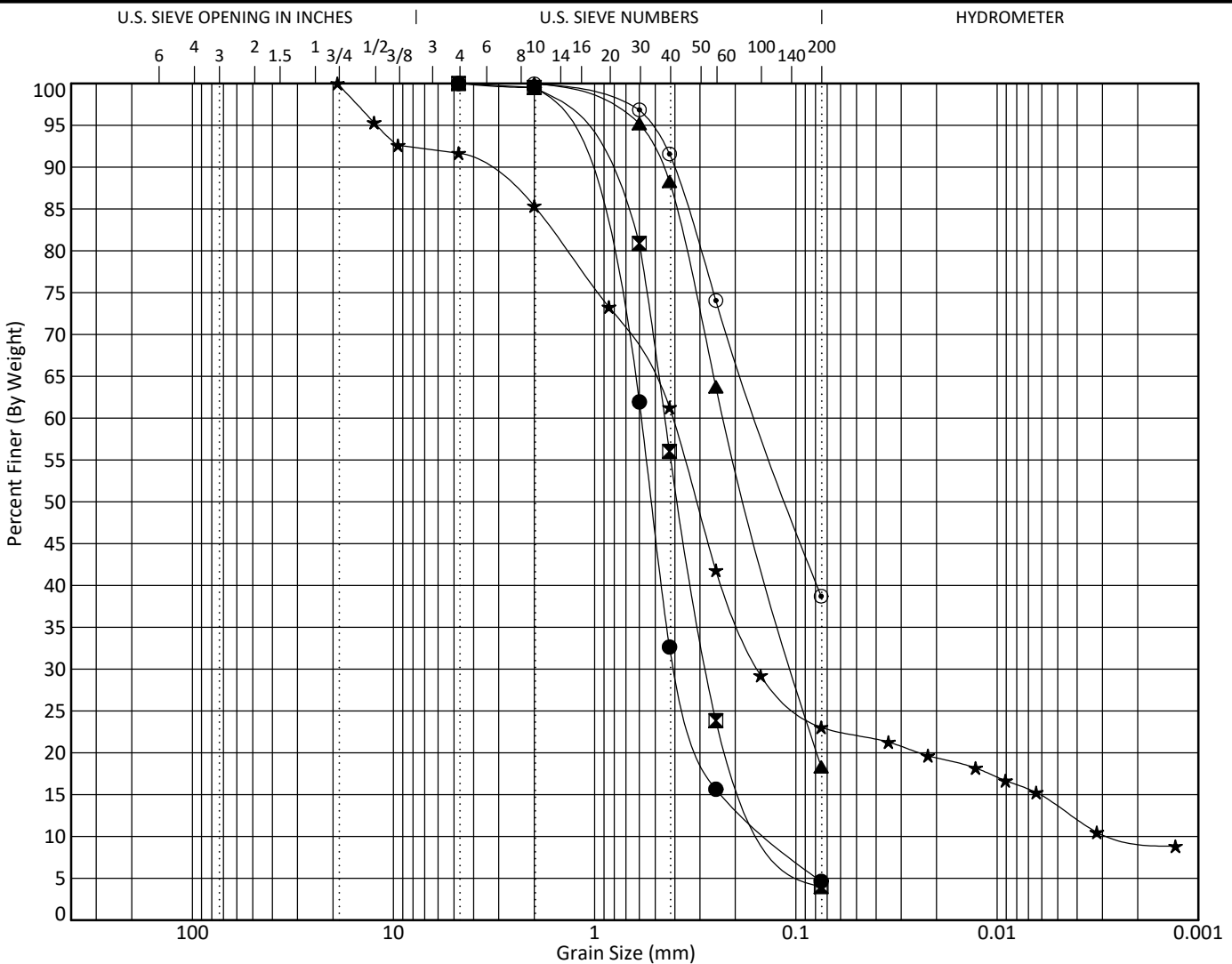
# GRAIN SIZE DISTRIBUTION

Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification					LL	PL	PI	Cc	Cu
● B-204	18.0' - 20.0'	POORLY GRADED SAND (SP)								1.94	4.35
☒ B-204	28.0' - 30.0'	POORLY GRADED SAND (SP)								1.58	4.16
▲ B-205	13.0' - 15.0'	()									
★ B-206	38.0' - 40.0'	()								23.89	168.13
◎ B-207	4.0' - 6.0'	SILTY, CLAYEY SAND (SC-SM)					21	15	6		
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
● B-204	18.0' - 20.0'	4.75	0.586	0.391	0.135	0.0	95.4	4.6		19.8	
☒ B-204	28.0' - 30.0'	4.75	0.449	0.277	0.108	0.0	96.0	4.0		23.3	
▲ B-205	13.0' - 15.0'	4.75	0.226	0.102		0.0	81.7	18.3		16.8	
★ B-206	38.0' - 40.0'	19	0.41	0.155	0.002	8.3	68.6	9.5	13.6		34.0
◎ B-207	4.0' - 6.0'	4.75	0.155			0.0	61.3	38.7		16.8	

U.S. GRAIN SIZE 66W-0224 LAB TESTING (ROUND 3) GPI F&R GDT 3/4/19

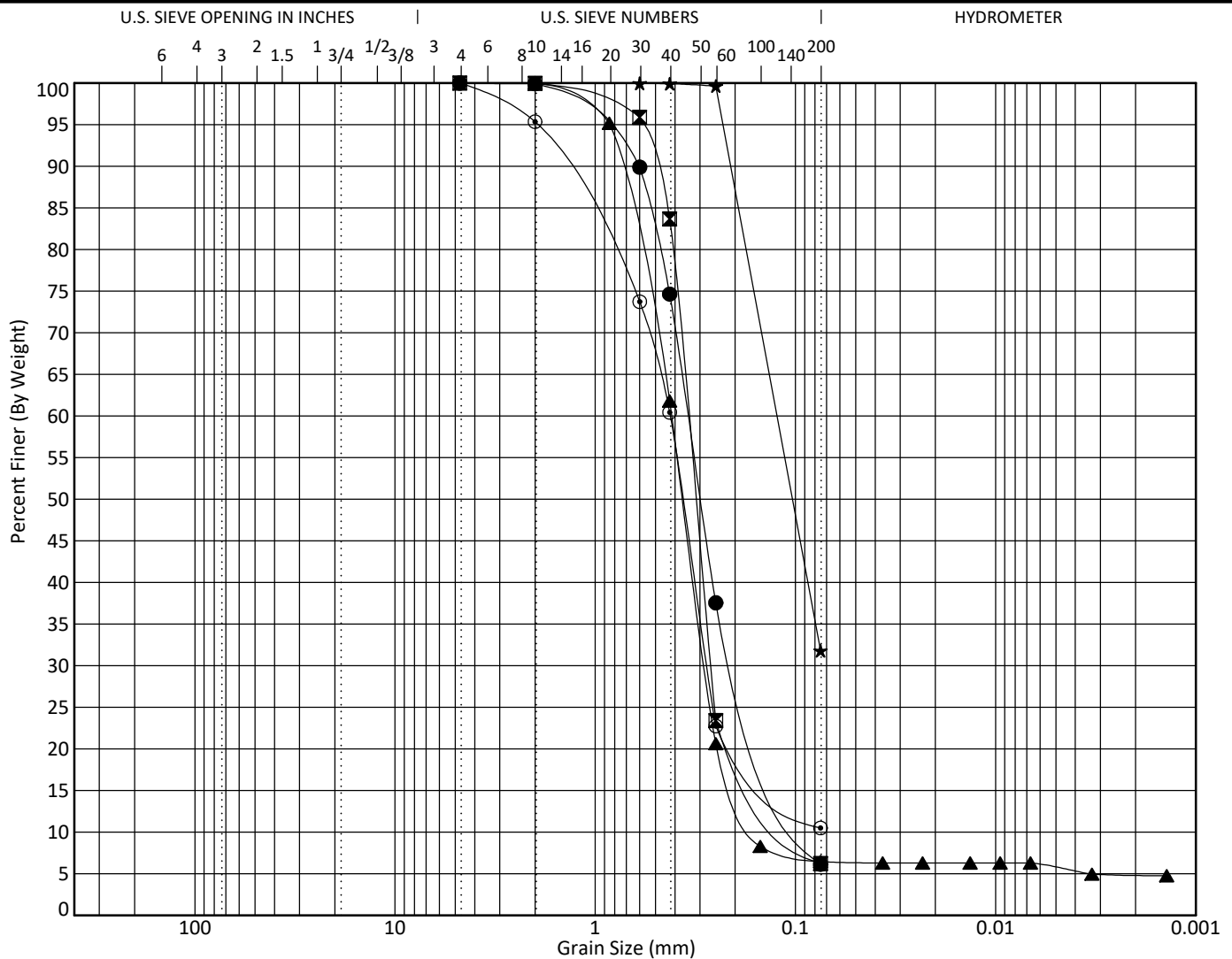


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification				LL	PL	PI	Cc	Cu
● B-207	18.0' - 20.0'	( )							1.17	3.96
⊠ B-208	13.0' - 15.0'	( )							2.08	3.53
▲ B-209	8.0' - 10.0'	( )							1.19	2.58
★ B-209	23.0' - 25.0'	( )								
⊙ B-210	13.0' - 15.0'	( )							2.54	5.91
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content
● B-207	18.0' - 20.0'	4.75	0.345	0.187	0.087	0.0	93.9	6.1		20.7
⊠ B-208	13.0' - 15.0'	4.75	0.345	0.265	0.098	0.0	93.8	6.2		23.8
▲ B-209	8.0' - 10.0'	2	0.415	0.282	0.161	0.0	93.5	0.7	5.8	53.6
★ B-209	23.0' - 25.0'	2	0.124			0.0	68.2	31.8		27.2
⊙ B-210	13.0' - 15.0'	4.75	0.422	0.277		0.0	89.5	10.5		24.9

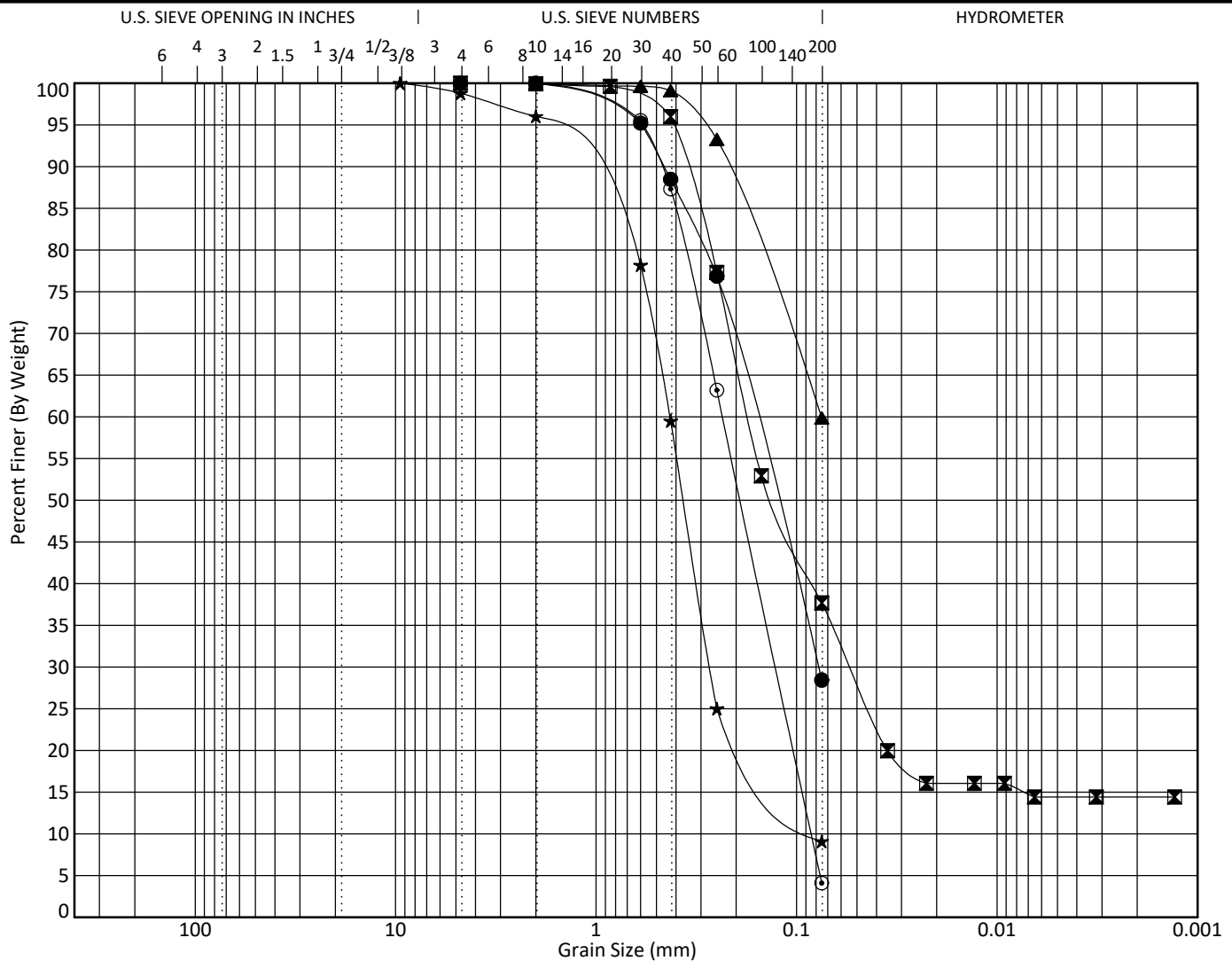


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES		GRAVEL		SAND			SILT OR CLAY				
		coarse	fine	coarse	medium	fine					
Boring No.	Depth	Classification					LL	PL	PI	Cc	Cu
● B-302	4.0' - 6.0'	()									
☒ B-302	6.0' - 8.0'	()									
▲ B-304	13.0' - 15.0'	SANDY LEAN CLAY (CL)					32	21	11		
★ B-305	8.0' - 10.0'	()								2.12	5.34
⊙ B-307	2.0' - 4.0'	POORLY GRADED SAND (SP)								0.82	2.77
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
● B-302	4.0' - 6.0'	4.75	0.164	0.078		0.0	71.6	28.4		16.7	
☒ B-302	6.0' - 8.0'	4.75	0.174	0.054		0.0	62.3	23.3	14.4	14.8	
▲ B-304	13.0' - 15.0'	2	0.075			0.0	40.1	59.9		22.3	
★ B-305	8.0' - 10.0'	9.5	0.429	0.27	0.08	1.2	89.7	9.1		15.2	
⊙ B-307	2.0' - 4.0'	2	0.234	0.127	0.085	0.0	95.9	4.1		5.1	



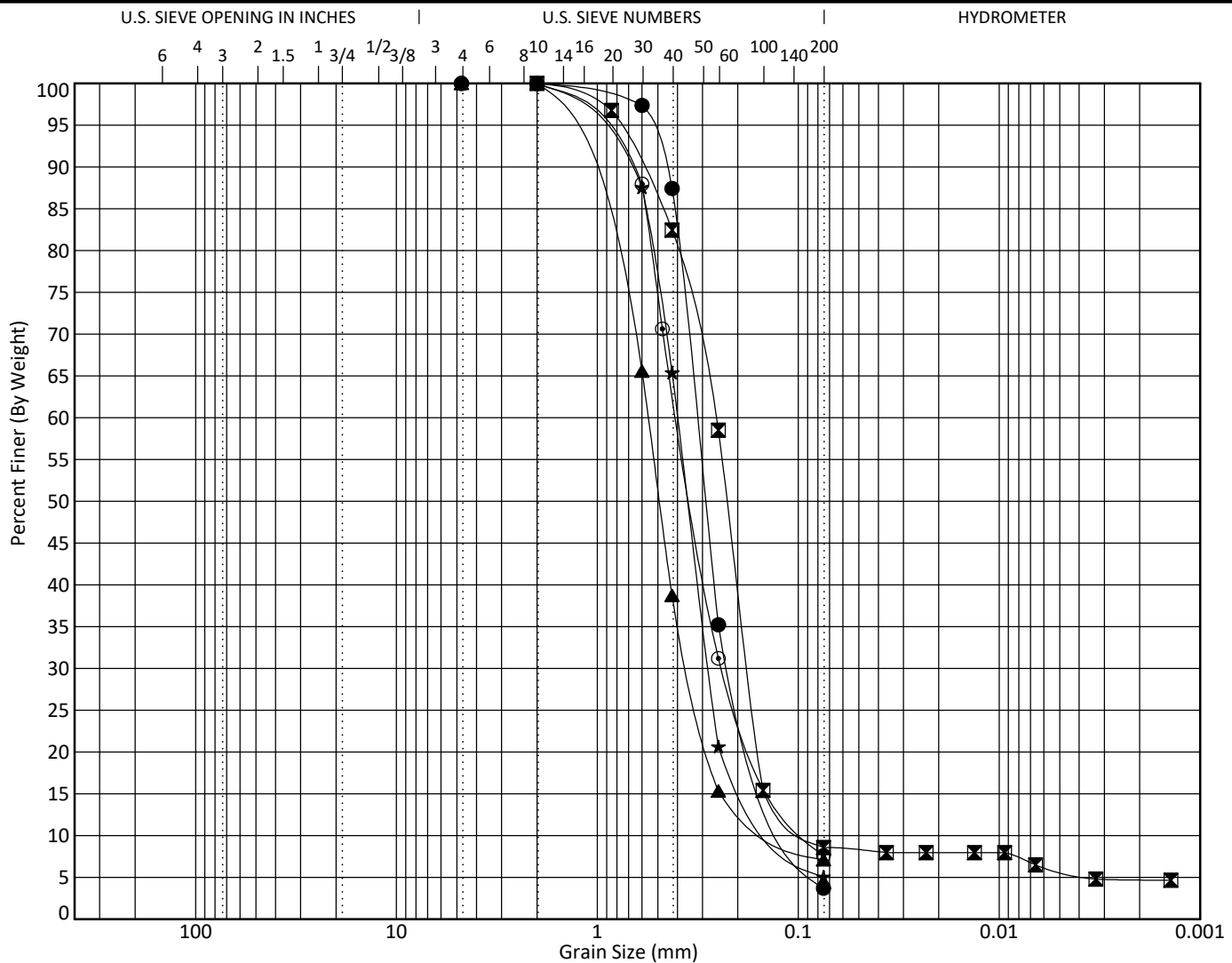


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification					LL	PL	PI	Cc	Cu
● B-308	13.0' - 15.0'	POORLY GRADED SAND (SP)								1.37	3.37
⊠ B-309	8.0' - 10.0'	()								1.42	2.98
▲ B-311	6.0' - 8.0'	()								1.90	4.88
★ B-313	4.0' - 6.0'	()								1.78	3.63
⊙ B-314	4.0' - 6.0'	()								1.63	4.72
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
● B-308	13.0' - 15.0'	4.75	0.322	0.205	0.095	0.0	96.3	3.7		26.5	
⊠ B-309	8.0' - 10.0'	2	0.259	0.178	0.087	0.0	91.4	2.8	5.8	22.8	
▲ B-311	6.0' - 8.0'	4.75	0.558	0.349	0.114	0.0	92.9	7.1		13.5	
★ B-313	4.0' - 6.0'	4.75	0.399	0.279	0.11	0.0	94.9	5.1		5.3	
⊙ B-314	4.0' - 6.0'	4.75	0.4	0.235	0.085	0.0	92.4	7.6		6.0	

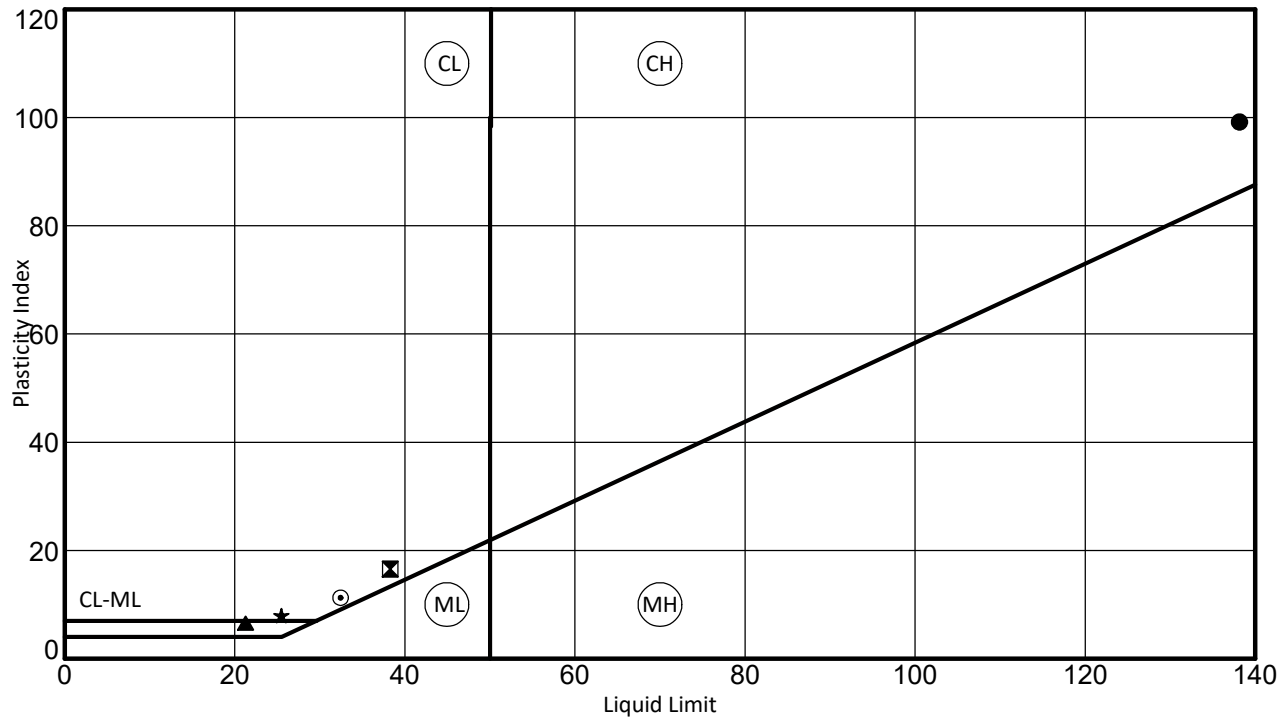


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



Sample No.	Location	Depth	LL	PL	PI	Fines	Classification	% Natural Water Content
● S-5	B-202	8.0' - 10.0'	138	39	99		()	71.0
▣ S-5	B-203	8.0' - 10.0'	38	22	16	54.0	SANDY LEAN CLAY (CL)	18.7
▲ S-3	B-207	4.0' - 6.0'	21	15	6	38.7	SILTY, CLAYEY SAND (SC-SM)	16.8
★ S-6	B-301	13.0' - 15.0'	25	18	7		()	14.6
⊙ S-6	B-304	13.0' - 15.0'	32	21	11	59.9	SANDY LEAN CLAY (CL)	22.3



FROEHLING & ROBERTSON

Engineering Stability Since 1881

# ASTM LABORATORY TEST SUMMARY SHEET

Sheet: 1 of 1

**Project No:** 66W-0224

**Client:** CDM Smith

**Project:** Brunswick Co. NW WTP

**City/State:** Leland, NC

Sample No.	Location	Depth (ft)	Natural Moisture (%)	LL	PL	PI	USCS Class.	% GRAVEL	% SAND	% FINES	Organic Content (%)	-
S-02	B-211	2.0' - 4.0'	15.3					0.0	82.1	17.9		
S-04	B-211	6.0' - 8.0'	24.3	46	23	23	CL	0.0	11.9	88.1		
S-08	B-211	23.0' - 25.0'	18.5					0.2	94.0	5.8		
S-02	B-212	2.0' - 4.0'	5.9					0.0	92.4	7.6		
S-05	B-212	8.0' - 10.0'	24.0	46	18	28	CL	0.0	6.4	93.6		
S-04	B-213	6.0' - 8.0'	8.7					0.0	94.9	5.1		
S-10	B-213	33.0' - 35.0'	26.4					0.0	66.2	33.8		
S-15	B-213	58.0' - 60.0'	21.5					0.0	43.4	56.6		
S-03	B-214	4.0' - 6.0'	14.2								0.8	
S-05	B-214	8.0' - 10.0'	20.8				SP	0.1	96.2	3.7		
S-09	B-214	28.0' - 30.0'	25.3					10.1	62.6	27.3		
S-15	B-214	58.0' - 60.0'	25.3	27	21	6	CL-ML	0.0	46.5	53.5		
S-03	B-215	4.0' - 6.0'	20.9					0.0	94.9	5.1		
S-07	B-215	18.0' - 20.0'	16.5				SP	16.3	80.2	3.5		
S-12	B-215	43.0' - 45.0'	19.5					0.0	44.2	55.8		
S-04	B-216	6.0' - 8.0'	13.5					0.1	82.4	17.5		
S-10	B-216	33.0' - 35.0'	25.7					0.0	51.6	48.4		
S-15	B-216	58.0' - 60.0'	27.7					0.0	55.0	45.0		
S-03	B-315	4.0' - 6.0'	9.5					0.0	82.0	18.0		
S-05	B-316	8.0' - 10.0'	18.8					0.0	85.4	14.6		
S-02	B-318	4.0' - 6.0'	14.4					0.0	71.0	29.0		
S-05	B-318	8.0' - 10.0'	29.8	54	19	35	CH	0.0	48.2	51.8		

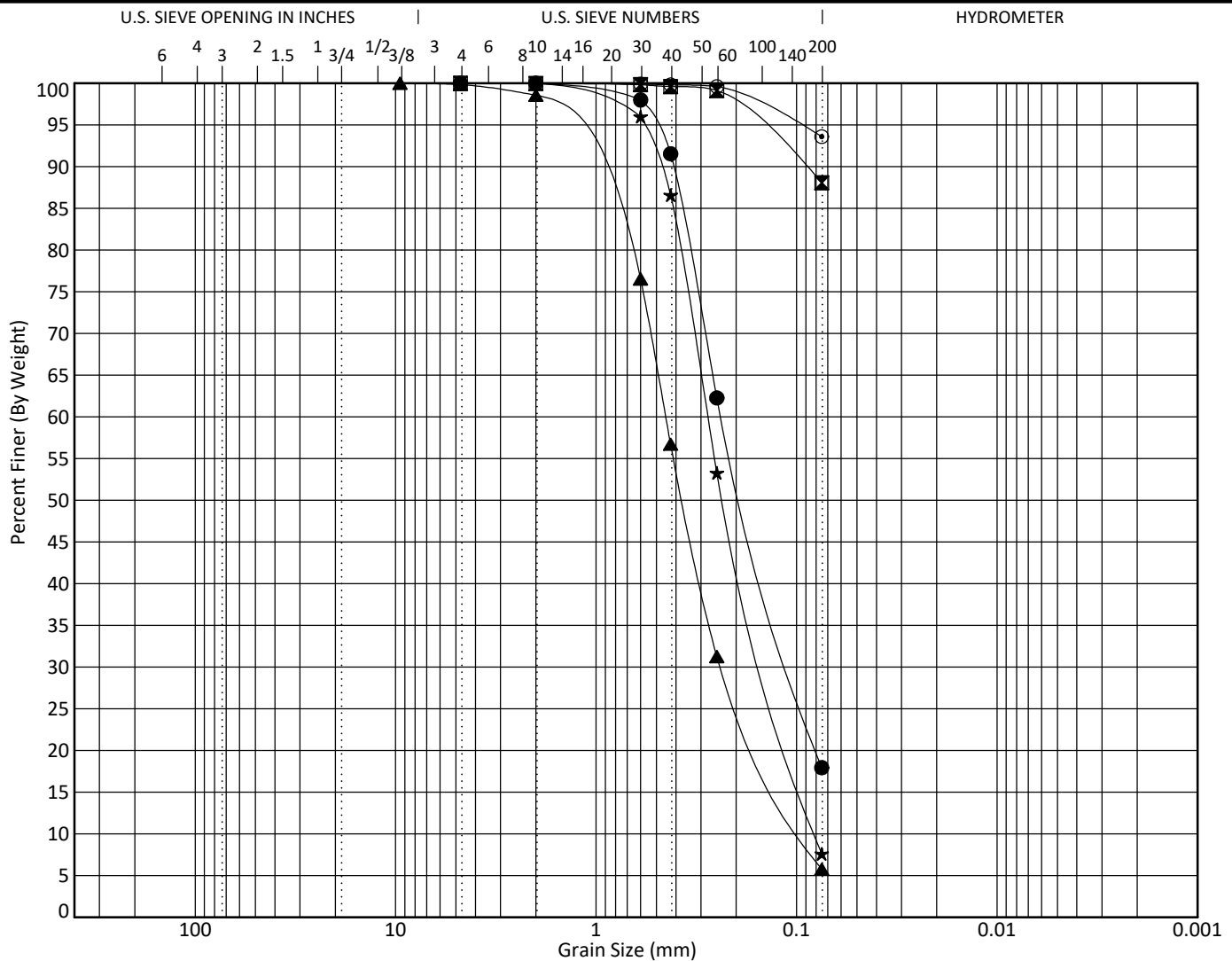


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification				LL	PL	PI	Cc	Cu
● B-211	2.0' - 4.0'	()								
■ B-211	6.0' - 8.0'	LEAN CLAY (CL)				46	23	23		
▲ B-211	23.0' - 25.0'	()							1.35	4.91
★ B-212	2.0' - 4.0'	()							0.82	3.48
○ B-212	8.0' - 10.0'	LEAN CLAY (CL)				46	18	28		
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content
● B-211	2.0' - 4.0'	4.75	0.235	0.104		0.0	82.1	17.9		15.3
■ B-211	6.0' - 8.0'	4.75				0.0	11.9	88.1		24.3
▲ B-211	23.0' - 25.0'	9.5	0.45	0.236	0.092	0.2	94.0	5.8		18.5
★ B-212	2.0' - 4.0'	2	0.278	0.135	0.08	0.0	92.4	7.6		5.9
○ B-212	8.0' - 10.0'	2				0.0	6.4	93.6		24.0

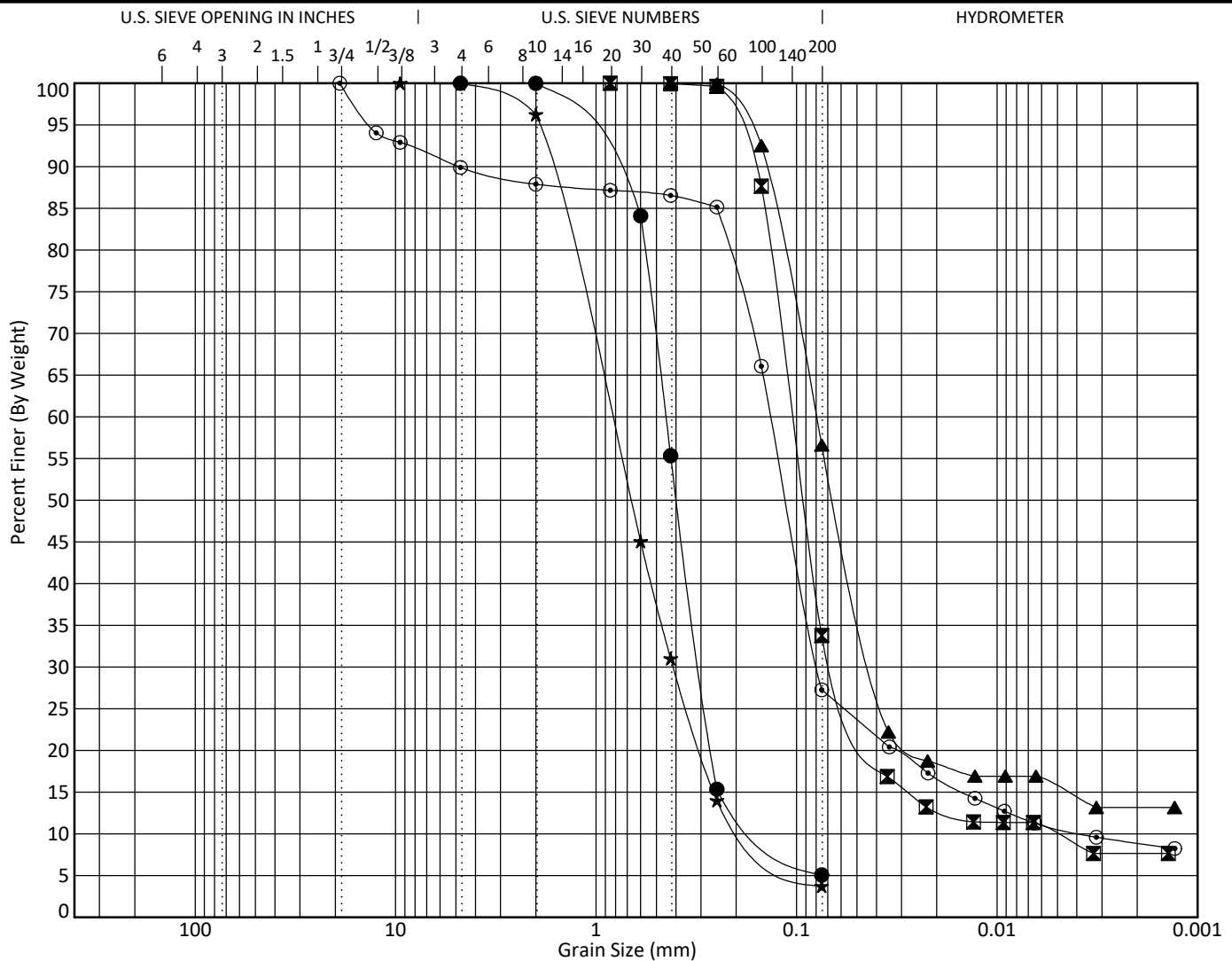


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification					LL	PL	PI	Cc	Cu
● B-213	6.0' - 8.0'	()								1.54	3.36
■ B-213	33.0' - 35.0'	()								7.48	20.56
▲ B-213	58.0' - 60.0'	()									
★ B-214	8.0' - 10.0'	POORLY GRADED SAND (SP)								1.27	5.45
○ B-214	28.0' - 30.0'	()								12.13	35.42
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
● B-213	6.0' - 8.0'	4.75	0.449	0.304	0.134	0.0	94.9	5.1		8.7	
■ B-213	33.0' - 35.0'	0.85	0.105	0.063	0.005	0.0	66.2	23.9	9.9	26.4	
▲ B-213	58.0' - 60.0'	0.425	0.08	0.041		0.0	43.4	41.0	15.6	21.5	
★ B-214	8.0' - 10.0'	9.5	0.852	0.412	0.156	0.1	96.2	3.7		20.8	
○ B-214	28.0' - 30.0'	19	0.135	0.079	0.004	10.1	62.6	16.6	10.7	25.3	

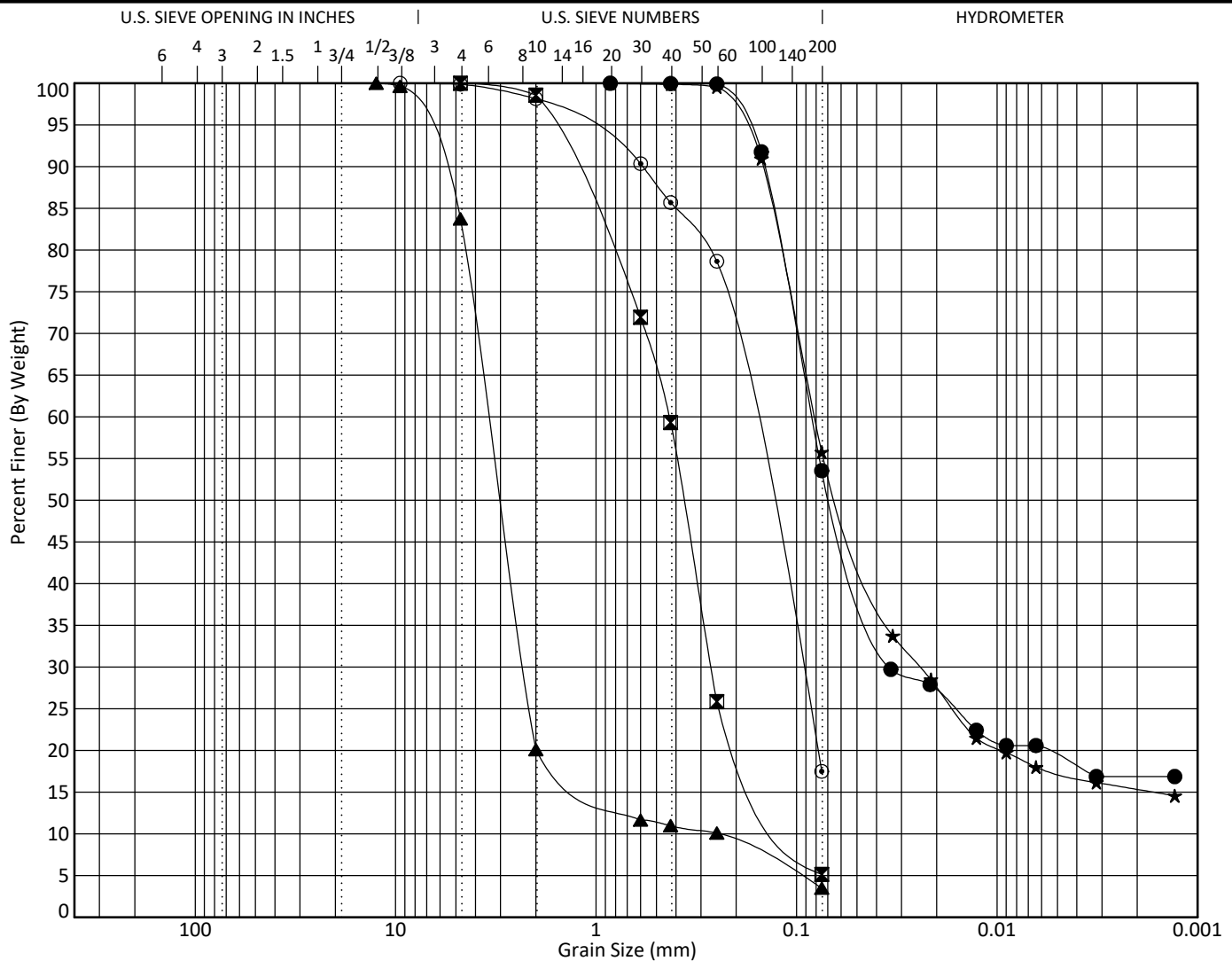


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.      Depth			Classification					LL	PL	PI	Cc	Cu
●	B-214	58.0' - 60.0'	SANDY SILTY CLAY (CL-ML)					27	21	6		
⊠	B-215	4.0' - 6.0'	()								1.65	4.35
▲	B-215	18.0' - 20.0'	POORLY GRADED SAND with GRAVEL (SP)								6.20	14.02
★	B-215	43.0' - 45.0'	()									
◎	B-216	6.0' - 8.0'	()									
	Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
●	B-214	58.0' - 60.0'	0.85	0.084	0.034		0.0	46.5	34.2	19.3	25.3	
⊠	B-215	4.0' - 6.0'	4.75	0.433	0.267	0.1	0.0	94.9	5.1		20.9	
▲	B-215	18.0' - 20.0'	12.5	3.44	2.288	0.245	16.3	80.2	3.5		16.5	
★	B-215	43.0' - 45.0'	0.85	0.082	0.024		0.0	44.2	38.5	17.3	19.5	
◎	B-216	6.0' - 8.0'	9.5	0.173	0.096		0.1	82.4	17.5		13.5	



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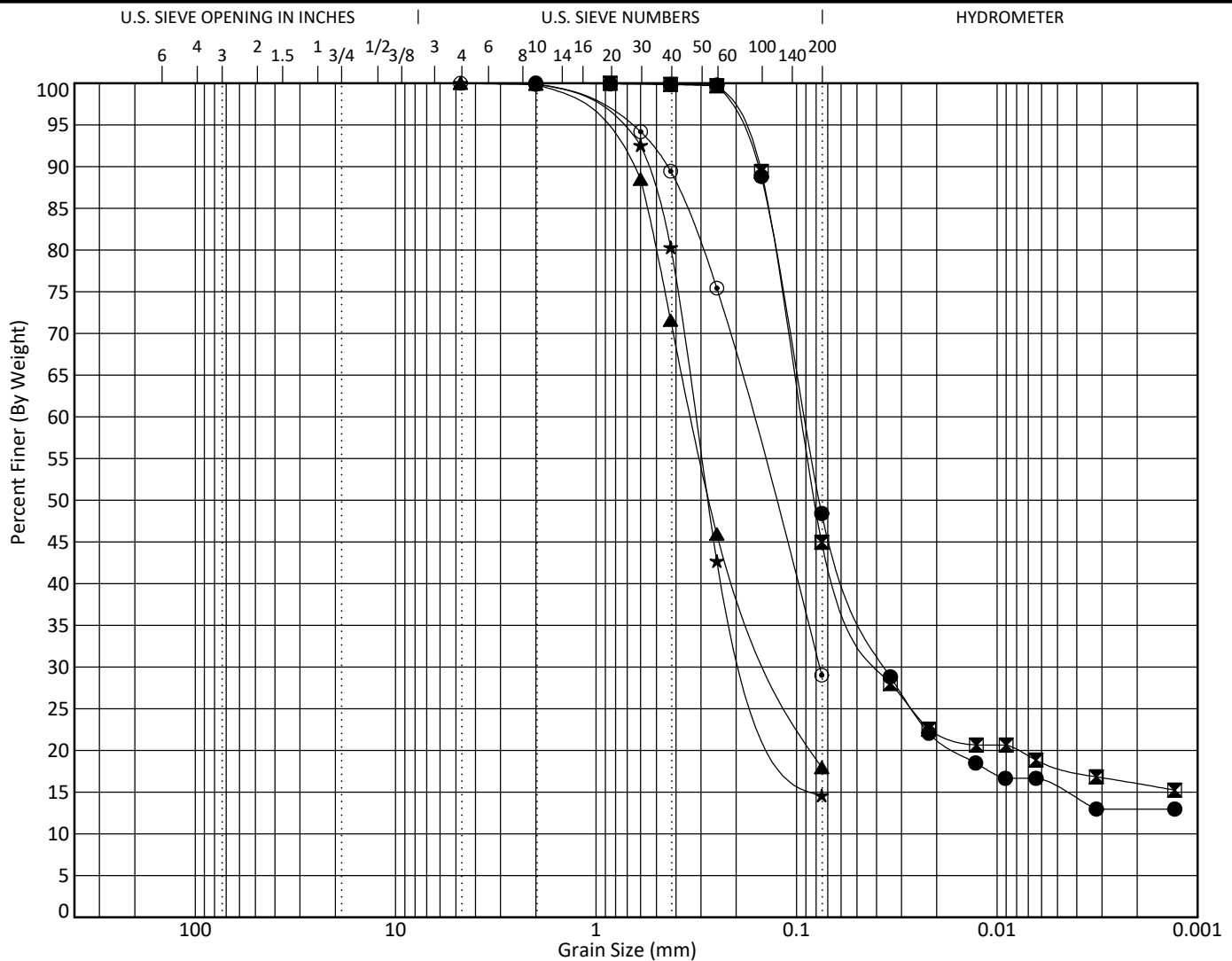
# GRAIN SIZE DISTRIBUTION

Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification				LL	PL	PI	Cc	Cu
● B-216	33.0' - 35.0'	()								
☒ B-216	58.0' - 60.0'	()								
▲ B-315	4.0' - 6.0'	()								
★ B-316	8.0' - 10.0'	()								
○ B-318	4.0' - 6.0'	()								
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content
● B-216	33.0' - 35.0'	2	0.091	0.036		0.0	51.6	33.1	15.3	25.7
☒ B-216	58.0' - 60.0'	0.85	0.095	0.037		0.0	55.0	26.9	18.1	27.7
▲ B-315	4.0' - 6.0'	4.75	0.334	0.126		0.0	82.0	18.0		9.5
★ B-316	8.0' - 10.0'	4.75	0.319	0.145		0.0	85.4	14.6		18.8
○ B-318	4.0' - 6.0'	4.75	0.168	0.077		0.0	71.0	29.0		14.4

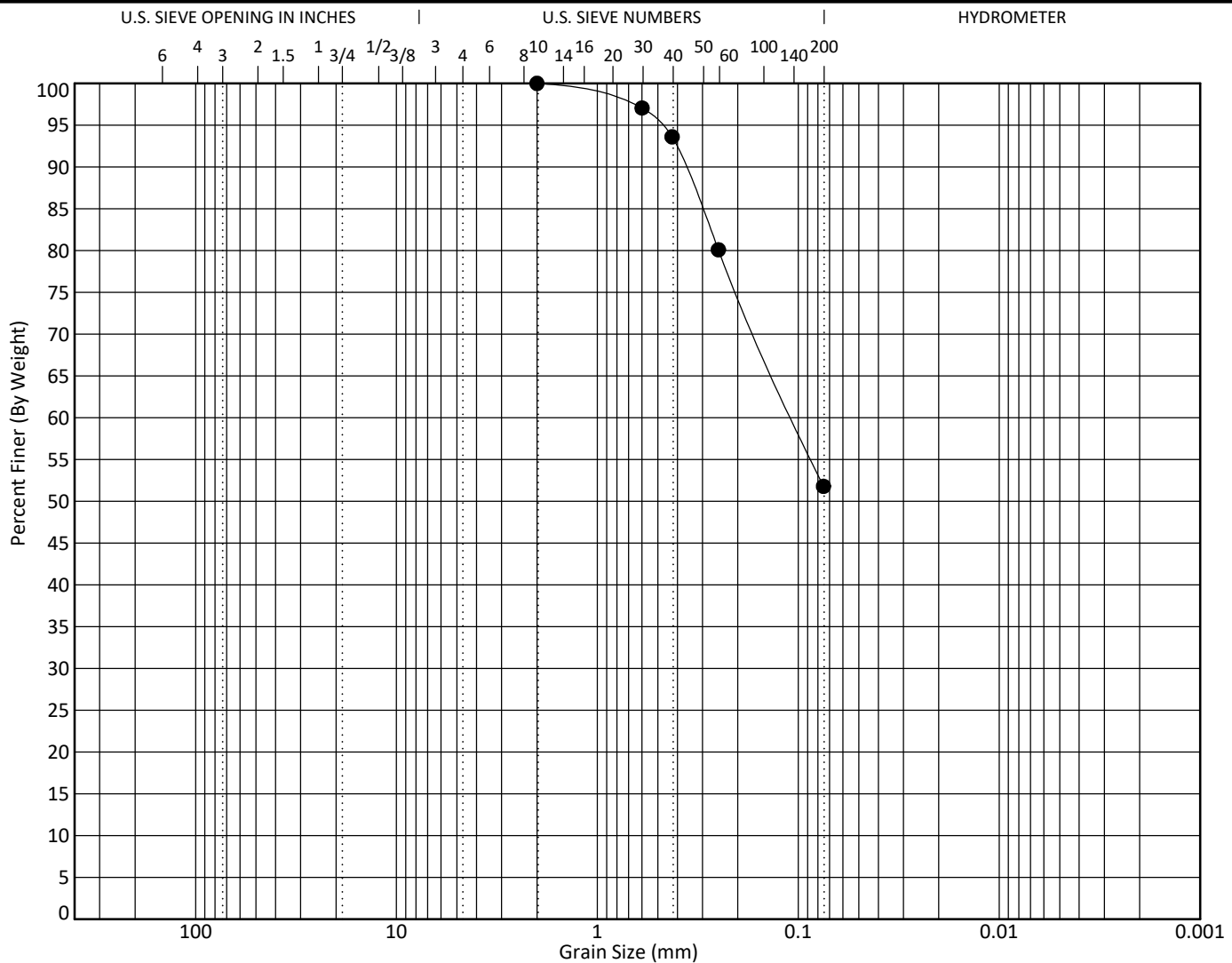


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification					LL	PL	PI	Cc	Cu
● B-318	8.0' - 10.0'	SANDY FAT CLAY (CH)					54	19	35		
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
● B-318	8.0' - 10.0'	2	0.106			0.0	48.2	51.8		29.8	



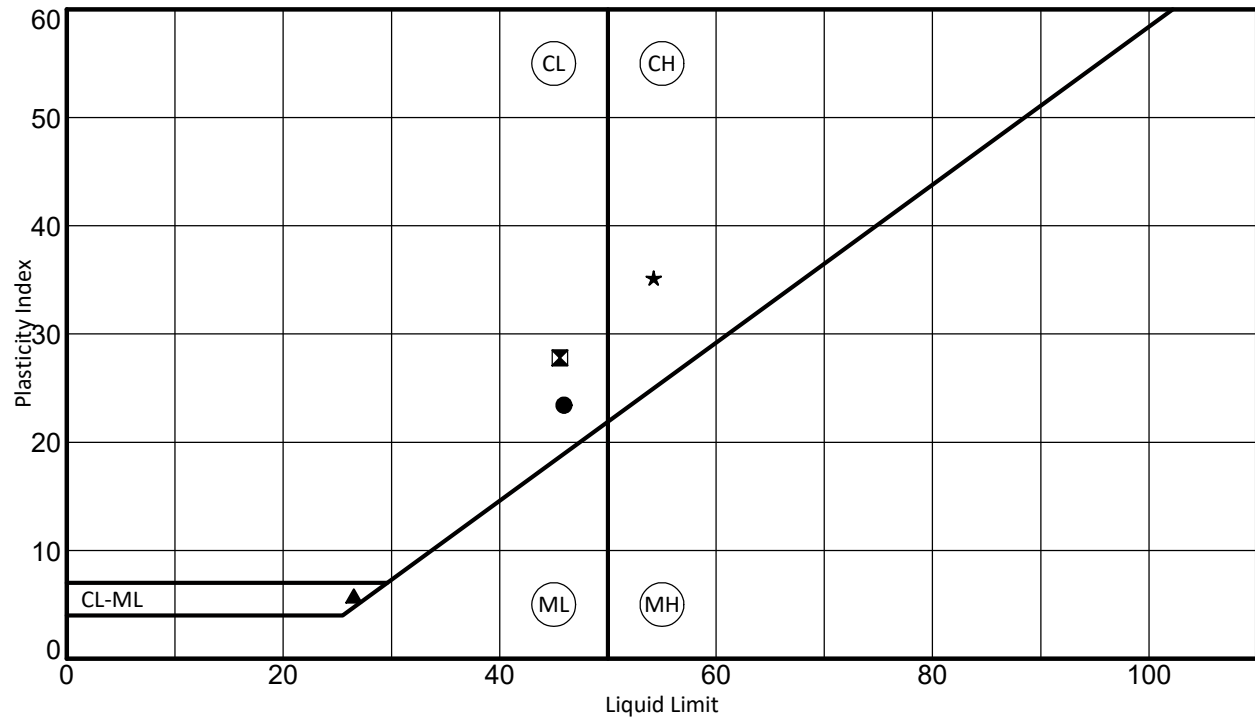


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



Boring No.	Depth	LL	PL	PI	Fines	Classification	% Natural Water Content
● B-211	6.0' - 8.0'	46	23	23	88.1	LEAN CLAY (CL)	24.3
⊠ B-212	8.0' - 10.0'	46	18	28	93.6	LEAN CLAY (CL)	24.0
▲ B-214	58.0' - 60.0'	27	21	6	53.5	SANDY SILTY CLAY (CL-ML)	25.3
★ B-318	8.0' - 10.0'	54	19	35	51.8	SANDY FAT CLAY (CH)	29.8



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# ASTM LABORATORY TEST SUMMARY SHEET

Sheet: 1 of 1

**Project No:** 66W-0224

**Client:** CDM Smith

**Project:** Brunswick Co. NW WTP

**City/State:** Leland, NC

Sample No.	Location	Depth (ft)	Natural Moisture (%)	LL	PL	PI	USCS Class.	% GRAVEL	% SAND	% FINES	Organic Content (%)	-
S-2	B-211	2.0' - 4.0'	15.3					0.0	82.1	17.9		
S-4	B-211	6.0' - 8.0'	24.3	46	23	23	CL	0.0	11.9	88.1		
S-8	B-211	23.0' - 25.0'	18.5					0.2	94.0	5.8		
S-2	B-212	2.0' - 4.0'	5.9					0.0	92.4	7.6		
S-5	B-212	8.0' - 10.0'	24.0	46	18	28	CL	0.0	6.4	93.6		
S-4	B-213	6.0' - 8.0'	8.7					0.0	94.9	5.1		
S-10	B-213	33.0' - 35.0'	26.4					0.0	66.2	33.8		
S-15	B-213	58.0' - 60.0'	21.5					0.0	43.4	56.6		
S-3	B-214	4.0' - 6.0'	14.2								0.8	
S-5	B-214	8.0' - 10.0'	20.8				SP	0.1	96.2	3.7		
S-9	B-214	28.0' - 30.0'	25.3					10.1	62.6	27.3		
S-15	B-214	58.0' - 60.0'	25.3	27	21	6	CL-ML	0.0	46.5	53.5		
S-3	B-215	4.0' - 6.0'	20.9					0.0	94.9	5.1		
S-7	B-215	18.0' - 20.0'	16.5				SP	16.3	80.2	3.5		
S-12	B-215	43.0' - 45.0'	19.5					0.0	44.2	55.8		
S-04	B-216	6.0' - 8.0'	13.5					0.1	82.4	17.5		
S-10	B-216	33.0' - 35.0'	25.7					0.0	51.6	48.4		
S-15	B-216	58.0' - 60.0'	27.7					0.0	55.0	45.0		
S-3	B-315	4.0' - 6.0'	9.5					0.0	82.0	18.0		
S-5	B-316	8.0' - 10.0'	18.8					0.0	85.4	14.6		
S-2	B-318	2.0' - 4.0'	14.4					0.0	71.0	29.0		
S-5	B-318	8.0' - 10.0'	29.8	54	19	35	CH	0.0	48.2	51.8		

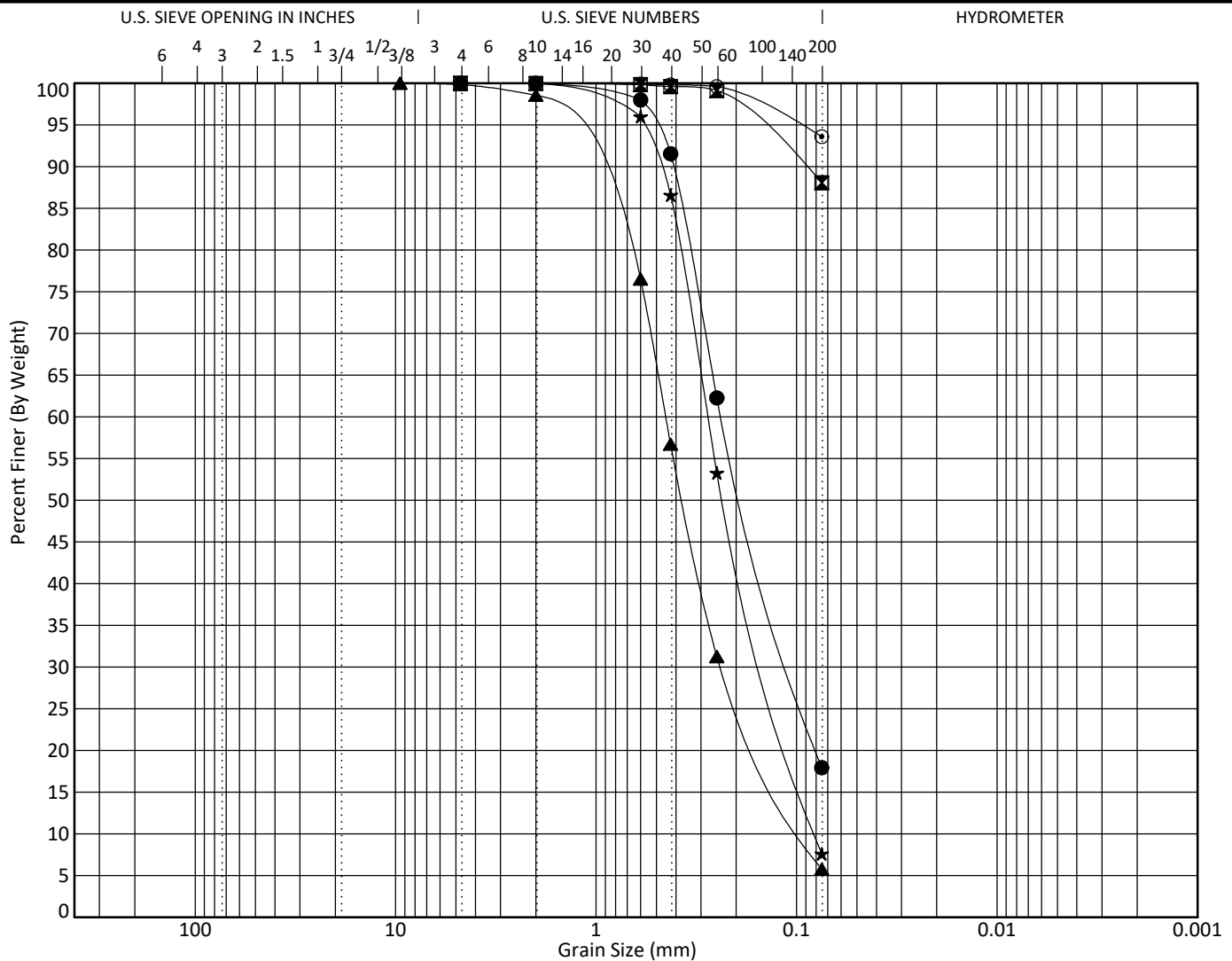


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification				LL	PL	PI	Cc	Cu
● B-211	2.0' - 4.0'	()								
☒ B-211	6.0' - 8.0'	LEAN CLAY (CL)				46	23	23		
▲ B-211	23.0' - 25.0'	()							1.35	4.91
★ B-212	2.0' - 4.0'	()							0.82	3.48
◎ B-212	8.0' - 10.0'	LEAN CLAY (CL)				46	18	28		
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content
● B-211	2.0' - 4.0'	4.75	0.235	0.104		0.0	82.1	17.9		15.3
☒ B-211	6.0' - 8.0'	4.75				0.0	11.9	88.1		24.3
▲ B-211	23.0' - 25.0'	9.5	0.45	0.236	0.092	0.2	94.0	5.8		18.5
★ B-212	2.0' - 4.0'	2	0.278	0.135	0.08	0.0	92.4	7.6		5.9
◎ B-212	8.0' - 10.0'	2				0.0	6.4	93.6		24.0

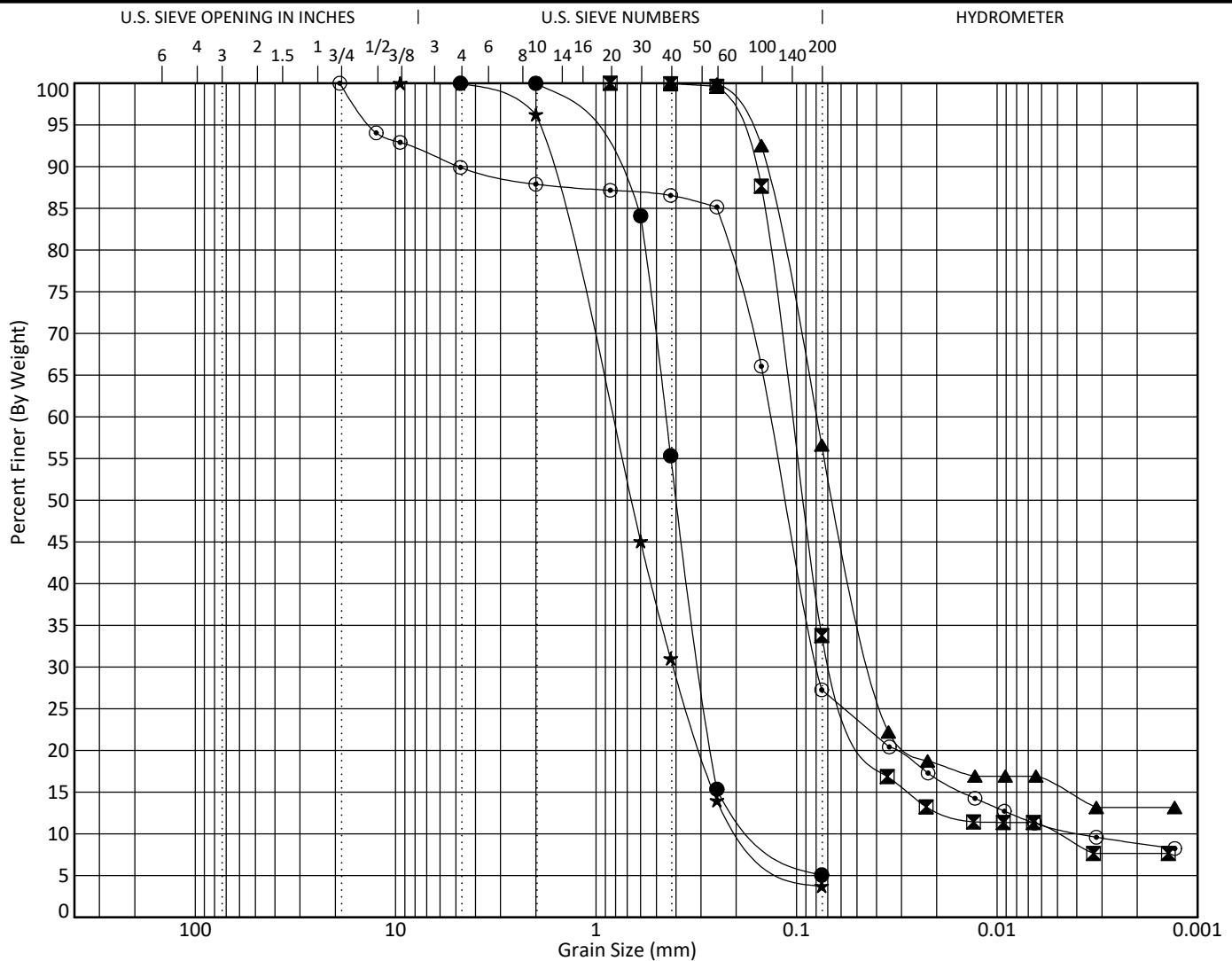


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification					LL	PL	PI	Cc	Cu
● B-213	6.0' - 8.0'	()								1.54	3.36
☒ B-213	33.0' - 35.0'	()								7.48	20.56
▲ B-213	58.0' - 60.0'	()									
★ B-214	8.0' - 10.0'	POORLY GRADED SAND (SP)								1.27	5.45
⊙ B-214	28.0' - 30.0'	()								12.13	35.42
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
● B-213	6.0' - 8.0'	4.75	0.449	0.304	0.134	0.0	94.9	5.1		8.7	
☒ B-213	33.0' - 35.0'	0.85	0.105	0.063	0.005	0.0	66.2	23.9	9.9	26.4	
▲ B-213	58.0' - 60.0'	0.425	0.08	0.041		0.0	43.4	41.0	15.6	21.5	
★ B-214	8.0' - 10.0'	9.5	0.852	0.412	0.156	0.1	96.2	3.7		20.8	
⊙ B-214	28.0' - 30.0'	19	0.135	0.079	0.004	10.1	62.6	16.6	10.7	25.3	

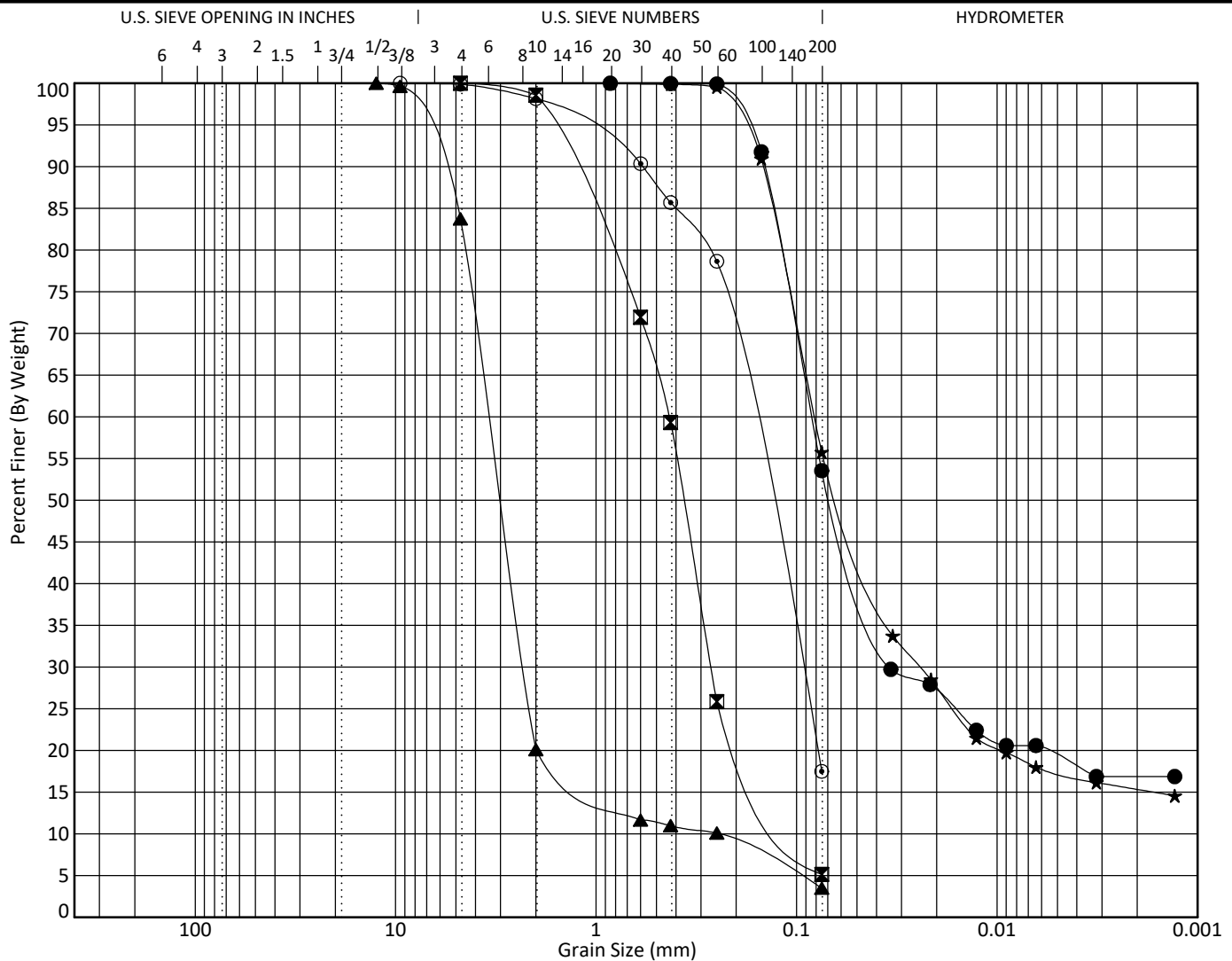


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification					LL	PL	PI	Cc	Cu
● B-214	58.0' - 60.0'	SANDY SILTY CLAY (CL-ML)					27	21	6		
⊠ B-215	4.0' - 6.0'	()								1.65	4.35
▲ B-215	18.0' - 20.0'	POORLY GRADED SAND with GRAVEL (SP)								6.20	14.02
★ B-215	43.0' - 45.0'	()									
⊙ B-216	6.0' - 8.0'	()									
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
● B-214	58.0' - 60.0'	0.85	0.084	0.034		0.0	46.5	34.2	19.3	25.3	
⊠ B-215	4.0' - 6.0'	4.75	0.433	0.267	0.1	0.0	94.9	5.1		20.9	
▲ B-215	18.0' - 20.0'	12.5	3.44	2.288	0.245	16.3	80.2	3.5		16.5	
★ B-215	43.0' - 45.0'	0.85	0.082	0.024		0.0	44.2	38.5	17.3	19.5	
⊙ B-216	6.0' - 8.0'	9.5	0.173	0.096		0.1	82.4	17.5		13.5	



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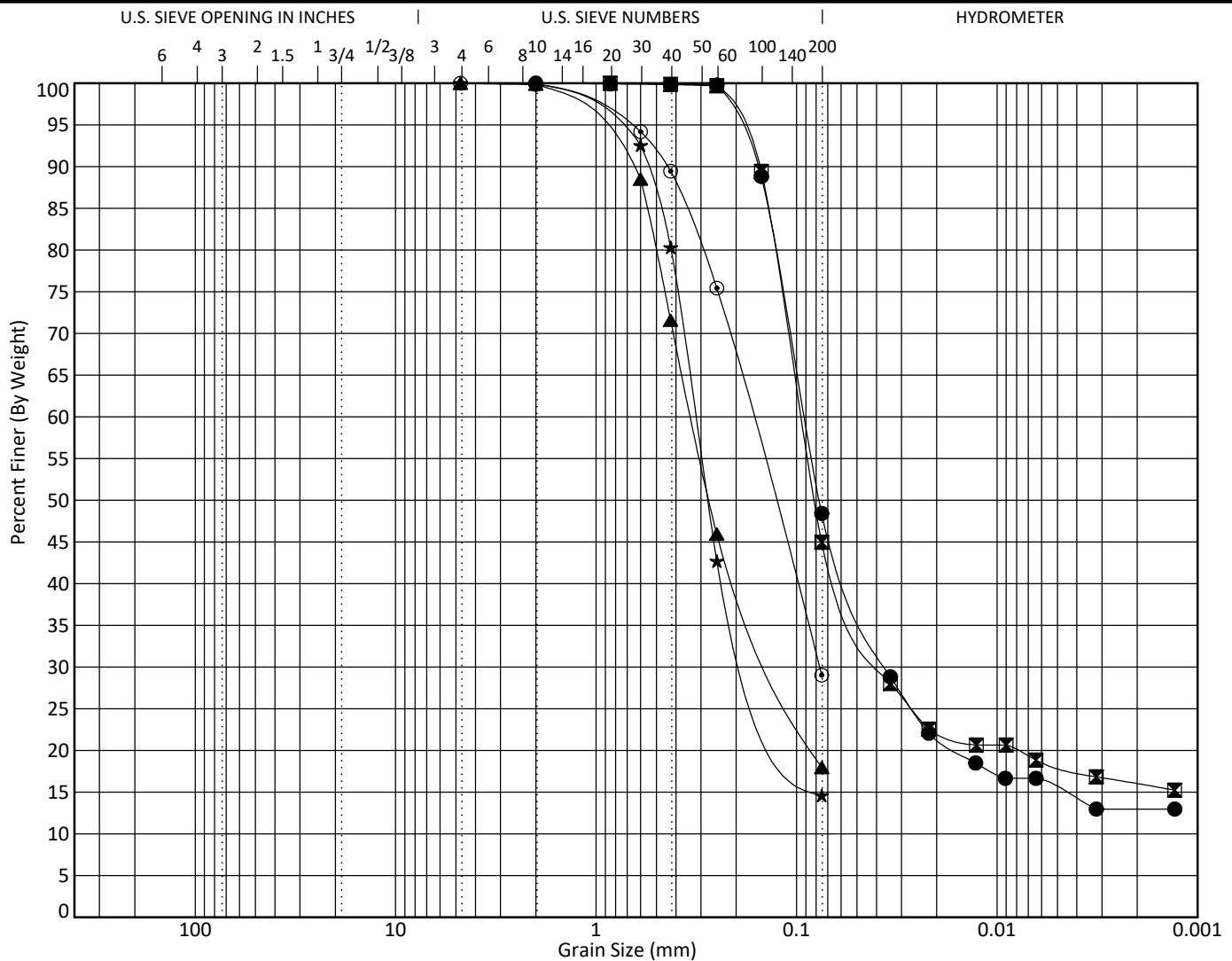
# GRAIN SIZE DISTRIBUTION

Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification				LL	PL	PI	Cc	Cu
● B-216	33.0' - 35.0'	()								
☒ B-216	58.0' - 60.0'	()								
▲ B-315	4.0' - 6.0'	()								
★ B-316	8.0' - 10.0'	()								
⊙ B-318	2.0' - 4.0'	()								
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content
● B-216	33.0' - 35.0'	2	0.091	0.036		0.0	51.6	33.1	15.3	25.7
☒ B-216	58.0' - 60.0'	0.85	0.095	0.037		0.0	55.0	26.9	18.1	27.7
▲ B-315	4.0' - 6.0'	4.75	0.334	0.126		0.0	82.0	18.0		9.5
★ B-316	8.0' - 10.0'	4.75	0.319	0.145		0.0	85.4	14.6		18.8
⊙ B-318	2.0' - 4.0'	4.75	0.168	0.077		0.0	71.0	29.0		14.4

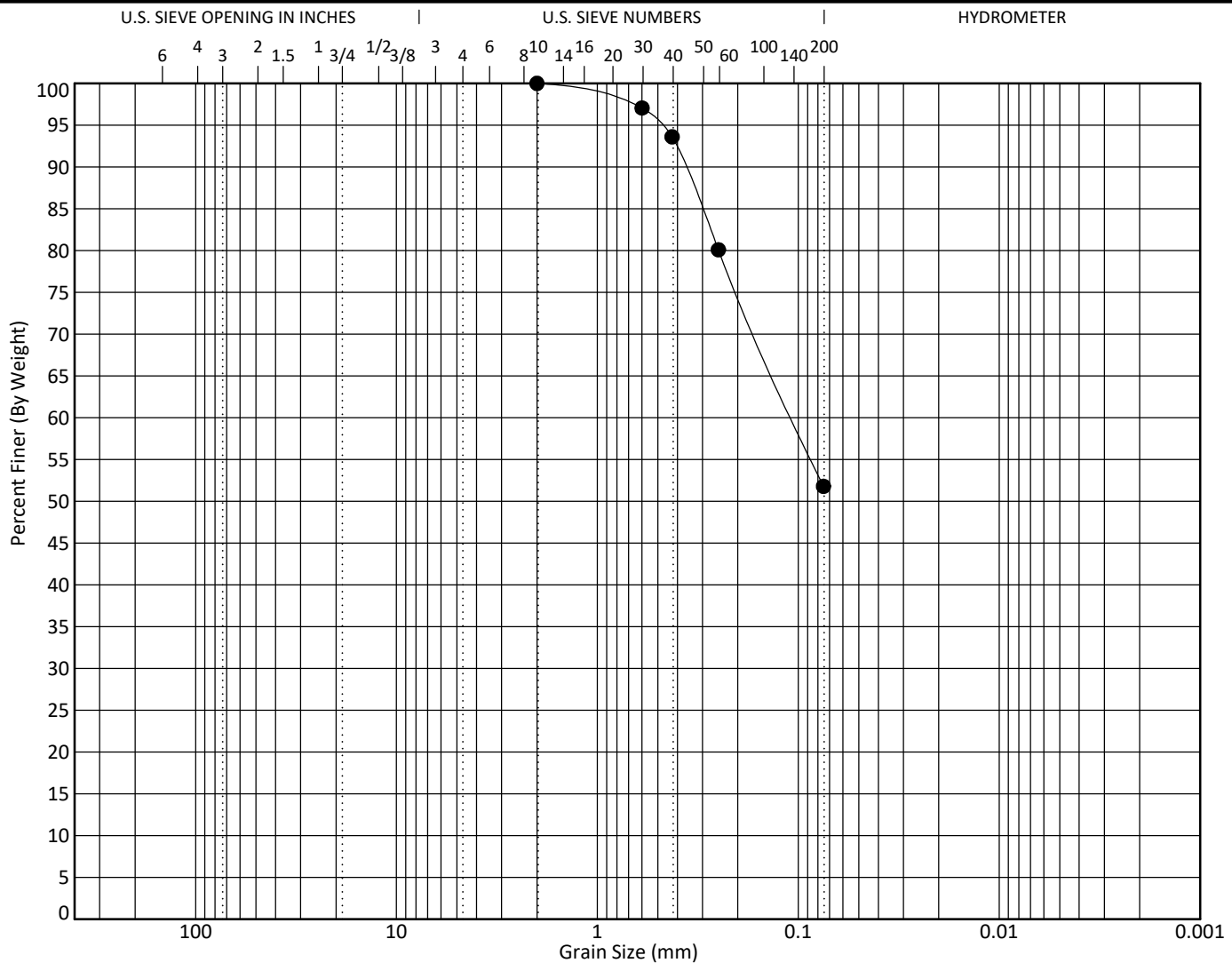


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification					LL	PL	PI	Cc	Cu
● B-318	8.0' - 10.0'	SANDY FAT CLAY (CH)					54	19	35		
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
● B-318	8.0' - 10.0'	2	0.106			0.0	48.2	51.8		29.8	

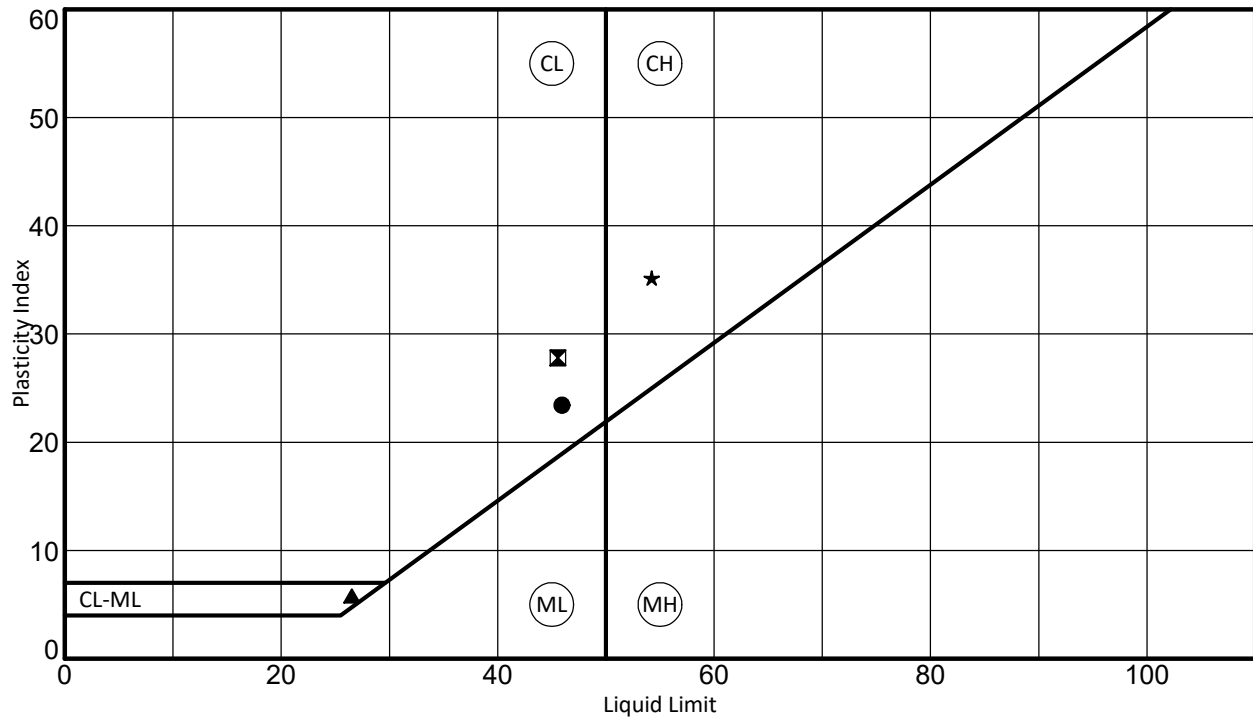


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



Boring No.	Depth	LL	PL	PI	Fines	Classification	% Natural Water Content
● B-211	6.0' - 8.0'	46	23	23	88.1	LEAN CLAY (CL)	24.3
⊠ B-212	8.0' - 10.0'	46	18	28	93.6	LEAN CLAY (CL)	24.0
▲ B-214	58.0' - 60.0'	27	21	6	53.5	SANDY SILTY CLAY (CL-ML)	25.3
★ B-318	8.0' - 10.0'	54	19	35	51.8	SANDY FAT CLAY (CH)	29.8





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ASTM LABORATORY TEST  
SUMMARY SHEET

Sheet: 1 of 1

Project No: 66W-0224  
Client: CDM Smith  
Project: Brunswick Co. NW WTP  
City/State: Leland, NC

Boring/ Sample No.	Location	Depth (ft)	Natural Moisture (%)	LL	PL	PI	USCS Class.	% GRAVEL	% SAND	% FINES	-	-
S-5	B-401	8.0' - 10.0'	26.5					0.0	56.0	44.0		
S-11	B-401	39.0' - 40.5'	26.0	54	17	37	CH	0.0	43.5	56.5		
S-16	B-401	64.0' - 65.5'	25.1	66	18	48	CH	0.0	3.7	96.3		
S-3	B-402	4.0' - 6.0'	27.6					0.0	56.7	43.3		
S-9	B-402	28.0' - 29.5'	26.4	39	21	18	CL	0.0	49.1	50.9		
S-14	B-402	53.0' - 54.5'	26.7					0.0	50.6	49.4		

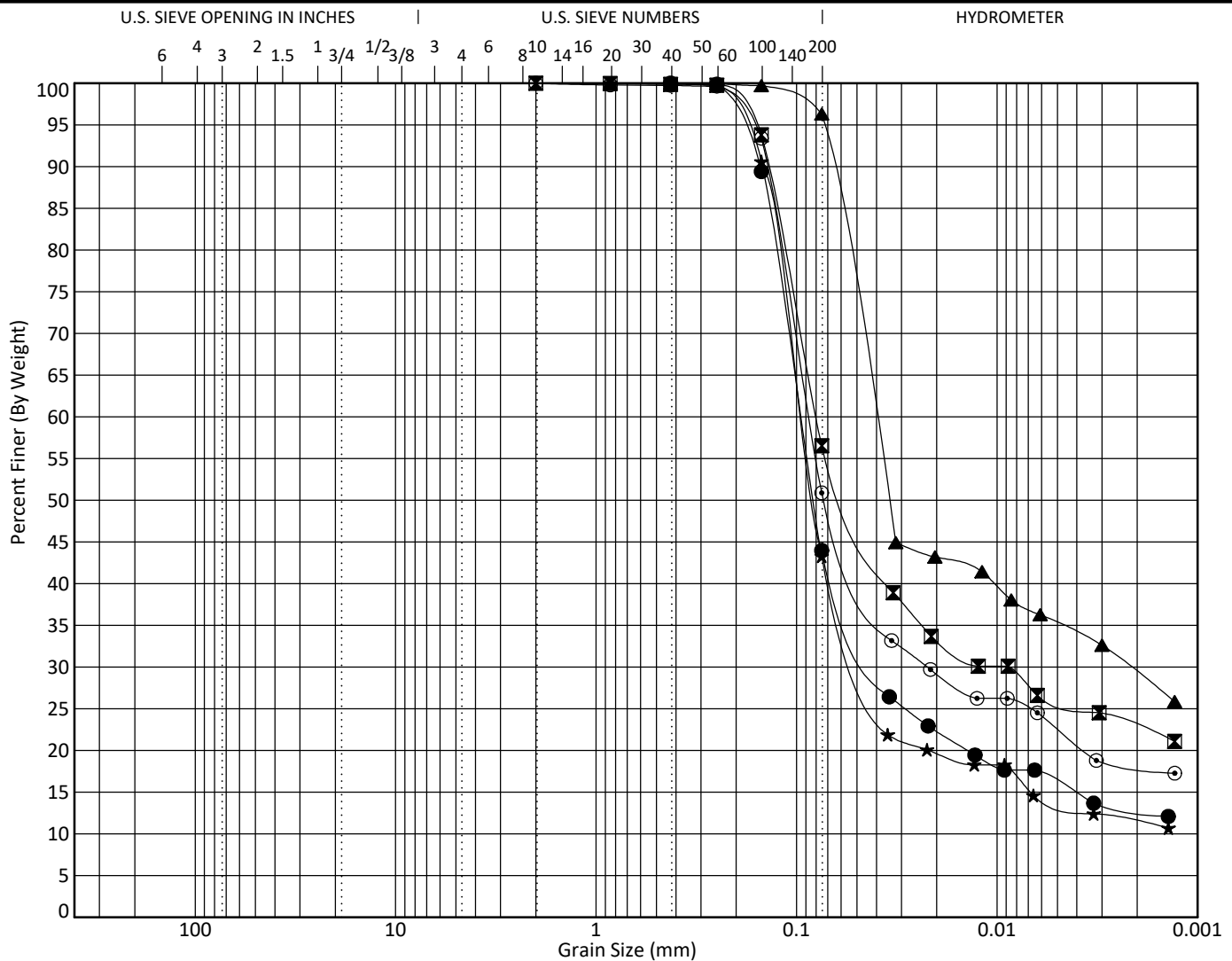


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.      Depth			Classification					LL	PL	PI	Cc	Cu
●	B-401	8.0' - 10.0'	()									
☒	B-401	39.0' - 40.5'	SANDY FAT CLAY (CH)					54	17	37		
▲	B-401	64.0' - 65.5'	FAT CLAY (CH)					66	18	48		
★	B-402	4.0' - 6.0'	()									
⊙	B-402	28.0' - 29.5'	SANDY LEAN CLAY (CL)					39	21	18		
Boring No.		Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
●	B-401	8.0' - 10.0'	0.425	0.096	0.04		0.0	56.0	27.9	16.1	26.5	
☒	B-401	39.0' - 40.5'	2	0.08	0.009		0.0	43.5	30.6	25.9	26.0	
▲	B-401	64.0' - 65.5'	0.85	0.041	0.002		0.0	3.7	61.1	35.2	25.1	
★	B-402	4.0' - 6.0'	0.85	0.096	0.047		0.0	56.7	29.6	13.7	27.6	
⊙	B-402	28.0' - 29.5'	2	0.087	0.022		0.0	49.1	28.3	22.6	26.4	

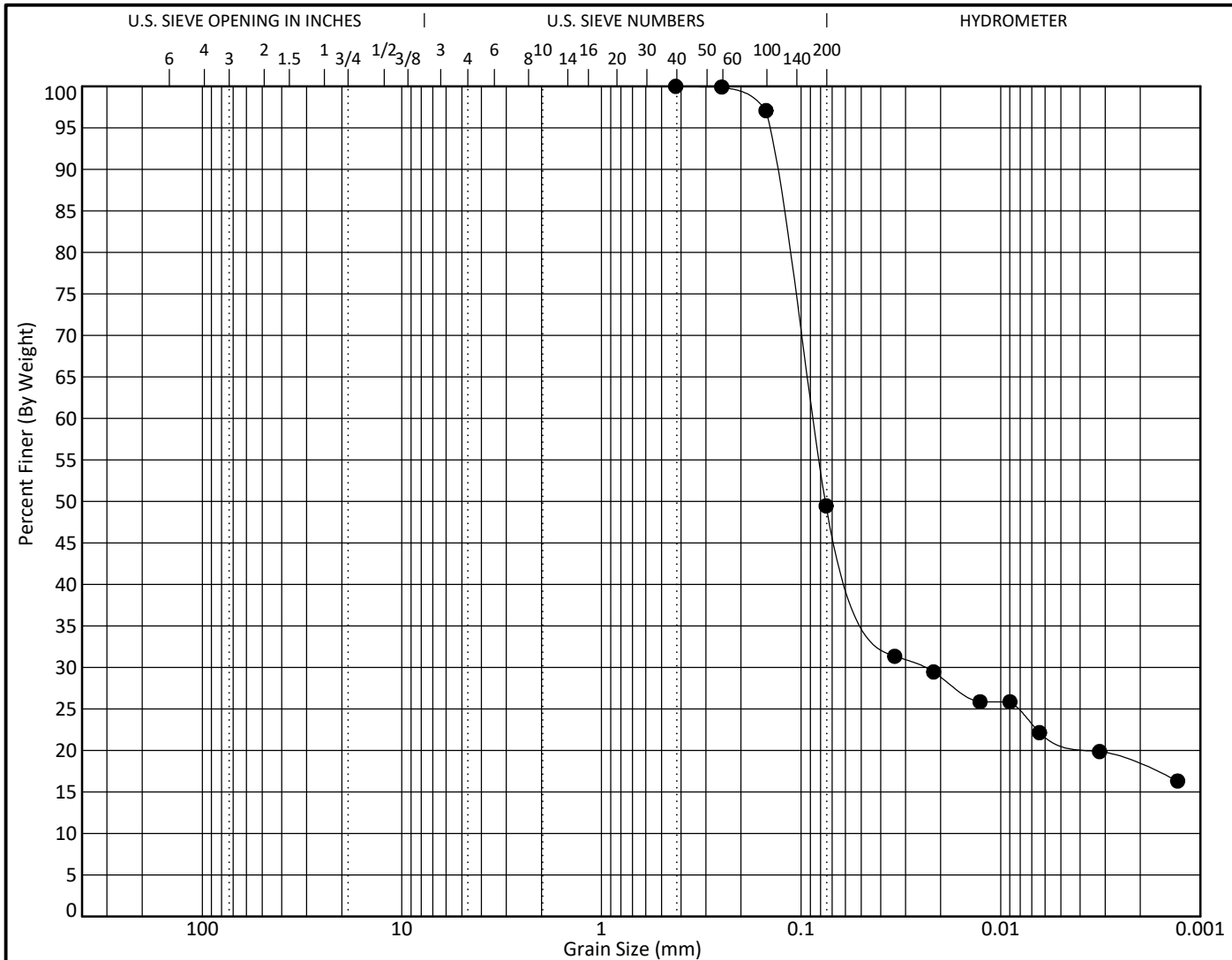


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification					LL	PL	PI	Cc	Cu
● B-402	53.0' - 54.5'	()									
Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	% Water Content	
● B-402	53.0' - 54.5'	0.425	0.087	0.025		0.0	50.6	28.1	21.3	26.7	

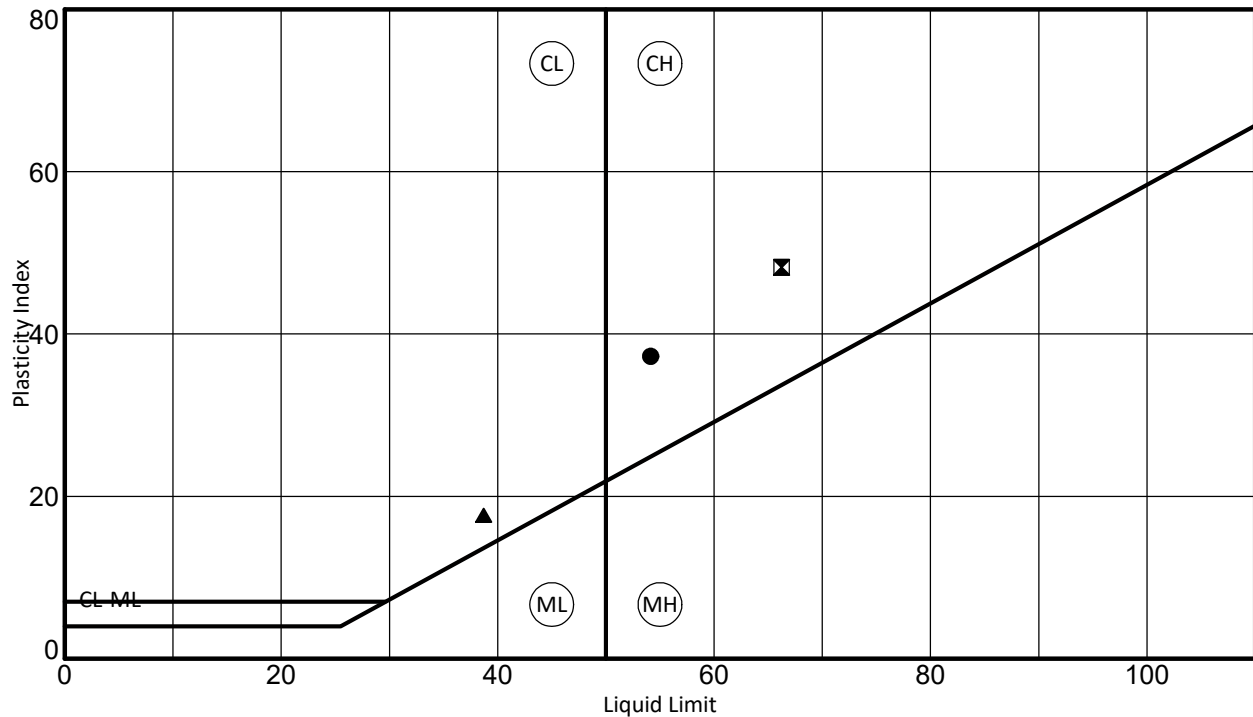


Project No: 66W-0224

Client: CDM Smith

Project: Brunswick Co. NW WTP

City/State: Leland, NC



Boring No.	Depth	LL	PL	PI	Fines	Classification	% Natural Water Content
● B-401	39.0' - 40.5'	54	17	37	56.5	SANDY FAT CLAY (CH)	26.0
⊠ B-401	64.0' - 65.5'	66	18	48	96.3	FAT CLAY (CH)	25.1
▲ B-402	28.0' - 29.5'	39	21	18	50.9	SANDY LEAN CLAY (CL)	26.4

## **Appendix B**

### **Stormwater Permit**



ROY COOPER

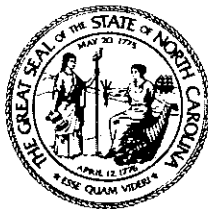
Governor

MICHAEL S. REGAN

Secretary

S. DANIEL SMITH

Director



NORTH CAROLINA  
Environmental Quality

September 27, 2019

Brunswick County Public Utilities  
Attn: John Nichols, Director  
PO Box 249  
Bolivia, NC 28422

**Subject: Stormwater Permit COC No. SWG04 040114  
Northwest WTP Concentrate Discharge Line  
General Permit - Utility Project  
Brunswick County**

Dear Mr. Nichols:

On September 20, 2019, the DEMLR received your Express permit application for a Utility Line Project to be covered under the State Stormwater General Permit Number SWG040000. In accordance with your application, we are forwarding herewith the subject Certificate of Coverage Number SWG04 040114, along with a copy of the General Permit, for the construction of a linear utility line project with associated incidental built-upon area. The General Permit is issued pursuant to the requirements of North Carolina General Statute 143-215.1 and Title 15A NCAC 2H .1000, the stormwater management rules.

Please take notice that this Certificate of Coverage is not transferable except by action of and approval by DEMLR. The DEMLR may require modification or revocation and reissuance of the Certificate of Coverage.

This permit does not affect the legal requirement to obtain other permits which may be required by the Division of Energy, Mineral and Land Resources, the Division of Water Resources, Coastal Area Management Act, or any other Federal, State, or Local agency, law, rule, or ordinance, having jurisdiction.

If you have any questions concerning this permit, or if you need additional information regarding this matter, please contact Linda Lewis at (910) 796-7215 or via email at [linda.lewis@ncdenr.gov](mailto:linda.lewis@ncdenr.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "S. Daniel Smith".

For S. Daniel Smith, Director  
Division of Energy, Mineral and Land Resources

GDS/arl: G:\\\\Stormwater\\Permits & Projects\\SWG04 Utility\\040114 COC-SWG04\\2019 09 permit 040114

Enclosures: Copy of General Permit SWG 040000  
Copy of Notice of Intent

cc: Kelly Boone, PE, CDM Smith (5400 Glennwood Ave. Suite 400 Raleigh NC 27612)  
NCDOT District Engineer  
Brunswick County Engineering  
Wilmington Regional Office Stormwater File



North Carolina Department of Environmental Quality | Division of Energy, Mineral and Land Resources  
Wilmington Regional Office | 127 Cardinal Drive Extension | Wilmington, North Carolina 28405  
910.796.7215

STATE OF NORTH CAROLINA  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF ENERGY, MINERAL AND LAND RESOURCES

**STATE STORMWATER MANAGEMENT GENERAL PERMIT NO. SWG040000**

**CERTIFICATE OF COVERAGE NO. SWG040114**

LINEAR UTILITY LINE PROJECT AND  
ASSOCIATED INCIDENTAL BUILT-UPON AREA

In compliance with the provisions of North Carolina General Statute 143-215.1, as amended, other lawful standards and regulations promulgated and adopted by the North Carolina Environmental Management Commission, and 15A NCAC 2H.1000, the Stormwater rules,

***Brunswick County Public Utilities***

is hereby authorized to construct 714 square feet of built-upon area incidental to the proposed utility line installation located at

***Northwest WTP Concentrate Discharge Line***

*Line begins at 3954 Clearwell Drive ends at Hooper Road, Leland, Brunswick County*

and to discharge stormwater to receiving waters designated as the Cape Fear River, classified C Sw, Stream Index #18-63 in the CPF17 River Basin, in accordance with the provisions of the General Permit for a Linear Utility Line, No. SWG040000, and the approved stormwater management plans and specifications, and other supporting data as attached and on file with and approved by the Division of Energy, Mineral and Land Resources and considered a part of this permit for the subject project.

This Certificate of Coverage shall become effective September 27, 2019 and shall remain in effect for the duration of the General Permit SWG040000.

Signed this the 27<sup>th</sup> day of September, 2019.

NORTH CAROLINA ENVIRONMENTAL MANAGEMENT COMMISSION



For S. Daniel Smith, Director  
Division of Energy, Mineral and Land Resources  
By Authority of the Environmental Management Commission



**Appendix C**  
**No Rise Certification**  
**Approval**





# North Carolina Department of Public Safety

## Emergency Management

Roy Cooper, Governor  
Erik A. Hooks, Secretary

Michael A. Sprayberry, Director

October 1, 2019

John M. Shirk, CZO  
Floodplain Administrator  
P. O. Box 249  
Bolivia, NC 28422

Subject: No-Rise Certification for Northwest WTP Expansion Discharge Pipeline, Cape Fear River, Brunswick County, North Carolina

Dear Mr. Shirk:

The North Carolina Department of Public Safety Division of Emergency Management Risk Management National Flood Insurance Program (NCNFIP) staff has received the Engineering No-Rise Certification Study for the proposed water treatment effluent discharge pipeline at cross-sections 223834 through 223859 of the Cape Fear River in Brunswick County. The study was prepared by CDM Smith, Seungho Song, P.E. The study is dated August 29, 2019. It was received in this office on September 24, 2019.

Based on the information provided, the NCNFIP review indicates the report meets the requirements of the Federal Emergency Management Agency's (FEMA) guidance for a no-rise certification. The NCNFIP finds no objection to the conclusion of no increase in base flood elevation or floodway elevation as contained in the report.

A floodplain development permit will be required prior to starting work.

If you have any questions or concerns with the items herein, please feel free to contact Dan Brubaker at (919) 825-2300, by email at [dan.brubaker@ncdps.gov](mailto:dan.brubaker@ncdps.gov) or at the address shown on the footer of this document.

**MAILING ADDRESS:**  
4218 Mail Service Center  
Raleigh NC 27699-4218  
[www.ncdps.gov](http://www.ncdps.gov)  
[www.ncfloodmaps.com](http://www.ncfloodmaps.com)



**RM OFFICE LOCATION:**  
4105 Reedy Creek Road  
Raleigh, NC 27607  
Telephone: (919) 825-2341  
Fax: (919) 825-0408

Sincerely,

A handwritten signature in black ink, appearing to read "John D. Brubaker". The signature is fluid and cursive, with the first name "John" and last name "Brubaker" clearly distinguishable.

John D. Brubaker, P.E., CFM  
NC State NFIP Coordinator  
Risk Management

cc: Eryn Futral, NC NFIP Eastern Planner

CDM Smith  
Attention: Seungho Song, P.E., CFM  
4600 Park Road, Suite 240  
Charlotte, NC 28209



