PROJECT MANUAL

FOR

NEW HANOVER
HOLLY SHELTER ROAD BUSINESS PARK – ROADWAY INFRASTRUCTURE IMPROVEMENTS – PHASE I

RFB# 26-0250

WILMINGTON, NORTH CAROLINA
NEW HANOVER COUNTY PROJECT

120 N. Boylan Avenue
Raleigh, NC 27603
919.828.0531
License Number: F-0115

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CERTIFICATIONS PAGE

A. Civil Specifications

I, Ana Wadsworth, P.E., hereby certify that Section(s) 1-3, Contract Requirements, Division 01, Division 03, Division 31, Division 32, and Division 33 of the Holly Shelter Road Business Park – Roadway Infrastructure Improvements Project Manual were prepared by me or under my direct supervision.

NORTH CAROLINA PROFESSIONAL SEAL 042389 ENGINEER ANASTASIA M. WADSWORTH

11/17/25

B. Utilities, Water and Sewer Specifications

I, Brian Oschwald, P.E., hereby certify that Section(s) 01, 03, 05, 09, 10, 26, 31, 32, 33, 40 and 43 from CFPUA technical specifications of the Holly Shelter Road Business Park – Roadway Infrastructure Improvements Project Manual were prepared by me or under my direct supervision.

NORTH CAROLINA PROFESSIONAL SEAL 28689 ENGINEER BRIAN J. P. OSCHWALD

Signed by: Brian Oschwald
ABD5410B7609A4AC...

11/17/2025

C. Structural Specifications

I, Min Hsu, P.E., hereby certify that Section 3 from CFPUA technical specifications of the Holly Shelter Road Business Park – Roadway Infrastructure Improvements Project Manual were prepared by me or under my direct supervision.

NORTH CAROLINA PROFESSIONAL SEAL ENGINEER MIN CHIANG HSU

11/17/2025

D. Electrical Specifications

I, Henry Boure, P.E., hereby certify that Section 26 from CFPUA technical specifications of the Holly Shelter Road Business Park – Roadway Infrastructure Improvements Project Manual were prepared by me or under my direct supervision.

NORTH CAROLINA PROFESSIONAL SEAL 029900 ENGINEER HENRY M. BOURNE

11/17/25

END OF SECTION

Section 1 – Request for Bid

Pursuant to GS 143-129, sealed bids addressed to **Lena Butler**, **Purchasing Supervisor**, **New Hanover County Finance Department**, **230 Government Center Drive, Wilmington, NC 28403** and marked **"RFB 26-0250 Holly Shelter Road Business Park – Roadway Infrastructure Improvements – Phase 1"** will be accepted until **3:00 PM EST, 01/15/2026** for the following work:

1.1 Project Details:

The project will generally consist of a new pump station including 12' ID wetwall, duplex submersible pumps with one spare pump, valve vault, prefabricated control building, backup generator, SCADA, and other associated appurtenances. Work will include entire full buildout for pump station installation, testing, and start up etc. In addition, a new onsite divided median roadway approximately 2750 LF and a new right turn lane approximately 800 LF off Holly Shelter Road. Work will include, clearing and grubbing, grading, paving, drainage, utilities, erosion control, and striping.

The bids will be publicly opened and read aloud following the latest time for receipt of bids in the New Hanover County Government Center - Meeting Room 134 @ 230 Government Center Drive, Wilmington, NC 28403.

Bids will be received for a Single Prime Contract. Bidders must be properly licensed under Chapter 87 of the North Carolina General Statues and pre-qualified in accordance with New Hanover County's pre-qualification ordinance.

Bidding Documents may be examined at the County's Finance Department Office located at 230 Government Center Drive, Wilmington, NC 28403 during regular office hours or by contacting lbutler@nhcgov.com or visit https://www.nhcgov.com/bids.aspx. Persons requesting shipment of documents shall bear the additional, non-refundable cost of shipment, if applicable.

The County will conduct a Pre-Bid meeting at 3:00 PM on 12/2/2025. The meeting will be held in multipurpose room 137 located at 230 Government Center Drive, Wilmington, NC 28403, with access to the proposed site as well.

A Bid Bond Equal to 5% of the base bid price is required by all bidders. The successful bidder will be required to provide Performance and Payment bonds equal to one hundred percent (100%) of the contract price.

No Bid may be withdrawn for a period of thirty (30) days after bid opening date.

The bidder shall make good faith efforts, as defined in the bid specifications, to subcontract 10% of the dollar value of the single prime contract to businesses owned and controlled by minorities.

The County reserves the right to waive any informalities, to reject any or all bids, and to accept that Bid or Bids which is in the best interest of the County

Section 2 - Instructions to Bidders

2.1 SCHEDULE

Advertisement	**Monday, November 17, 2025**
Pre-Bid Meeting	**Tuesday, December 2, 2025 @ 3:00 PM**
Deadline for Questions	**Tuesday, December 16, 2025 @ 3:00 PM**
County Response to Questions	**Friday, December 19, 2025 @ 5:00 PM**
Deadline for Receipt of Bids	**Thursday, January 15, 2026 @ 3:00 PM** **Finance Department Office** 230 Government Center Drive, Wilmington, NC 28403

2.2 PRE-BID CONFERENCE

The County will conduct a Pre-Bid meeting at 3:00 PM on Tuesday, December 2, 2025. The meeting will be held in multipurpose room 137 located at 230 Government Center Drive, Wilmington, NC 28403. 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 bidding documents.

It is requested that prospective Bidders review the bidding documents and submit their questions to Lena Butler by emailing lbutler@nhcgov.com no later than **3:00 PM on 12/16/2025**. Responses will be posted as an addendum no later than 12/19/2025 @ 5:00 PM.

2.3 PREQUALIFICATION REQUIRED

All prime bidders on this project must be pre-qualified in accordance with New Hanover County's Pre-qualification Ordinance in order to bid. If prime contractor will be using a subcontractor for the pump station (utilities and electrical) construction, his or her subcontractor must be prequalified as well. Bids will not be accepted unless the bidder is pre-qualified.
Pre-qualification applications may be obtained at the County's Legal Department, 230 Government Center Drive, Suite 155, Wilmington, NC 28403 or by visiting the County's website @ https://www.nhcgov.com/316/Contractors-Approved-for-Bidding.

2.4 BID

Bids shall be made in strict accordance with the "Bid Package" provided herein, and all blank spaces for bids, alternates and unit prices shall be properly filled in. When requested alternates are not bid, the bid may be considered incomplete. Any modifications to the "Bid Package" (including alternates and/or unit prices) may disqualify the bid and cause the bid to be rejected.

The Bidder agrees that the "Bid Package" detached from specifications will be considered and will have the same force and effect as if attached thereto. Photocopied or faxed bids will not be accepted. Numbers shall be stated both in writing and in figures for the base bids and alternates.

Unit prices quoted in the "Bid Package" shall include overhead, profit and taxes and shall be the full compensation for the Bidder's cost involved in the work.

Bids may be rejected if they show omissions, alterations of form, additions not called for, conditional bids, or irregularities of any kind.

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 G.S. 143-128.2(c) and G.S. 143-128.2(f). Failure to comply with these requirements is grounds for rejection of the bid.

2.5 EXAMINATION OF CONDITIONS

By submitting a bid, the Bidder is affirming 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 and structures within and adjacent to the site, and has satisfied himself as to the nature of the work, the condition of existing buildings and structures, the conformation of the ground, the character, quality and quantity of the material to be encountered, 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, 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.

The Bidder further affirms by submitting a bid that he has satisfied himself as to the feasibility and meaning of the plans, drawings, specifications, and other contract documents for the construction of 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.

Reference is made to contract documents for the identification of those surveys and investigative 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/owner in preparing the documents. The County will make copies of all such surveys and reports available to the Bidder upon request. 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 County. Any reasonable request for access to the site will be honored by the County.

2.6 FAMILIARITY WITH LAWS

The bidders are assumed to have made themselves familiar with all laws, ordinances, and regulations which in any manner affect those engaged or employed in the work or the materials or equipment used in or upon the work, or in any way affects the conduct of the work.

2.7 CODES AND STANDARDS

Wherever reference is given to codes, standard specifications or other data published by regulating agencies including, but not limited to, national electrical codes, North Carolina state building codes, all relevant local authoritative jurisdictions, federal specifications, ASTM specifications, various institute specifications, etc., it shall be understood that such reference is to the latest edition including addenda published prior to the date of the contract documents.

2.8 PREPARATION OF BID

The bidder must submit their bid on the form herewith provided, and prices must be given both in writing and in figures (if requested). The bidder shall sign the bid form. **Bids not signed will be rejected**.

2.9 SUBMISSION OF BID FORM

2.9.1 Bid Surety

Each bid shall be accompanied by a deposit of cash, or a cashier's check, or a certified check on some bank or trust company insured by the Federal Deposit Insurance Corporation in an amount equal to not less than five percent (5%) of the bid. In lieu of making the cash deposit as above provided, such bidder may file a bid bond executed by a corporate surety licensed under the laws of North Carolina to execute such bonds, conditioned that the surety will upon demand forthwith make payment to the obligee upon said bond if the bidder fails to execute the contract in accordance with the bid bond. This deposit shall be retained if the successful bidder fails to execute the contract within 10 days after the award or fails to give satisfactory surety as required herein. (Bidders providing a bid bond in lieu of the cash deposit must use the attached bid bond form).

2.9.2 Bid Submission.

Must be on the form contained in this bid package and must be submitted in a sealed envelope properly marked "RFB 26-0250 Holly Shelter Road Business Park – Roadway Infrastructure Improvements – Phase I" and shall be addressed to County at the following address:

New Hanover County Finance Department
Attn: Lena Butler, Purchasing Supervisor
230 Government Center Drive
Wilmington, NC 28403

2.9.3 Unacceptable Bids

Bids submitted via telegraph, facsimile (FAX), telephone, and electronic means, including but not limited to e-mail, in response to the Request for Bids will not be acceptable.

2.10 LICENSING

The successful Contractor must be properly licensed to do the work in accordance with the North Carolina General Statutes (Chapter 87, Article 1). Upon request, bidders shall show evidence of proper license type and limitation.

2.11 LATE BIDS

Late bids will not be accepted. It is the responsibility of the Bidder to have his/her bid in the office specified in the Request for Bids by the time and date of the opening.

2.12 COMMUNICATION

After the bid issue date, all communications between the County and prospective Bidders regarding this bid request shall be in writing. Any inquires, requests for interpretation, technical questions, clarification, or additional information shall be directed to **Lena Butler, Purchasing Supervisor,** by emailing lbutler@nhcgov.com. All questions concerning this bid shall reference the bid number,

section number and paragraph. Questions and responses affecting the specifications of the bid will be provided by issuance of an Addendum to all known bidders of record. Questions are due **12/9/2025 at 3:00 PM.**

2.13 TIME OF BID OPENING

Bids shall be opened and read aloud. After the opening of bids, no bid may be withdrawn, except under the provisions of General Statute 143-129.1, for a period of thirty (30) days unless otherwise specified. Should the successful bidder default and fail to execute a contract, the contract may be awarded to the next lowest and responsible bidder**. Bids will be publicly opened and real aloud on 12/17/2025 @ 3:00 PM at the New Hanover County Government Center - Meeting Room 134 located at** 230 Government Center Drive, Wilmington, NC 28403.

2.14 WITHDRAWAL OF BIDS

Bidders may withdraw or withdraw and resubmit their bid at any time prior to the closing time for receipt of bids. No bid may be withdrawn after the scheduled closing time for receipt of bids for a period of thirty (30) days except as provided under G.S. 143-129.1 which allows a bidder to withdraw his/her bid from consideration after the bid opening without forfeiture of his/her bid security if the price bid was based upon a mistake, which constituted a substantial error, provided the bid was submitted in good faith, and the bidder submits credible evidence that the mistake was clerical in nature as opposed to a judgment error, and was actually due to an unintentional and substantial arithmetic error or an unintentional omission of a substantial quantity of work, labor, apparatus, supplies, materials, equipment, or services made directly in the compilation of the bid, which unintentional arithmetic error or unintentional omission can be clearly shown by objective evidence drawn from inspection of the original work papers, documents or materials used in the preparation of the bid sought to be withdrawn.

2.15 AWARD OF CONTRACT

The award of any contract resulting from this bid will be made to the lowest responsible bidder, taking into consideration quality, performance and time specified in the bid for the performance of the contract. In the event the lowest responsible, responsive bid is in excess of the funds available for the project, the County may enter into negotiations with the lowest responsible, responsive bidder and may make reasonable changes in the plans and specifications to bring the price within the funds available for the project and award the bid. If such negotiations prove to be unsuccessful, the County will re-advertise the project after making such changes in the plans and specifications as may be necessary to bring the cost of the project within the funds available.

2.16 SUBSTITUTIONS

In accordance with the provisions of G.S. 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/owner with sufficient data to confirm material, product, or equipment equality. Proposed substitutions submitted after this time will be considered only as a potential change order.

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, 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, and test results.

e. Other pertinent data including data requested by the Designer/owner to confirm product equality.

If a proposed material, product, or equipment substitution is deemed equal by the Designer/owner to those specified, all bidders of record will be notified by Addendum***.***

2.17 PERFORMANCE BOND

Each contractor shall furnish a performance bond executed by a surety company authorized to do business in North Carolina. The bonds shall be in the full contract amount. Bonds shall be executed in the form included with these specifications. The bond shall be countersigned by an authorized agent of the bonding company who is licensed to do business in North Carolina.

2.18 PAYMENT BOND

Each contractor shall furnish a performance bond executed by a surety company authorized to do business in North Carolina. The bonds shall be in the full contract amount. Bonds shall be executed in the form included with these specifications. The bond shall be countersigned by an authorized agent of the bonding company who is licensed to do business in North Carolina.

2.19 ADDENDA

Any addenda to specifications issued during the time of bidding are to be considered covered in the bid and in closing a contract they will become a part thereof. 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 in, or omission from, the drawings or documents or should he be in doubt as to their meaning, he or she shall at once notify Lena Butler by emailing lbutler@nhcgov.com who will send written instructions in the form of addenda to all bidders. Notification should be no later than seven (7) days prior to the date set for receipt of bids. Neither the owner nor the designer/owner will be responsible for any oral instructions.

All addenda should be acknowledged by the bidder(s) on the Bid Form. However, even if not acknowledged, by submitting a bid, the bidder has certified that he has reviewed all issued addenda and has included all costs associated within his bid.

2.20 LIQUIDATED DAMAGES

Contractor understands and acknowledges that the Contractor shall pay to the County the sum of $750 Dollars per day for each and every calendar day of unexcused delay in achieving Substantial Completion. Any sums due and payable hereunder may be deducted from any payments owed to the contractor by the Owner or collected from the sureties, whichever is deemed expedient by the Owner

2.21 SUBSTANTIAL COMPLETION

Contractor understands and acknowledges that substantial completion means the project is fit for its intended use. The onsite roadway and the offsite roadway improvements are completed and have been approved by NCDOT; all utilities and the pump station has been approved and activated by Cape Fear Public Utility Authority (CFPUA).

2.22 COMPLIANCE WITH BID REQUIREMENTS

Failure to comply with these provisions or any other provisions of the General Statutes of North Carolina will result in rejection of bid.

2.23 E-VERIFY

Pursuant to N.C.G.S. § 143-48.5 (Session Law 2014-418), Contractor shall fully comply and certify compliance of each of its subcontractors with Article 2 of Chapter 64 of the N.C. General Statutes, including the requirement for each employer with more than 25 employees in North Carolina to verify the work authorization of its employees through the federal E-Verify system. County shall be provided affidavits attesting to Contractor's and subcontractor's compliance or exemption. Violation of the provision, unless timely cured, shall constitute a breach of Contract.

2.24 RIGHT TO REJECT BIDS

The County reserves the right to waive any or all informalities, to reject any or all bids, and to accept that Bid or Bids which is in the best interest of the County

2.25 CERTIFICATE OF AUTHORITY

Subject to several statutory exceptions, a business entity incorporated or organized in a state other than North Carolina must obtain a certificate of authority from the North Carolina Secretary of State prior to transacting Business in the State. See G.S. 55-15-01(a) (business corporations); G.S. 55A-15-01(a) (nonprofit corporations); G.S. 57D-7-01(a) (limited liability companies); G.S. 59-902(a) (limited partnerships); G.S. 59-91(a) (registered limited liability partnerships); G.S.55B-16(a) (professional corporations). When the requirement applies, the foreign entity transacting Business in the State is responsible for obtaining a certificate of authority—not the domestic (i.e., North Carolina) corporations, public entities, or individuals with whom the foreign entity might contract.

Section 3 – Bid Form

Holly Shelter Road Business Park – Roadway Infrastructure Improvements – Phase I
RFB# 26-0250

Bid Form

Deadline for Receipt of Bids: 3:00 P.M. EST, January 15, 2026

Name of Bidder:_____

Bidder's Address:_____

_____

Bidders Phone Number:_____

Bidder's Email:_____

Bidder's License Number:_____

The undersigned, as bidder, hereby declares that the only person or persons interested in this bid as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this bid or in the contract to be entered into; that this bid is made without connection with any other person, company or parties making a bid or bid; and that it is in all respects fair and in good faith without collusion or fraud. 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 further declares that he and his subcontractors have fully complied with NCGS 64, Article 2 in regard to E- Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143- 129(j).

Performance and Delivery Time:
The Contractor shall begin work on or before the "commence work" date specified in the **NOTICE TO PROCEED** issued by the Owner and as set forth in the plans, specifications, and proposal. All work shall be completed in all events on or before the date set forth in the **NOTICE TO PROCEED.**

Should the undersigned be required to perform work over and above that required by the Contract Documents or should he/she be ordered to omit work required by the Contract Documents, he/she will be paid an extra, or shall credit the Owner, as case may be on the basis of unit prices stated herein.

The Contractor is hereby notified that the Contract will contain a Liquidated Damages Clause.

Section 3 – Bid Form (continued)

The undersigned, as bidder, proposes and agrees if this bid is accepted, to contract with the New Hanover County for the furnishing of all materials, equipment, and labor necessary to complete the construction of the work described in these documents in full and complete accordance with plans, specifications as designed by The Wooten Company dated November 7, 2025, contract documents, and to the full and entire satisfaction of New Hanover County for the sum of:

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Price
	Base Bid Costs				
1	Mobilization (5% Max of Total Base Bid)	LS	1		$
	Main Internal Spine Road (100'ROW)				
2	Erosion Control	LF	1		$
3	6" Perforated Underdrain Pipe	LF	1,500		$
4	Traffic Control	LS	1		$
5	Clearing and Grubbing	LS	1		$
6	Remove existing Storm Drainage Pipe	LF	50		$
7	Grading/Earthwork	LS	1		$
8	Undercut (Removal and Replacement) - Roadway	CY	3,200		$
9	Geotextile Underliner	SY	9,500		$
10	Concrete Median Curb and Gutter (1'-6")	LF	4,500		$
11	Aggregate Base Course (8")	TON	3,500		$
12	3.0" S-9.5C Asphalt Concrete Surface Course	TON	2,000		$
13	4.0" I-9.0C Asphalt Concrete Intermediate Course	TON	2,750		$
14	Arch RCP (27"x44")	LF	77		$
15	Arch RCP (36" x 22.5")	LF	58		
16	24" RCP Class III	LF	305		$
17	Dual L2 Aluminum Box Culvert w/ Wingwalls (9'-2" x 3'-3")	LS	1		$
18	Pavement Striping (Thermoplastic)	LF	11,600		$
19	Direction Arrows (Thermoplastic)	EA	4		$
20	Stop Bars (24" wide)	LF	91		$
21	Signage	EA	6		$
22	Class 1 Rip Rap	TON	4,500		$
23	Class A Rip Rap	TON	90		$
24	Incidental Stone (#57)	TON	300		$
25	Seeding and Mulching	AC	2		$
	Offsite Road Improvements (Holly Shelter Rd right turn lane)				
26	Erosion Control	LS	1		$
27	Traffic Control	LS	1		$
28	Grading/Earthwork	LS	1		$
29	Undercut (Removal and Replacement) - Roadway	CY	1,500		$
30	Geotextile Underliner	SY	2,000		$
31	Remove Existing Storm Drainage Pipe	LF	30		$
32	Remove Existing Asphalt Pavement (5" – 7" inches)	SY	285		$
33	Mill Asphalt Pavement 1.5" depth x 10' wide	SY	800		$
34	Aggregate Base Course (8")	TON	900		$
35	3.0" S-9.5C Asphalt Concrete Surface Course	TON	235		$

36	4.0” I-9.0C Asphalt Concrete Intermediate Course	TON	500		$
37	4.0” B25.0C Asphalt Concrete Base Course (<6’ wide)	TON	10		$
38	Pavement Striping (Thermoplastic)	LF	5,190		$
39	Direction Arrows (Thermoplastic)	EA	2		$
40	Incidental Stone (#57)	TON	100		$
41	Seeding and Mulching	AC	0.5		$
	Holly Shelter Business Park Pump Station				
42	Pump Station	LS	1		$
	Holly Shelter Force Main and Water Main				
43	12” C900 PVC Force Main	LF	1,250		$
44	5’ ID Manhole and 2” Combination Air Release Valve	EA	1		$
45	Force Main Connection to New Force Main on Spine Rd	LS	1		$
46	5’ ID Manhole, Depth 10 – 12 ft	EA	1		$
47	5’ ID Manhole, Depth 12 – 14 ft	EA	9		$
48	10” C900 DR18 PVC Gravity Sewer Main, Depth 8 - 10 ft	LF	1,050		$
49	10” C900 DR18 PVC Gravity Sewer Main, Depth 10 – 12 ft	LF	652		$
50	10" C900 DR18 PVC Gravity Sewer Main, Depth 12 - 14 ft	LF	336		$
51	10" C900 DR18 PVC Gravity Sewer Main, Depth 14 - 16 ft	LF	119		$
52	16” C900 PVC Water Main	LF	2,900		$
53	16” Gate Valve and Box	EA	2		$
54	12” C900 PVC Water Main	LF	250		$
55	12” Gate Valve and Box	EA	4		$
56	Fittings	LBS	8,979		$
57	Fire Hydrant Assembly	EA	7		$
58	Water Main Connection to Ex. Water Main @ Holly Shelter Rd ROW	EA	1		$
59	Undercut Unstable Pipe Foundation (Removal and Replacement)	CY	1,000		$

_____

Numeric Dollar Amount Sum of proposal

_____

Written Dollar Amount Sum of proposal

Bidder’s Name:_____

Example

$ $10,000.48 ten thousand dollars and 48 cents

Numeric Dollar Amount Written Dollar Amount:

Section 3 – Bid Form (continued)

Subcontracts:

1. Bidders shall list all subcontractors they have selected to perform the following work: Utility and Electrical (water, sewer and pump station). Bidder shall also list the Work/Service to be performed, amount the subcontractor shall be paid, the percent of the total bid amount the subcontractor shall perform and the subcontractor's NC license permitting them to perform this type of work (if applicable). Bidders shall only list one subcontractor for each work/service to be performed.

2. Subcontractor Summary Table:

Subcontractor Name or indicate Self-Performing	Work/Service to be Performed	Amount to be Paid	Percentage of Total Bid	License Number (if applicable)

Bidder acknowledges by signing below that all subcontractors performing the work as described listed above. A contractor whose bid is accepted shall not substitute any person as a subcontractor in the place of the subcontractor listed in the original bid unless approved by the New Hanover County with justification from the contractor. Failure to comply with these terms may result in the bid being rejected based on non-responsiveness.

BIDDER SIGNATURE: _____

(To be submitted with all Bids/Proposals)

Iran Divestment Act Certification

Name of Contractor:_____

IRAN DIVESTMENT ACT CERTIFICATION
REQUIRED BY N.C.G.S. 147-86.55 et. seq.

As of the date listed below, the Contractor list4ed above or any of its subcontractors are not listed on the Final Divestment List created by the State Treasurer pursuant to N.C.G.S. 147-86.58.
The undersigned hereby certifies that he or she is authorized by the Contractor listed above to make the foregoing statement.

Signature:_____ Date:_____

Printed Name:_____ Title:_____

Notes to persons signing this form:

N.C.G.S. 147-86.59 requires this certification for bids or contracts with the State of North Carolina, a North Carolina local government, or any other political subdivision oif the State of North Carolina. The certification is required at the following times:

- When a bid is submitted
- When a contract is entered into (if the certification was not already made when the vendor made its bid)
- When a contract is renewed or assigned

N.C.G.S. 147-86.60 requires that contractors with the State, a North Carolina local government, or any other political subdivision of the State of North Carolina must not utilize any subcontractor found on the State Treasurer's Final Divestment List.

The State Treasurer's Final Divestment List can be found on the State Treasurer's website at the address www.nctreasurer.com/Iran and will be updated every 180 days.

Bid Bond Form

KNOW ALL MEN BY THESE PRESENTS THAT _____
_____as principal, and _____, as surety, who is duly licensed to act as surety in North Carolina, are held and firmly bound unto New Hanover County through _____ as obligee, in the penal sum of _____DOLLARS, lawful money of the United States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Signed, sealed and dated this _____day of _____20____

\WHEREAS, the said principal is herewith submitting proposal for and the principal desires to file this bid bond in lieu of making the cash deposit as required by G.S. 143- 129.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such that if the principal 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 days after the award of same to the principal, then this obligation shall be null and void; but if the principal fails to so execute such contract and give performance bond as required by G.S.143-129, the surety shall, upon demand, forthwith pay to the obligee the amount set forth in the first paragraph hereof. Provided further that the bid may be withdrawn as provided by G.S. 143-129.1

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

POWER OF ATTORNEY, BID BOND

PAGE FOR ATTACHING

BID BOND

POWER OF ATTORNEY

END OF SECTION

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:

_____
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

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)

By:

(Proprietorship or Partnership)

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

New Hanover County
Minority and/or Women Business Enterprise
(M/WBE) Program

Construction Guidelines and Affidavits

These instructions shall be included with each bid solicitation.

New Hanover County
Minority and/or Women Business Enterprise Program

Guidelines for M/WBE Participants

Policy Statement
It is the policy of New Hanover County that minority businesses, as defined by North Carolina General Statute 143-128, have maximum opportunity to participate in the performance of contracts and subcontracts funded in whole or in part with public funds. This includes all aspects of the County's contracting and procurement programs, including but not limited to construction projects, supplies and materials, as well as professional and personal service contracts.

Goals and Good Faith Efforts
Bidders responding to this solicitation shall comply with the M/WBE program by making Good Faith Efforts to achieve the following aspiration goals for participation.

PROJECT	MWBE
Holly Shelter Road Business Park – Roadway Infrastructure Improvements – Phase I	10%

Bidders must submit M/WBE information with their bids on the forms provided. Firms qualifying as "WBE" must be designated as 'women-owned business" by NC Department of Historically Underutilized Businesses (NCHUB). Firms qualifying as "MBE" must be certified in one of the other categories (i.e.: Black, Hispanic, Asian American, American Indian, Disabled, or Socially and Economically Disadvantaged) by NCHUB.

The NC Department of Transportation (NC DOT) and the NC Office for Historically Underutilized Businesses (HUB Office) have an agreement that allows companies certified through NC DOT's Disadvantaged Business Enterprise (DBE) program to use a simplified application process to become certified as a Historically Underutilized Business (HUB).

Please note: A contractor may utilize any firm desired; however, in order to count towards the County's minority participation goals, all MWBE vendors who wish to do business *as a minority* *or female* must be certified by NC HUB.

The Bidder shall make good faith efforts to encourage participation of M/WBEs prior to submission of bids in order to be considered as a responsive bidder. Bidders are cautioned that even though their submittal indicates they will meet the M/WBE goal, they should document their good faith efforts and be prepared to submit this information, if requested.

The M/WBE's listed by the Contractor on the Identification of Minority/Women Business Participation which are determined by the County to be certified shall perform the work and supply the materials for which they are listed unless the Contractors receive prior authorization from the County to perform the work with other forces or to obtain materials from other sources.

If a contractor is proposing to perform all elements of the work with his own forces, he must be prepared to document evidence satisfactory to the owner of similar government contracts where he has self-performed.

The Contractor shall enter into and supply copies of fully executed subcontracts with each M/WBE or supply signed Letter(s) of Intent to the Project Manager after award of contract and prior to Notice to Proceed. Any amendments to subcontracts shall be submitted to the Project Manager prior to execution.

Instructions

The Bidder shall provide with the bid the following documentation:

☐ Identification of Minority/Women Business Participation
(if participation is zero, please mark zero—Blank forms will be considered nonresponsive)

☐ Affidavit A (if subcontracting)

OR

☐ Identification of Minority/Women Business Participation
(if participation is zero, please mark zero—Blank forms will be considered nonresponsive)

☐ Affidavit B (if self-performing; must attest that bidder does not customarily subcontract work on this type of project—includes supplies and materials)

Within 72 hours or 3 business days after notification of being the apparent low bidder who is subcontracting anything must provide the following information:

☐ Affidavit C (if aspirational goals are met or are exceeded)

OR

☐ Affidavit D (if aspirational goals are not met)

After award of contract and prior to issuance of notice to proceed:

☐ Letter(s) of Intent or Executed Contracts

**With each pay request, the prime contractors will submit the Proof of Payment Certification, listing payments made to M/WBE subcontractors.

***If a change is needed in M/WBE Participation, submit a Request to Change M/WBE Participation Form. Good Faith Efforts to substitute with another M/WBE contractor must be demonstrated.

Minimum Compliance Requirements:

All written statements, affidavits, or intentions made by the Bidder shall become a part of the agreement between the Contractor and the County for performance of contracts. Failure to comply with any of these statements, affidavits or intentions or with the minority business guidelines shall constitute a breach of the contract. A finding by the County that any information submitted (either prior to awarding the contract or during the performance of the contract) is inaccurate, false, or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the County whether to terminate the contract for breach or not. In determining whether a contractor has made Good Faith Efforts, the County will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts.

NEW HANOVER COUNTY
Identification of Minority/Women Business Participation

I,_____,
(Name of Proposer)
do hereby certify that on this project, I will use the following minority/women business enterprises as subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work type	*M/WBE Category

*M/WBE categories: Black, African American (B), Hispanic (H), Asian American (A) American Indian (I), Female (F) Socially and Economically Disadvantaged (S) Disabled (D)

If you will not be utilizing M/WBE contractors, please certify by entering zero “0”

The total value of M/WBE business contracting will be ($)_____.

NEW HANOVER COUNTY AFFIDAVIT A – Listing of Good Faith Efforts

County of _____

(Name of Bidder)

Affidavit of_____

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 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 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 and included in the bid documents that provide assistance in recruitment of minority businesses.
- ❑ 5 – (10 pts) Attended Prebid meetings scheduled by the public 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.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority/Women Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(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/women 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 _____

SEAL

NEW HANOVER COUNTY --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____
(Name of Bidder)

I hereby certify that it is our intent to perform 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: _____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20___

Notary Public _____

My commission expires _____

NEW HANOVER COUNTY - AFFIDAVIT C - Portion of the Work to be Performed by M/WBE Firms

County of _____

(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 M/WBE businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% 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 72 hours after notification of being low bidder.

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

_____
(Project Name)

Project ID#_____ Amount of Bid: $_____

I will expend a minimum of _____% of the total dollar amount of the contract with M/WBE firms. Minority and Women 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.

Name and Phone Number	*M/WBE Category	Work description	Dollar Value

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

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with M/WBE 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:_____

SEAL

Signature:_____

Title:_____

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20_____

Notary Public_____

My commission expires_____

NEW HANOVER COUNTY AFFIDAVIT D – Good Faith Efforts

County of _____

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

If the goal of 10% participation by minority/women business 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)

Project ID#_____Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with M/WBE firms. Minority and Women 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 needed)

Name and Phone Number	*M/WBE 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 (S) Disabled (D)

Examples of documentation 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.

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with M/WBE 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:_____

SEAL

State of _____, County of _____

_____

Subscribed and sworn to before me this _____day of _____

_____20____

Notary Public_____

My commission expires _____

LETTER OF INTENT
M/WBE Subcontractor Performance

Please submit this form or executed subcontracts with M/WBE firms after award of contract and prior to issuance of notice to proceed.

PROJECT: _____
(Project Name)

TO: _____
(Name of Prime Bidder/Architect)

The undersigned intends to perform work in connection with the above project as a:

____Minority Business Enterprise _____Women Business Enterprise

The M/WBE status of the undersigned is certified the NC Office of Historically Underutilized Businesses (required). ___ Yes ___ No

The undersigned is prepared to perform the following described work or provide materials or services in connection with the above project at the following dollar amount:

Work/Materials/Service Provided	Dollar Amount of Contract	Projected Start Date	Projected End Date

_____
(Date)

_____ _____
(Address) (Name & Phone No. of M/WBE Firm)

_____ _____
(Name & Title of Authorized Representative of M/WBE) (Signature of Authorized Representative of M/WBE)

REQUEST TO CHANGE M/WBE PARTICIPATION

(Submit changes only if notified as apparent lowest bidder, continuing through project completion)

Project: _____

Bidder or Prime Contractor: _____

Name & Title of Authorized Representative: _____

Address: _____ Phone #: _____

_____ Email Address: _____

Total Contract Amount (including approved change orders or amendments): $_____

Name of subcontractor: _____

Good or service provided: _____

Proposed Action:

___Replace subcontractor
___Perform work with own forces

For the above actions, you must provide one of the following reasons (Please check applicable reason):

___ The listed MBE/WBE, after having had a reasonable opportunity to do so, fails or refuses to execute a written contract.

___The listed MBE/WBE is bankrupt or insolvent.

___The listed MBE/WBE fails or refuses to perform his/her subcontract or furnish the listed materials.

__The work performed by the listed subcontractor is unsatisfactory according to industry standards and is not in accordance with the plans and specifications; or the subcontractor is substantially delaying or disrupting the progress of the work.

If replacing subcontractor:

Name of replacement subcontractor: _____

The M/WBE status of the contractor is certified by the NC Office of Historically Underutilized Businesses (required). ___Yes ___No

Dollar amount of original contract $_____

Dollar amount of amended contract $ _____

Other Proposed Action:

___Increase total dollar amount of work
___Decrease total dollar amount of work
___Add additional subcontractor
___Other

Please describe reason for requested action: _____

_____

If adding additional subcontractor:*

The M/WBE status of the contractor is certified by the NC Office of Historically Underutilized Businesses (required). ___Yes ___No

**Please attach Letter of Intent or executed contract document*

Dollar amount of original contract $_____

Dollar amount of amended contract $ _____

Interoffice Use Only:

Approval _Y _N

Date_____

Signature_____

Pay Application No. _____

Purchase Order No. _____

Proof of Payment Certification
M/WBE Contractors, Suppliers, Service Providers

Project Name: _____

Prime Contractor: _____

Current Contract Amount (including change orders): $_____

Requested Payment Amount for this Period: $_____

Is this the final payment? ___Yes ___No

Firm Name	M/WBE Category*	Total Amount Paid from this Pay Request	Total Contract Amount (including changes)	Total Amount Remaining

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

Date: _____

Certified By: _____
Name

_____
Title

_____
Signature

Acknowledgement of Addenda

Bidder's Name:_____

Acknowledgment of Addenda

Addendum No. _____Dated_____ Addendum No. _____Dated_____

Addendum No. _____Dated_____ Addendum No. _____Dated_____

Attachments to Bid

1. Bid Bond
2. Certificate of Insurance
3. E-Verify Form
4. Identification of Minority/Women Business Participation and Affidavit A or Affidavit B

_____ _____

Signature Printed Name/Title

Date _____

Draft Contract

STATE OF NORTH CAROLINA

AGREEMENT

NEW HANOVER COUNTY

THIS CONTRACT made and entered into this _____ day of _____ 2025 by and between **NEW HANOVER COUNTY**, a political subdivision of the State of North Carolina, hereinafter referred to as "County"; and _____, a _____, hereinafter referred to as "Contractor."

W I T N E S S E T H :

That the Contractor, for the consideration hereinafter fully set out, hereby agrees with the County as follows:

1. Scope of Services: Contractor shall provide all labor, equipment and materials for the construction of the proposed infrastructure improvements for the Holly Shelter Business Park- Phase I. Construction consists of a new onsite divided median roadway, offsite right turn lane off Holly Shelter Road, new onsite pump station and associated appurtenances. The work will consist of but not limited to, clearing and grubbing, grading, drainage, utilities, erosion control, paving, striping, etc. as more specifically described in the documents and drawings by The Wooten Company attached herein as Exhibit A. All work shall be constructed to New Hanover, NCDOT, CFPUA and state standards as required.

2. Time of Performance. The term of this Agreement shall begin from receipt of Notice to Proceed, and all work shall be completed within Eighteen (18) Months of said Notice.

3. Payment. County hereby agrees to pay for the cost of this Contract not to exceed a sum of ____ ($_____) Dollars. Payment is contingent upon a final County inspection and acceptance of work or services.

4. Extra Work. County and Contractor shall negotiate and agree upon the value of any extra work or services prior to the issuance of a County Change Order or Renewal/Amendment (CRA) form covering said extra work or services. Such Change Order or CRA shall set forth the corresponding adjustment, if any, to the Contract Price and Contract Time.

5. Indemnity. Contractor shall indemnify and hold County, its officers, officials, agents, and employees, harmless against any and all claims, demands, causes of action, or other liability, including attorney fees, for any property damages, personal injuries or death arising out of, relating to, or resulting from the negligence, willful act, or omission of Contractor, its agents, employees and subcontractors in the performance of work or services.

6. Insurance. Before commencing any work or services, Contractor shall procure insurance in Contractor's name and maintain all insurance policies for the duration of the Contract of the types and in the amounts listed in this Contract. The insurance shall provide coverage against claims for injuries to persons or damages to property which may arise from operations or in connection with the performance of the work hereunder by Contractor, its agents, representatives, employees, or subcontractors, whether such operations by itself or anyone directly or indirectly employed by it.

7. Minimum Scope and Limits of Insurance

7.1. Commercial General Liability

7.1.1. Contractor shall maintain Commercial General Liability (CGL) and if necessary, Commercial Umbrella Liability (CUL) insurance with a total limit of not less than $1,000,000 for each occurrence for bodily injury and property damage.

If such CGL insurance contains a general aggregate limit, it shall apply separately to this work or services, or the general aggregate shall be twice the required limit.

7.1.2. CGL insurance shall be written on Insurance Services Office (ISO) "occurrence" form CG 00 01 covering CGL or its equivalent and shall cover the liability arising from premises, operations, independent contractors, products- completed operations, personal and advertising injury, and liability assumed under an insured contract, including the tort liability of another assumed in a business contract.

7.1.3. County, its officers, officials, agents, and employees are to be covered as additional insureds under the CGL by endorsement CG 20 10 and CG 20 37 or an endorsement providing equivalent coverage as respects to liability arising out of activities performed by or on behalf of Contractor; products and completed operations of Contractor; premises owned, leased or used by Contractor; and under the CUL, if any. The coverage shall contain no special limitations on the scope of protection afforded to County, its officers, officials, agents, and employees.

7.1.4. Contractor's CGL insurance shall be primary as respects County, its officers, officials, agents, and employees. Any other insurance or self-insurance maintained by County, its officers, officials, agents, and employees shall be in excess of and shall not contribute to Contractor's insurance.

7.2. Workers' Compensation and Employer's Liability

7.2.1. Contractor shall maintain Workers' Compensation as required by the general statutes of the State of North Carolina and Employer's Liability Insurance.

7.2.2. Employer's Liability, and if necessary, CUL insurance shall not be less than $1,000,000 for each accident for bodily injury by accident, $1,000,000 for each employee for bodily injury by disease, and $1,000,000 policy limit.

7.2.3. The insurer shall agree to waive all rights of subrogation against County, its officers, officials, agents, and employees for losses arising from work or services performed by Contractor for County.

7.3. Business Auto Liability

7.3.1. Contractor shall maintain applicable Business or Personal Auto Liability and, if necessary, CUL insurance with a limit of not less than $1,000,000 each accident. Personal auto insurance may be accepted in lieu of Business Auto Insurance.

7.3.2. Such insurance shall cover liability arising out of any auto, including owned, hired, and non-owned autos used in the performance of work or services.

7.3.3. Business Auto coverage shall be written on ISO form CA 00 01, or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide Contractual liability coverage equivalent to that provided in ISO form CA 00 01.

7.3.4. Contractor's Business Auto Liability insurance shall be primary as respects County, its officers, officials, agents, and employees. Any other insurance or self-insurance maintained by County, its officers, officials, agents, and employees shall be in excess of and shall not contribute to Contractor's insurance.

7.4 Contractors Pollution Liability

7.4.1 Contractor shall maintain Contractor's Pollution Liability covering losses caused by pollution incidents that arise from the operations of the Contractor described under the scope of services of this Contract.

7.4.2 Contractor's Pollution Liability shall apply to bodily injury; property damage, including loss of use of damaged property or of property that has not been physically injured; cleanup costs and defense, including costs and expenses incurred in the investigation defense, or settlement of claims. The policy of insurance affording these required coverages shall be written in an amount of at least $1,000,000 per claim, with an annual aggregate of at least $1,000,000.

7.4.3 Contractor's Pollution Liability shall include as an additional insured County, its officers, officials, agents, and employees.

7.4.4 If Contractor's Pollution Liability is written on a claims- made basis, the Contractor warrants that any retroactive date applicable to coverage under the policy precedes the effective date of this contract; and that continuous coverage will be maintained or an extended discovery period will be exercised for a period of three
(3) years, beginning from the time that work under the contract is complete.

7.4.5 If the scope of services as defined in this Contract includes the disposal of any hazardous or nonhazardous materials from the job site, the Contractor must furnish to County evidence of pollution liability insurance maintained by the disposal site operator for losses arising from the insured facility accepting waste under this contract. Coverage certified to County under this Contract must be maintained in minimum amounts of $1,000,000 per loss, with an annual aggregate of at least
$1,000,000.

7.5 Surety Bond - Performance & Payment Bonds. Contractor shall furnish and deliver to County a Payment Bond and a Performance Bond covering the faithful performance and completion of work included in this Contract and payment for all materials and labor furnished or supplied in connection with work included in this Contract. All bonds shall be issued and furnished to County prior to, and as a condition precedent to, commencement of the Work of this Contract. The Payment Bond and Performance Bond shall be furnished on behalf of Contractor, shall name County obligee, and shall be one hundred percent (100%) of the amount of the guaranteed repair and maintenance costs. Such bond(s) shall be solely for the protection of County. The Payment Bond and the Performance Bond shall be issued by a surety of financial

standing having a rating from A.M. Best Company equal to or better than A and must be included on the approved list of sureties issued by the United States Department of Treasury. The bond shall remain in effect at least one (1) year after the date when final payment is made. The surety bond must be in the form set forth in N.C.G.S. 44A-33, without any variations therefrom. Contractor shall provide surety bond wherein Surety waives notice of all modifications, omissions, additions, changes and advance payments or deferred payments in or about the Contract and agrees that the obligations undertaken by the Bond shall not be impaired in any manner due to any modifications, omissions, additions, changes, and advance payments or deferred payments. The surety bond must set forth no requirement that suit be initiated prior to the time stipulated in applicable North Carolina Statutes of Limitation.

7.6. Deductibles and Self-Insured Retentions

7.6.1. Any deductibles or self-insured retentions must be declared to and approved by County. At the option of County, either the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects County, its officers, officials, agents, or employees; Contractor shall procure a bond guaranteeing payment of deductibles or self-insured retentions.

7.6.2. Contractor shall be solely responsible for the payment of all deductibles to which all policies are subject, regardless of whether County is an insured under the policy.

7.7. Miscellaneous Insurance Provisions.

7.7.1. Any failure to comply with reporting provisions of the policies listed in this Contract shall not affect coverage provided to County, its officers, officials, agents, and employees.

7.7.2. Each insurance policy required by this Contract shall be endorsed to state that coverage shall not be canceled by either party except after thirty (30) days prior written notice has been given to County, 230 Government Center Drive, Ste. #125, Wilmington, NC 28403.

7.7.3. If Contractor's liability policies do not contain the standard ISO separation of insureds provision, or a substantially similar clause, they shall be endorsed to provide cross-liability coverage.

7.8. Acceptability of Insurers**.** Insurance is to be placed with insurers licensed to do business in the State of North Carolina with an A.M. Best's rating of no less than A VII unless County has granted a specific exemption.

7.9. Evidence of Insurance

7.9.1. Contractor shall furnish County with a certificate(s) of insurance, executed by a duly authorized representative of each insurer, showing compliance with the insurance requirements prior to commencing the work or services, and thereafter upon renewal or replacement of each certified coverage until all operations under this Contract are deemed complete.

7.9.2. Evidence of additional insured status shall be noted on the certificate of insurance as per requirements in this Contract.

7.9.3. With respect to insurance maintained after final payment in compliance with requirements, an additional certificate(s) evidencing such coverage shall be provided to County with final application for payment and thereafter upon renewal or replacement of such insurance until the expiration of the period for which such insurance must be maintained.

7.10. Subcontractors**.** Contractor shall include all subcontractors as insureds under its policies or shall furnish separate certificates for each subcontractor. All coverage for subcontractors shall be subject to all of the requirements stated herein. CGL coverage shall include independent contractors' coverage, and Contractor shall be responsible for assuring that all subcontractors are properly insured.

7.11. Conditions

7.11.1. County may, at its discretion and with approval of Risk Management and the Finance Department, accept letters of credit or custodial accounts in lieu of specific insurance requirements.

7.11.2. Contractor shall warrant the insurance contributing to the satisfaction of insurance requirements in this Contract shall not be canceled, terminated, or modified by Contractor without prior written approval of County.

7.11.3. Contractor shall promptly notify New Hanover County Facilities Management and New Hanover County Risk Management at (910) 798-7497 of any accidents arising in the course of operations under the Contract causing bodily injury or property damage.

7.11.4. County reserves the right to obtain complete, certified copies of all required insurance policies.

7.11.5. Failure of County to demand a certificate of insurance or other evidence of full compliance with these insurance requirements or failure of County to identify a deficiency from evidence that is provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

7.11.6. County does not represent that coverage and limits will be

adequate to protect Contractor and such coverage and limits shall not be deemed as a limitation of Contractor's liability under the indemnities granted to County in this Contract. If Contractor fails to maintain the insurance as set forth herein, County shall have the right to purchase said insurance at Contractor's expense. Contractor agrees to reimburse County for all expenses incurred for such purchase.

7.11.7. Contractor or its agent may apply to County for approval of higher deductibles based on financial capacity and quality of the carrier affording coverage.

7.11.8. County shall have the right to prohibit Contractor or any subcontractor from performing work or services and may withhold payment until required certificates has been received and approved by County.

8. Independent Contractor. The parties mutually agree that the Contractor is an independent contractor and not an agent of the County, and as such, the Contractor shall not be entitled to any County employment benefits, such as, but not limited to, vacation, sick leave, insurance, workmen's compensation, or pension and retirement benefits.

9. Default and Termination. If Contractor fails to prosecute the work or services with such diligence as will insure its completion within the Contract time, or if Contractor breaches any of the terms or conditions contained in this Contract and fails to cure said breach within two (2) days of County's mailing of Notice of Default, or otherwise fails to perform the work or services hereunder to the County's reasonable satisfaction, County may terminate this Contract forthwith. Upon termination, County may, without prejudice to an action for damages or any other remedy, take the prosecution of the work or services out of the hands of Contractor. County may enter into another Contract for the completion of the Contract or use such other methods as may be required for the completion of the Contract. County may deduct all costs of completing the Contract from any monies due or which may become due to Contractor. In the event this Contract is terminated prior to completion of the services by the Contractor, the Contractor shall be paid for work or services performed to the date of termination. In no event will the amount due Contractor in the event of termination exceed that amount set forth in this Contract. Nothing contained herein shall prevent the County from pursuing any other remedy, which it may have against Contractor, including claims for damages.

10. Termination for Convenience. County may terminate this Contract for convenience at any time and without cause. Upon receipt of notice, Contractor shall immediately discontinue providing the work or service and, if applicable, the placing any orders for any materials, facilities, and supplies in connection with the performance of the work or services of this Contract.

11. Non-appropriation. All funds for payment by County under this Contract are subject to the availability of an annual appropriation of the New Hanover County Board of Commissioners for the services provided under the Contract, County will terminate the Contract, without termination charge or liability, on the last day of the then- current fiscal year or when the appropriation made for then-current year for the services/items covered by this Contract is spent, whichever occurs first. If at any time funds are not appropriated for the continuance of this Contract, cancellation shall be accepted by the Contractor on ten (10) business days' prior written notice, but failure to give such notice shall be of no effect and County shall not be obligated under this Contract beyond the date of termination.

12. Non-waiver of Rights. The parties mutually agree that either party's failure to insist upon the strict performance of any provision of this Contract or to exercise any right based upon a breach thereof, or the acceptance of any performance during such breach, shall not constitute a waiver of any rights under this Contract.

13. Conflict of Interest. No paid employee of the County shall have a personal or financial interest, direct or indirect, as a contracting party or otherwise, in the performance of this Contract.

14. Subcontracts. The Contractor shall utilize no subcontractors for performing the work or services to be performed under this Contract without the prior written approval of the County.

15. Entire Contract. This Contract constitutes the entire understanding of the parties.

16. Binding Effect. This Contract shall be binding upon the parties hereto, and their heirs, successors, executors, administrators, and assigns.

17. Severability. If any provision of this Contract is held unenforceable, all remaining provisions of this Contract shall remain in full force and effect.

18. Inclusive Terms. Use of the masculine herein shall include the feminine and neuter, and the singular shall include the plural.

19. Governing Law. All of the terms and conditions contained herein shall be interpreted in accordance with the laws of the State of North Carolina.

20. E-Verify Compliance. Pursuant to N.C.G.S. 143-133.3, Contractor shall fully comply with the U.S. Department of Homeland Security employee legal status E-Verify requirements for itself and all its subcontractors. Violation of the provision, unless timely cured, shall constitute a breach of Contract.

21. Compliance with Federal Law. If applicable, all federally funded projects, loans, grants, and sub grants whether funded in part or wholly, must be procured in a manner that conforms with all applicable Federal laws, policies, and standards, including those under the Uniform Guidance (2 C.F.R. Part 200).

23. Notices. All notices required hereunder to be sent to either party shall be sent to the following designated addresses, or to such other address or addresses as may hereafter be designated by either party by mailing of written notice of such change of address, by Certified Mail, Return Receipt Requested:

To County:
New Hanover County Finance Department
Attn: Lena Butler
230 Government Center Drive
Wilmington, NC 28403

To Contractor:

24. Assignability. The parties hereto agree that this Contract is not transferable and shall not be assigned by either party without the written consent of the other party to this Contract.

25. Contract Under Seal. The parties hereto expressly agree to create a Contract under seal.

IN WITNESS WHEREOF, the parties have hereunto affixed their hands and seals, the day and year first above written and by authority duly given.

CONTRACTOR.

_____ (Seal)
President

ATTEST:

_____
Secretary

STATE OF _____

_____COUNTY

I, _____, a Notary Public of the State and County aforesaid, certify that _____ came before me this day and Acknowledged that (s)he is _____ of _____, a_____, and that by authority duly given and as the act of the corporation, the foregoing instrument was signed and sealed in its name by its President.

WITNESS my hand and official seal, this _____ day of _____, 202_____.

_____
Notary Public

My commission expires: _____

[REST OF PAGE INTENTIONALLY BLANK.
NEW HANOVER COUNTY DIGITAL SIGNATURE PAGE FOLLOWS EXHIBIT A AND IS INCORPORATED HEREIN BY REFERENCE]

SECTION 00 31 32

GEOTECHNICAL DATA

PART 1 GENERAL

1.01 INVESTIGATION

A. Soil and subsurface investigations were conducted at the site, the results of which are to be found in the reports issued by:
   1. Soil Consultant:
      S&ME
      3006 Hall Waters Dr. Ste 100
      Wilmington, NC 28405
   2. Report Title(s):
      Report Name: Geotechnical Exploration Report Holly Shelter Industrial Park Phase I Access Road
      Report Project No.: 24060053
      Report Date: July 29, 2024

      Report Name: Geotechnical Exploration Report Holly Shelter Lift Station
      Report Project No.: 24060053A
      Report Date: February 14, 2025

B. A copy of the report is appended.

C. Bidders are urged to examine soil investigation data and to make their own investigation of the site before bidding.

1.02 INTERPRETATION

A. Soil investigation data are provided only for information and the convenience of bidders. The Owner and Engineer disclaim any responsibility for the accuracy, true location, and extent of the soils investigation that has been prepared by others. They further disclaim responsibility for interpretation of that data by bidders, as in projecting soil-bearing values, rock profiles, soil stability, and the presence, level, and extent of underground water.

B. Soil investigation data are not part of the Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 31 32.10

GEOTECHNICAL REPORT

Geotechnical Exploration Report
Holly Shelter Industrial Park
Phase I Access Road
Castle Hayne, North Carolina
S&ME Project No. 24060053

PREPARED FOR:

Wooten
120 N. Boylan Avenue
Raleigh, North Carolina 27603

PREPARED BY:

S&ME, Inc.
3006 Hall Waters Dr, Ste 100
Wilmington, North Carolina 28405

July 29, 2024

July 29, 2024

Wooten
120 Boylan Avenue
Raleigh, North Carolina 27603

Attention: Ms. Ana Wadsworth, P.E., LEED
Practice Manager

Reference: **Geotechnical Exploration Report**
Holly Shelter Industrial Park – Phase I Access Road
Castle Hayne, North Carolina
S&ME Project No. 24060053

Dear Ms. Wadsworth:

S&ME, Inc. (S&ME) is pleased to submit this geotechnical exploration report for the Phase I access road that will be installed for the Holly Shelter Industrial Park located in Castle Hayne, North Carolina. Our services were performed in general accordance with proposal No. 24060053, dated April 3, 2024. This report presents a brief discussion of our understanding of the project, results of the exploration, and our geotechnical conclusions and recommendations regarding proposed pavement construction.

We appreciate the opportunity to work with you on this project. Please contact us with any questions, or if you need additional information.

Sincerely,

S&ME, Inc.

Jonathan M. Prevatte
Associate Project Manager

NORTH CAROLINA PROFESSIONAL SEAL 42575 ENGINEER NATHAN P. BUFFUM
7.29.24

Nathan Buffum, P.E.
Office Principal/Vice President
NC Registration No. 042575

Senior Reviewed By: Keith Brown, P.E. – Senior Vice President

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Appendices

Appendix I –Figures

Appendix II – Soil Test Boring Logs

Appendix III – Laboratory Results

1.0 Project and Site Information

We understand that New Hanover County is developing a new 320 acre industrial park off Holly Shelter Road in Castle Hayne, North Carolina. As part of Phase I of the development, an approximate 2,800-foot-long drive with associated utilities (water, sewer) will be constructed. In addition, Holly Shelter Road will be widened to allow for a deceleration lane into this phase of the industrial park. The widening will extend approximately 25 feet off the edge of pavement. The industrial access road upon full build out will be 110 feet in width.

2.0 Regional Geology

The site is located within the Coastal Plain Physiographic Province of North Carolina. The Coastal Plain Province is typically characterized by marine, alluvial, and aeolian sediments that were deposited during periods of fluctuating sea levels and moving shorelines. The soils and basal formations in the North Carolina Coastal Plain Physiographic Province are typical of those laid down in a shallow sloping sea bottom; interbedded sands and clays with irregular deposits of shells and layers of limestone and cemented sands. Alluvial sands, silts, and clays are typically present near rivers and creeks. Deposits of peat, organic silt, and organic clay are also typically present in or near current or former tidal marsh areas in the outer portion of the Coastal Plain.

3.0 Exploration Program

Our geotechnical field evaluation included the performance of seven (7) soil test borings labeled B-1 through B-7 to depths of 15 feet below existing site grade with the exception of boring B-1 which was extended to a depth of 20 feet to assess very soft clays at that depth. Approximate boring locations are shown on the attached Figure 2, Boring Location Plan. Boring locations were established in the field by S&ME using a hand-held GPS and should be considered approximate.

Soil test borings were drilled using a CME-45 ATV drill rig mounted on an all-terrain vehicle and were advanced using mud-rotary drilling techniques. Split-spoon soil samples were taken at approximate 2-foot intervals in the upper 10 feet and 5 foot thereafter. Standard penetration tests were conducted using an automatic hammer in conjunction with split-spoon sampling in general accordance with ASTM D1586.

Water level measurements were attempted immediately after drilling within all borings and after a period of about 24 hours. Borings were backfilled with auger cuttings after the 24 hour water measurements.

Test Boring Records and a Generalized Subsurface Profile (Figure 2) showing specific subsurface information from each boring are included in the Appendix. Stratification lines shown on Test Boring Records and the Subsurface Profile are intended to represent approximate depths of changes in soil types. Naturally, transitional changes in soil types are often gradual and cannot be defined at exact depths. Ground surface elevations shown on the boring logs and profiles were obtained from Google Earth and should be considered approximate.

3.1 Laboratory Testing

After the recovered soil samples were brought to our laboratory, a geotechnical professional examined and/or tested each sample to estimate its distribution of grain sizes, plasticity, organic content, moisture condition, color, presence of lenses and seams, and apparent geologic origin in general accordance with ASTM D 2488, *"Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)"*. The resulting classifications are presented on the logs, included in Appendix II. Similar soils were grouped into representative strata on the logs. The strata contact lines represent approximate boundaries between soil types. The actual transitions between soil types in the field are likely more gradual in both the vertical and horizontal directions than those which are indicated on the logs.

We performed the following quantitative ASTM-standardized laboratory tests on select split-spoon samples and the bulk samples, to help classify the soils and formulate our conclusions and recommendations. ASTM D 2216, "Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass", ASTM D 1140, "*Standard Test Methods for Amount of Material in Soils Finer than No. 200 (75-µm) Sieve"*, and ASTM D 4318, "*Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils",* to measure the plasticity of the soil.

Additionally, the bulk samples were tested for moisture-density relationship ("Proctor") using standard effort ASTM D 698, "Standard Test Methods for Laboratory Compaction Characteristics of Soil Using standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))" and were re-compacted to approximately 98 percent of the standard Proctor maximum dry density and tested in general accordance with ASTM D 1883, *"Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils"* to evaluate the subgrade support characteristics of the soils.

A summary of the laboratory procedures used to perform these tests is presented in Appendix III. The individual test results are also included in Appendix III.

4.0 Site Conditions

4.1 Surface Conditions

The project site currently consists of some short length grasses and a shallow ditch along the proposed widening off Holly Shelter Road. The site consists of recently clearcut areas and some wooded areas consisting of rows of pines with some underbrush along the proposed industrial park alignment. A large ditch runs parallel to the industrial park road alignment.

A surficial layer of topsoil, ranging from approximately 2 to 6 inches in thickness, was encountered at the test locations. Topsoil is typically a dark-colored soil material containing roots, fibrous matter, and/or other organic components, and is unsuitable for engineering purposes. Topsoil depths provided in this report are based on measurements at widely spaced test locations. Topsoil may be thicker or thinner in unexplored areas of the site. We note that the transition from topsoil to underlying natural soils may be gradual.

4.2 Subsurface Conditions

4.2.1 Upper Coastal Plain Sand Mixtures

A stratum of Coastal Plain sand mixtures were encountered underlying surficial materials in all borings. This stratum was encountered to the maximum exploration depth of 15 feet in borings B-2, B-4 , and B-5 and to depths ranging from 8 to 18 feet below the ground surface in the remaining borings. The soils encountered within this stratum were classified as silty sands (SM), clayey sands (SC) and poorly graded sand with silt (SP-SM). These soils were generally moist to wet with tan, brown to dark brown, and gray to dark gray coloration. SPT N-values in this stratum ranged from weight-of-hammer (WOH) to 19 blows per foot (bpf), and averaged 8 bpf indicating a generally loose with some very loose to medium dense layers.

4.2.2 Very Soft Clays

A stratum of very soft to soft clays were encountered underlying the Coastal Plain sand mixtures in borings B-1, B-3, B-6 and B-7. This stratum was encountered to the maximum exploration depth of 15 to 20 feet in the remaining. The soils encountered within this stratum were classified as sandy fat clays (CH). A layer of poorly graded sand with silt (SP-SM) was encountered within this stratum at test location B-3. These soils were generally wet with tan and gray to dark gray coloration. SPT N-values in this stratum were weight-of-hammer (WOH) indicating a generally very soft consistency.

4.2.3 Groundwater Levels

Groundwater level measurements were attempted in all borings at completion of drilling operations and after a period of approximately 24 hours. Groundwater water was observed in all borings at depths ranging from approximately 2 to 3 ½ feet below the ground surface. After a period of about 24 hours groundwater levels measured ranged from approximately 2 to 3 ½. Groundwater levels may fluctuate with seasonal changes and with rainfall and evaporation rates at other times of the year.

4.3 Summary of Laboratory Test Results

We performed laboratory testing on two bulk samples and select grab samples to further assess the engineering index properties of the subsurface soils. The laboratory soil index test results are presented in Appendix III and are summarized in the following tables.

Table 4-1: Summary of Laboratory Soil Index Testing Results

Boring/ (Sample No.)	Sample Depth Range (ft.-ft.)	Natural Moisture Content (%)	Silt/Clay Fines Content (%)	Atterberg Plasticity Limits			USCS Classification
				LL	PL	PI	
B-1/(S-1)	1 – 2.5	21.7	---	---	---	---	SM
B-1/(S-2)	3.5 – 5	21.4	17.4	---	---	---	SM
B-1/(S-3)	6 – 7.5	24.6	9.4	---	---	---	SP-SM
B-1/(S-5)	13.5 – 15	28.1	21.0	---	NP*	---	SM
B-1/(S-6)	18.5 – 20	26.8	77.9	36	18	18	CL
B-2/(S-1)	1 – 2.5	14.8	13.9	---	NP*	---	SM
B-2/(S-5)	13.5 – 15	27.8	27.8	---	NP*	---	SM
B-3/(S-4)	8.5 – 10	41.7	---	---	---	---	CH
B-4/(S-1)	1 – 2.5	26.4	---	---	---	---	SM
B-1 to B-3/(Bulk-1)	1 – 2	22.2	---	---	NP*	---	SM
B-5 to B-7/(Bulk-2)	1 – 2	23.7	---	---	NP*	---	SM

*NP = Non-Plastic

Table 4-2: Summary of Moisture-Density and CBR Test Results

Boring /(Sample No.)	Standard Proctor (ASTM D698)		CBR at 0.1 in. Penetration – 98% Compaction (%)
	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	
B-1 to B-3/(Bulk-1)	102.5	16.5	21.3
B-5 to B-7/(Bulk-2)	104.0	16.5	22.5

.

5.0 Conclusions and Recommendations

The following sections provide our conclusions and recommendations regarding site development. The recommendations herein are based upon review of test borings, our understanding of the proposed construction, engineering analyses, and experience with similar projects and subsurface conditions. If provided traffic loading or site grades are different from those indicated, we should be provided the opportunity to review and comment upon the recommendations of this report so that they may be confirmed, extended, or modified as necessary. We have also assumed that the roadway will require structural fill to reach finished soil grade. A site grading plan was not provided to S&ME at the time of this report.

5.1 Site Preparation

Initial site preparation should begin by clearing trees and vegetation, stripping of organics and topsoil, and any other deleterious materials for a lateral distance of at least 10 feet beyond the limits of new construction. Based on the borings topsoil thicknesses ranged from 3 to 6-inches in thickness. However, deeper or shallower depths may be encountered in unexplored areas of the site. Due to shallow groundwater and the potential for perched water conditions at the site, the contractor should use tracked equipment to remove organics to limit rutting of the near surface materials. Any voids created from stripping should be cleaned and filled with well-compacted structural fill.

Existing ditches will require stripping and mucking of soft sediment prior to fill placement. Ditches should be backfilled with select structural fill and compacted following our recommendations in section 6.2 of this report.

Since the site is relatively flat and wet, with groundwater measured within 2 to 3 feet from existing site grade, after stripping of the site temporary ditches are recommended to help dry the near surface soils and control water runoff. In addition, to help with site drainage and stormwater diverging during mass grading the contractor may consider installation of the sites designed stormwater pond and stormwater collection system prior to mass grading the site.

After the required initial site clearing has been completed, we recommend that the exposed subgrade soils be proofrolled with a 10-ton smooth-drum self-propelled roller operating in the static mode or a loaded dump truck to locate any areas of soft, very loose, or otherwise unsuitable surface conditions. Any area that ruts or pumps should be disced, moisture conditioned to near the soil's optimum moisture content by drying or wetting, and recompacted. Relatively low-consistency silty sands that will likely be unstable under proofroll were encountered. Discing, drying, and recompacting of these soils may be required to provide stability for structural fill placed above.

Please note that groundwater levels were encountered within 2 to 3 ½ feet of the existing ground surface. During fill placement operation, the roller in vibratory mode will likely draw the shallow groundwater into the loose near-surface soils potentially making unstable soil conditions and compaction difficult. If design grades are to remain near existing grades, compaction with the roller operating in static mode will likely be required. Alternatively, if site grades can be raised, other recommendations such as the use of woven or non-woven geotextile and geogrid materials may be needed in "bridging" out of the loose surface materials. In addition, French drains may be needed to permanently divert subsurface water to drainage features. The use of geotextiles and placement of French drains are usually recommended by our representatives, based on our visual observations and site conditions at the time of construction.

Based on the laboratory data, the on-site soils will be moisture sensitive and can deteriorate under repeated construction traffic causing the soils to become unstable during grading operations and during rain events. The contractor should seal off fill soils at the end of each day using a smooth drum roller and provide positive drainage to not allow water to pond. Temporary ditches during construction may be needed to help divert stormwater.

5.2 Structural Fill

We recommend that soils used as structural fill for the roadways meet the following requirements:

- Contain less than 5 percent organics.
- Be free of debris or other deleterious materials.
- Have a maximum particle size of 2 inches or less.
- Contain no more than 20 percent fines (silt/clay) (Unified Soil Classification of SP, SP-SM, SP-SC or SM)

Based on the near-surface soils encountered in the borings, the upper coastal plain soils should be suitable for use as structural fill and backfill with the exception of the very soft clays observed in the deeper portions of our borings. Groundwater is anticipated during construction. Excavations will likely require dewatering and the excavated soils removed from these excavations will likely require drying prior to reuse as compacted structural fill. Because of the sandy nature of the near surface soils, we would anticipate observed groundwater levels to fluctuate and perch in the surface soils with prevailing weather conditions. Stockpiling of soil may also be required for deeper excavations below the groundwater table to allow the soils to dry.

All new structural fill soil should be placed in 8 to 10-inch loose lifts and compacted to at least 95 percent of the standard Proctor maximum dry density (MDD) (AASHTO T99). Finished soil subgrade should be compacted to at least 100 percent of the materials standard Proctor MDD (AASHTO T99). The moisture content of structural fill should be maintained at +/- 3 percent of optimum moisture content during compaction.

If imported material is anticipated, S&ME should perform laboratory testing on the materials from the proposed borrow source prior to being imported to the site and used to evaluate the materials suitability for roadway support.

A qualified S&ME soil technician working under the supervision of the geotechnical engineer should observe fill placement and compaction. An appropriate number of soil density tests should be conducted to confirm that adequate fill compaction is achieved. In addition, stability of the soils should be observed by S&ME during fill placement. Construction equipment such as the smooth drum roller and be observed during compactive effort. Unstable areas should be identified and repaired prior to additional lifts of fill material being placed.

5.3 Pavements

Pavement design procedures are based on AASHTO "Guide for Design of Pavement Structures" (1993), "NCDOT Pavement Design Procedure AASHTO 1993 Method", and associated literature. Pavement designs are provided for two segments of road, the Phase I Access Road into the industrial park and the Holly Shelter turn-lane to be built during widening of Holly Shelter Road.

The design inputs for these segments are based on specifications and traffic data provided by Davenport Engineering, presented in an email dated July 10, 2024 which included traffic data plan labeled Figure 16 2041 Full Build Volumes. It is also based on experience-based assumptions. If the provided values change for anticipated traffic, please notify us so that our design analysis can be re-evaluated.

5.3.1 Phase I Access Road

The first segment, Phase I Access Road into the industrial park, is subject to various design parameters, traffic data, and in-situ conditions. As this segment of road is new construction which will require an increase in elevation of the existing land, it is assumed fill material will be utilized for subgrade materials. As such, a CBR design value of 10 was chosen based on experience of typical fill materials used by NCDOT on past projects.

As provided, the peak hour traffic data for this road is documented as 537 vehicle trips. Typically, for urban environments, peak hour traffic counts result in an 8% to 12% of total average daily traffic (ADT). If the peak hour traffic count is considered 8% of the ADT, then a minimum ADT value should be 6,713. Davenport Engineering utilized Institute of Transportation Engineers (ITE) Trip Generation Software to determine traffic counts and percentage truck values for the industrial park. Davenport Engineering considered the 2,390,000 sq ft. industrial park to be 50% industrial and 50% manufacturing within the software. The software determined a traffic count of 9,341 and 13% trucks. The 9,341 traffic count exceeds the 8% assumption of ADT at 6,713 and is therefore a conservative, but acceptable traffic count for design.

NCDOT pavement design procedures for 1993 AASHTO method requires truck traffic to be separated into DUALS and Truck, Trailer with Semi-Trailer (TTST). The ITE Trip Generation software does not differentiate between the two categories. As such, to be conservative with the design approach, and given that the NCDOT design procedures assume a minimum DUALS percentage of 2%, the trucks percentage of 13% was divided as 2% DUALS and 11% TTST.

Finally, NCDOT design procedures assume a minimum growth value of the traffic counts at 2%. As a conservative design approach, we utilized a 3% growth rate. Traffic data dictates the design life of pavement sections. Typically, NCDOT prefers a design life of 30 years, but the low traffic counts and secondary road classification for this pavement section provides for a 20-year design life. All other design inputs are requirements in the NCDOT design manual.

Table 6-1 outlines the design parameters, traffic inputs for pavement design, and the Equivalent Single Axle Loads (ESALs) calculation for the Phase 1 Access Road. Table 6-2 outlines the design criteria for the pavement design and required structural number (SN) calculation. Finally, Table 6-3 provides S&ME's design recommendations for this pavement section based on AASHTO 93 and NCDOT pavement design procedures.

Table 5-1 – Design Parameters, Traffic Inputs, and ESALs Calculations for Phase I Access Road

ESALs Calculation:

TRAFFIC DATA			
Initial Year:	2024	Projection Year:	2044
Initial Year ADT:	9,341	Proj. Yr. ADT:	16,851
% DUALS:	2	% TTST:	11
		Growth (%):	3.0

DESIGN PARAMETERS			
Construction Year:	2024	Des. Life (Years):	20
Constr. Year ADT:	9,341	20 YEAR ADT=	16,851
DIR %:	50	TERM. SI:	2.5
LANES/DIRECT:	1	LANE DIST:	1
Rural/Urban:	U	Freeway/Other:	O
DUAL FACT (flex).:	0.25	TTST FACT (flex):	0.8
DUAL FACT (rig).:	0.35	TTST FACT (rig):	1.2
Contr. Year ADT (Trucks)	1214		
		ADDITIONAL 18K:	0
DAILY 18K (flex):	592	TOTAL 18K (flex):	**4,323,779**
(rigid)	885	(rigid)	6462423

ADDITIONAL ESAL CALCULATIONS**

TTST		Duals	
Trucks Per Day	0	Trucks Per Day	0
Trucks Per Year	0	Trucks Per Year	0
Years	20	Years	20
Total TTST	0	Total Dual	0
ESALs	0	ESALs	0

Table 5-2 – Design Criteria and Required Structural No. Calculations for Phase I Access Road

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project Information

Date:	July 19, 2024
Site:	Phase 1 Access Roadway, Holly Shelter Industrial Park
Location:	Castle Hayne, NC
Project No.:	24060053
Engineer:	JMD



Asphalt

Stone Subbase

Design Criteria

CBR Design Value	10
Fine Grained?	Yes
Resilient Modulus (M_r) (psi)=	11,153
Road Type	Secondary
Design Equivalent (18 kip) Single Axle Loads (ESALs)	4,323,779
20 Year ADT	16,851
30 Year ADT	16,851
Design Life (years)	20
Initial Serviceability	4.2
Terminal Serviceability	2.5
Design Serviceability	1.7
Reliability (%)	85
Standard Normal Deviate (ZR)	-1.037
Standard Deviation	0.45

Required Structural Number **3.65**

Table 5-3 – Pavement Design Recommendations for Phase I Access Road

Design Option 1 – Full Depth Asphalt Design Option 2 – Asphalt over ABC					
Materials	**SN/Inch**	**Design 1 Thickness (in.)**	**Design 1 SN**	**Design 2 Thickness (in.)**	**Design 2 SN**
Asphalt Surface Course, S9.5C PG64-22	0.44	1.50	0.66	1.50	1.66
Asphalt Intermediate Course, I19.0C PG64-22	0.44	5.00	2.20	5.00	2.20
Asphalt Base Course, B25.0C PG64-22	0.30	4.00	1.20	0.00	0.00
ABC Stone Base	0.14	0.00	0.00	8.00	1.12
		Total SN:	4.06	Total SN:	3.98

All materials and construction methods should conform to the 2020 edition of the NCDOT "Standard Specifications for Roads and Structures." In-place density tests of subgrade soils and crushed stone base course should be performed by a qualified soils technician and the area should be thoroughly proof-rolled under his observation.

Asphaltic concrete should conform to Section 610 in the 2020 edition of the NCDOT "Standard Specifications for Roads and Structures." Sufficient testing and observation should be performed during pavement construction to confirm that the required thickness, density, and quality requirements of the specifications are achieved.

Although our analysis was based on traffic loading for a 20-year design life, our experience indicates that pavement maintenance is necessary due to normal weathering of the asphaltic concrete. Normal weathering (i.e., oxidation) causes asphalt to become more brittle resulting in loss of tensional strength. This loss in strength can cause minor cracking which provides access for water infiltration into the stone base and subgrade. As the degree of saturation of the subgrade increases, the strength of the subgrade decreases leading to pavement failure. Routine maintenance in the form of sealing, patching, and maintaining proper drainage is required to increase pavement life. It is not uncommon for overlays to be required after 10 to 12 years.

5.3.2 Holly Shelter Road Widening Turn Lane

The second segment, Holly Shelter Road Widening Turn Lane into the industrial park, is subject to various design parameters, traffic data, and in-situ conditions. As this segment of road will be built upon existing subgrade soils, field samples for laboratory testing were collected to determine the CBR value. At 1/3 the value of CBR laboratory testing, a CBR design value of 7 was chosen for analysis.

The peak hour traffic counts provided by Davenport Engineering indicate a 342 to 195 ratio of traffic entering the Phase I Access Road from Holly Shelter Road. This ratio provides a 64% split of traffic that will utilize the to be built turn lane. As such, at 64% of the 9,341 traffic count along the Phase I Access Road, the Holly Shelter Road Turn Lane ADT for analysis is 5,978.

While the traffic split may be 64% for utilization of the turn lane, given the proximity of I-40, S&ME believes that a greater portion of the truck traffic will come from I-40 and therefore utilize the turn lane. In order to conservatively account for a greater percentage of truck traffic approaching from I-40, S&ME assumed 80% of the total truck traffic will utilize the turn lane. Attributing 80% of the truck counts for DUALS and TTST at the new ADT value of 5,978, we determine truck percentages of 2.5% DUALS and 13.8% TTST for design inputs.

Finally, NCDOT design procedures assume a minimum growth value of the traffic counts at 2%. As a conservative design approach, we utilized a 3% growth rate. Traffic data dictates the design life of pavement sections. Typically, NCDOT prefers a design life of 30 years, but the low traffic counts and secondary road classification for this pavement section provides for a 20-year design life. All other design inputs are requirements in the NCDOT design manual.

Table 6-4 outlines the design parameters, traffic inputs for pavement design, and the Equivalent Single Axle Loads (ESALs) calculation for the Holly Shelter Road Widening Turn Lane. Table 6-5 outlines the design criteria for the pavement design and required structural number (SN) calculation. Finally, Table 6-6 provides S&ME's design recommendations for this pavement section based on AASHTO 93 and NCDOT pavement design procedures.

Table 5-4 – Design Parameters, Traffic Inputs, and ESALs Calculations for Holly Selter Road Widening Turn Lane

ESALs Calculation:

TRAFFIC DATA			
Initial Year:	2024	Projection Year:	2044
Initial Year ADT:	5,978	Proj. Yr. ADT:	10,784
% DUALS:	2.5	% TTST:	13.8
		Growth (%):	3.0

DESIGN PARAMETERS			
Construction Year:	2024	Des. Life (Years):	20
Constr. Year ADT:	5,978	20 YEAR ADT=	10,784
DIR %:	50	TERM. SI:	2.5
LANES/DIRECT:	1	LANE DIST:	1
Rural/Urban:	U	Freeway/Other:	O
DUAL FACT (flex).:	0.25	TTST FACT (flex):	0.8
DUAL FACT (rig).:	0.35	TTST FACT (rig):	1.2
Contr. Year ADT (Trucks)	974		
		ADDITIONAL 18K:	0
DAILY 18K (flex):	475	TOTAL 18K (flex):	**3,470,750**
(rigid)	710	(rigid)	5187529

ADDITIONAL ESAL CALCULATIONS**

TTST		Duals	
Trucks Per Day	0	Trucks Per Day	0
Trucks Per Year	0	Trucks Per Year	0
Years	20	Years	20
Total TTST	0	Total Dual	0
ESALs	0	ESALs	0

Table 5-5 – Design Criteria and Required Structural No. Calculations for Holly Selter Road Widening Turn Lane

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project Information

Date:	July 19, 2024
Site:	Holly Shelter Rd Widening at Phase 1 Roadway, Holly Shelter Industrial Park
Location:	Castle Hayne, NC
Project No.:	24060053
Engineer:	JMD



Asphalt

Stone Subbase

Design Criteria

CBR Design Value	7
Fine Grained?	Yes
Resilient Modulus (M_r) (psi)=	8,877
Road Type	Secondary
Design Equivalent (18 kip) Single Axle Loads (ESALs)	3,470,750
20 Year ADT	10,784
30 Year ADT	10,784
Design Life (years)	20
Initial Serviceability	4.2
Terminal Serviceability	2.5
Design Serviceability	1.7
Reliability (%)	85
Standard Normal Deviate (ZR)	-1.037
Standard Deviation	0.45
Required Structural Number	**3.85**

Table 5-6 – Pavement Design Recommendations for Holly Selter Road Widening Turn Lane

Design Option 1 – Full Depth Asphalt Design Option 2 – Asphalt over ABC					
Materials	**SN/Inch**	**Design 1 Thickness (in.)**	**Design 1 SN**	**Design 2 Thickness (in.)**	**Design 2 SN**
Asphalt Surface Course, S9.5C PG64-22	0.44	1.50	0.66	1.50	1.66
Asphalt Intermediate Course, I19.0C PG64-22	0.44	4.00	1.76	5.00	2.20
Asphalt Base Course, B25.0C PG64-22	0.30	5.00	1.50	0.00	0.00
ABC Stone Base	0.14	0.00	0.00	8.00	1.12
		Total SN:	3.92	Total SN:	3.98

All materials and construction methods should conform to the 2020 edition of the NCDOT "Standard Specifications for Roads and Structures." In-place density tests of subgrade soils and crushed stone base course should be performed by a qualified soils technician and the area should be thoroughly proof-rolled under his observation.

Asphaltic concrete should conform to Section 610 in the 2020 edition of the NCDOT "Standard Specifications for Roads and Structures." Sufficient testing and observation should be performed during pavement construction to confirm that the required thickness, density, and quality requirements of the specifications are achieved.

Although our analysis was based on traffic loading for a 20-year design life, our experience indicates that pavement maintenance is necessary due to normal weathering of the asphaltic concrete. Normal weathering (i.e., oxidation) causes asphalt to become more brittle resulting in loss of tensional strength. This loss in strength can cause minor cracking which provides access for water infiltration into the stone base and subgrade. As the degree of saturation of the subgrade increases, the strength of the subgrade decreases leading to pavement failure. Routine maintenance in the form of sealing, patching, and maintaining proper drainage is required to increase pavement life. It is not uncommon for overlays to be required after 10 to 12 years.

6.0 Limitations of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be

notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be retained to review the final plans and specifications to confirm that earthwork and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork construction activities.

Appendices

Appendix I –Figures



REFERENCE:
Image Courtesy of Google Earth

NORTH

Site Vicinity Map

Holly Shelter Industrial Park – Access Road
Wilmington, North Carolina

SCALE:	FIGURE NO.
AS SHOWN	1
DATE: 7/8/24	
PROJECT NUMBER 24060053	



Test Location Sketch

Holly Shelter Industrial Park – Access Road
Castle Hayne, North Carolina

SCALE: Not to Scale

DATE: 7/8/2024

PROJECT NUMBER 224060053

FIGURE NO. 2

Appendix II – Soil Test Boring Logs

♦ Summary of Exploration Procedures

The American Society for Testing and Materials (ASTM) publishes standard methods to explore soil, rock and ground water conditions in Practice D-420-18, "*Standard Guide for Site Characterization for Engineering Design and Construction Purposes.*" The boring and sampling plan must consider the geologic or topographic setting. It must consider the proposed construction. It must also allow for the background, training, and experience of the geotechnical engineer. While the scope and extent of the exploration may vary with the objectives of the client, each exploration includes the following key tasks:

- Reconnaissance of the Project Area
- Preparation of Exploration Plan
- Layout and Access to Field Sampling Locations
- Field Sampling and Testing of Earth Materials
- Laboratory Evaluation of Recovered Field Samples
- Evaluation of Subsurface Conditions

The standard methods do not apply to all conditions or to every site. Nor do they replace education and experience, which together make up engineering judgment. Finally, ASTM D 420 does not apply to environmental investigations.

♦ Reconnaissance of the Project Area

We walked over the site to note land use, topography, ground cover, and surface drainage. We observed general access to proposed sampling points and noted any existing structures.

Checks for Hazardous Conditions - State law requires that we notify the South Carolina (SC 811) before we drill or excavate at any site. SC 811 is operated by the major water, sewer, electrical, telephone, CATV, and natural gas suppliers of South Carolina. SC 811 forwarded our location request to the participating utilities. Location crews then marked buried lines with colored flags within 72 hours. They did not mark utility lines beyond junction boxes or meters. We checked proposed sampling points for conflicts with marked utilities, overhead power lines, tree limbs, or man-made structures during the site walkover.

♦ Boring and Sampling

Soil Test Boring with Mud-Rotary and Hollow Stem Auger Drilling

Soil sampling and penetration testing were performed in general accordance with ASTM D1586, "Standard Test Method for Penetration Test and Split Barrel Sampling of Soils. Mud-rotary drilling methods were used to advance the deep borings (greater than 5 feet) and hollow stem auger techniques were used to advance the shallow borings (5 feet or less). Soil samples were obtained with a standard 1.4 inch I. D., two-inch O. D., split barrel sampler. The sampler was first seated six inches to penetrate any loose cuttings, then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through the two final six inch increments was recorded as the penetration resistance (SPT N) value. The N-value, when properly interpreted by qualified professional staff, is an index of the soil strength and foundation support capability.

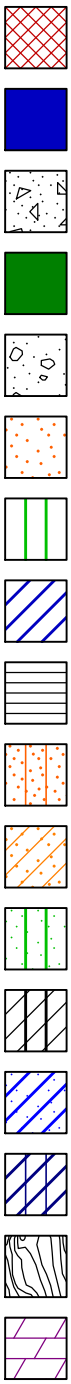
Water Level Determination & Backfilling of Borings

Subsurface water levels in the borings were measured at the end of the drilling and after a period of approximately 24 hours by measuring depths from the existing grade to the current water level using a measuring tape. After measurement of the water levels boring spoils were backfilled into the open bore hole to the existing ground surface.

LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

SOIL TYPES

(Shown in Graphic Log)



- Fill
- Asphalt
- Concrete
- Topsoil
- Gravel
- Sand
- Silt
- Clay
- Organic
- Silty Sand
- Clayey Sand
- Sandy Silt
- Clayey Silt
- Sandy Clay
- Silty Clay
- Partially Weathered Rock
- Cored Rock

WATER LEVELS

(Shown in Water Level Column)

▽ = Water Level At Termination of Boring
▼ = Water Level Taken After 24 Hours
◄ = Loss of Drilling Water
HC = Hole Cave

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Soft	0 to 2
Soft	3 to 4
Firm	5 to 8
Stiff	9 to 15
Very Stiff	16 to 30
Hard	31 to 50
Very Hard	Over 50

RELATIVE DENSITY OF COHESIONLESS SOILS

RELATIVE DENSITY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	Over 50

SAMPLER TYPES

(Shown in Samples Column)



- Shelby Tube
- Split Spoon
- Rock Core
- No Recovery

TERMS

Standard Penetration Resistance - The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586.

REC - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

RQD - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%.

Holly Shelter Industrial Park Access Road
Castle Hayne, North Carolina
S&ME Project No. 24060053

BORING LOG B-1

DATE DRILLED: **5/24/24**	ELEVATION:	NOTES:
DRILL RIG: **CME-45**	BORING DEPTH: **20.0 ft**	
DRILLER: **Mid. Atlantic/T. Bass**	WATER LEVEL: **2' ATD, 2.5' 24 hr**	
HAMMER TYPE: **Auto**	LOGGED BY: **J. Prevatte**	
SAMPLING METHOD: **Splti-Spoon**	NORTHING:	EASTING:
DRILLING METHOD: **Mud Rotary**		

DEPTH (feet)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	N VALUE
	TOPSOIL - 4 inches.						
	SILTY SAND (SM) - Very loose, dark brown, mostly fine sand, some low plasticity to non-plastic fines, moist.	1		3	2	2	4
	- - - Wet.	2		3	2	2	4
5	**POORLY GRADED SAND WITH SILT (SP-SM)** - Medium dense, tan and gray, mostly fine sand, few low plasticity to non-plastic fines, wet.	3		6	7	6	13
	- - - Loose.	4		4	3	4	7
10							
	SILTY SAND (SM) - Very loose, dark gray, mostly fine sand, some low plasticity to non-plastic fines, wet.	5		WOH	WOH	WOH	WOH
15							
	SANDY FAT CLAY (CH) - Very soft, gray, mostly medium to high plasticity fines, some fine sand, wet.	6		WOH	WOH	1	1
20	Boring terminated at 20 ft Target Depth						

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS
10 20 30 60 80

S&ME BORING LOG \ HOLLY SHELTER IND PARK ROAD SPT LOGS.GPJ \ LIBRARY 2011_06_28.GDT \ 6/13/24

NOTES:

1. ***THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.***
2. ***BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.***
3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

Holly Shelter Industrial Park Access Road
Castle Hayne, North Carolina
S&ME Project No. 24060053

BORING LOG B-2

DATE DRILLED: **5/24/24**	ELEVATION:	NOTES:
DRILL RIG: **CME-45**	BORING DEPTH: **15.0 ft**	
DRILLER: **Mid. Atlantic/T. Bass**	WATER LEVEL: **2' ATD, 2' 24 hr**	
HAMMER TYPE: **Auto**	LOGGED BY: **J. Prevatte**	
SAMPLING METHOD: **Splti-Spoon**	NORTHING:	EASTING:
DRILLING METHOD: **Mud Rotary**		

DEPTH (feet)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	N VALUE
	TOPSOIL - 3 inches.						
	SILTY SAND (SM) - Medium dense, dark brown, mostly fine sand, some low plasticity to non-plastic fines, moist.	1		4	5	6	11
	POORLY GRADED SAND WITH SILT (SP-SM) - Medium dense, tan and brown, mostly fine sand, few low plasticity to non-plastic fines, wet.	2		5	7	8	15
5	- - - Loose.	3		5	5	4	9
	- - - Very loose.	4		4	1	1	2
10							
	SILTY SAND (SM) - Very loose, dark gray, mostly fine sand, some low plasticity to non-platic fines, some clay lenses, wet.	5		WOH	WOH	1	1
15	Boring terminated at 15 ft Target Depth						

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS
10 20 30 60 80

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NOTES:

1. ***THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.***
2. ***BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.***
3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

Holly Shelter Industrial Park Access Road
Castle Hayne, North Carolina
S&ME Project No. 24060053

BORING LOG B-3

DATE DRILLED: **5/24/24**	ELEVATION:	NOTES:
DRILL RIG: **CME-45**	BORING DEPTH: **15.0 ft**	
DRILLER: **Mid. Atlantic/T. Bass**	WATER LEVEL: **2' ATD, 2' 24 hr**	
HAMMER TYPE: **Auto**	LOGGED BY: **J. Prevatte**	
SAMPLING METHOD: **Splti-Spoon**	NORTHING:	EASTING:
DRILLING METHOD: **Mud Rotary**		

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
		TOPSOIL - 5 inches.									
		SILTY SAND (SM) - Loose, dark brown, mostly fine sand, some low plasticity to non-plastic fines, moist.	▼		1		3	3	4		7
		POORLY GRADED SAND WITH SILT (SP-SM) - Medium dense, tan and brown, mostly fine sand, few low plasticity to non-plastic fines, wet.			2		5	6	6		12
5					3		3	8	9		17
		SANDY FAT CLAY (CH) - Very soft, gray and tan, mostly medium to high plasticity fines, some fine sand, wet.			4		WOH	WOH	WOH		WOH
10											
		POORLY GRADED SAND WITH SILT (SP-SM) - Very loose, dark gray, mostly fine sand, few low plasticity to non-plastic fines, wet.			5		WOH	WOH	WOH		WOH
15		Boring terminated at 15 ft Target Depth									

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

S&ME BORING LOG \ HOLLY SHELTER IND PARK ROAD SPT LOGS.GPJ \ LIBRARY 2011_06_28.GDT \ 6/13/24

NOTES:

1. ***THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.***
2. ***BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.***
3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

Holly Shelter Industrial Park Access Road
Castle Hayne, North Carolina
S&ME Project No. 24060053

BORING LOG B-4

DATE DRILLED: **5/24/24**	ELEVATION:	NOTES:
DRILL RIG: **CME-45**	BORING DEPTH: **15.0 ft**	
DRILLER: **Mid. Atlantic/T. Bass**	WATER LEVEL: **2.5' ATD, 3' 24 hr**	
HAMMER TYPE: **Auto**	LOGGED BY: **J. Prevatte**	
SAMPLING METHOD: **Splti-Spoon**	NORTHING:	EASTING:
DRILLING METHOD: **Mud Rotary**		

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
		TOPSOIL - 5 inches.									
		SILTY SAND (SM) - Very loose, dark brown, mostly fine sand, some low plasticity to non-plastic fines, moist.	▽		1		2	1	3		4
		POORLY GRADED SAND WITH SILT (SP-SM) - Medium dense, tan and brown, mostly fine sand, few low plasticity to non-plastic fines, wet.	▼		2		8	9	10		19
5					3		5	9	9		18
					4		3	6	8		14
10		- - - Very loose.									
					5		3	1	1		2
15		Boring terminated at 15 ft Target Depth									

10 20 30 60 80

S&ME BORING LOG \ HOLLY SHELTER IND PARK ROAD SPT LOGS.GPJ \ LIBRARY 2011_06_28.GDT \ 6/13/24

NOTES:

1. *THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.*
2. *BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.*
3. *STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.*
4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

Holly Shelter Industrial Park Access Road
Castle Hayne, North Carolina
S&ME Project No. 24060053

BORING LOG B-5

DATE DRILLED: **5/24/24**	ELEVATION:	NOTES:
DRILL RIG: **CME-45**	BORING DEPTH: **15.0 ft**	
DRILLER: **Mid. Atlantic/T. Bass**	WATER LEVEL: **3' ATD, 3.5' 24 hr**	
HAMMER TYPE: **Auto**	LOGGED BY: **J. Prevatte**	
SAMPLING METHOD: **Splti-Spoon**	NORTHING:	EASTING:
DRILLING METHOD: **Mud Rotary**		

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
		TOPSOIL - 6 inches.							
		SILTY SAND (SM) - Medium dense, dark brown, mostly fine sand, some low plasticity to non-plastic fines, moist.	1		2	2	1		3
		POORLY GRADED SAND WITH SILT (SP-SM) - Loose, tan and brown, mostly fine sand, few low plasticity to non-plastic fines, wet.	2		1	2	4		6
5		- - - Medium dense.	3		3	5	7		12
		- - - Loose.	4		5	5	4		9
10									
			5		4	3	2		5
15		Boring terminated at 15 ft Target Depth							

Water level: ▽ 3' ATD; ▼ 3.5' 24 hr

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

S&ME BORING LOG \ HOLLY SHELTER IND PARK ROAD SPT LOGS.GPJ \ LIBRARY 2011_06_28.GDT \ 6/13/24

NOTES:

1. *THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.*
2. *BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.*
3. *STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.*
4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

Holly Shelter Industrial Park Access Road
Castle Hayne, North Carolina
S&ME Project No. 24060053

BORING LOG B-6

DATE DRILLED: **5/24/24**	ELEVATION:	NOTES:
DRILL RIG: **CME-45**	BORING DEPTH: **15.0 ft**	
DRILLER: **Mid. Atlantic/T. Bass**	WATER LEVEL: **3.5' ATD, 3.5' 24 hr**	
HAMMER TYPE: **Auto**	LOGGED BY: **J. Prevatte**	
SAMPLING METHOD: **Splti-Spoon**	NORTHING:	EASTING:
DRILLING METHOD: **Mud Rotary**		

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
		TOPSOIL - 6 inches.									
		SILTY SAND (SM) - Loose, dark brown, mostly fine sand, some low plasticity to non-plastic fines, moist.			1		2	3	3		6
		POORLY GRADED SAND WITH SILT (SP-SM) - Medium dense, tan and brown, mostly fine sand, few low plasticity to non-plastic fines, wet.	▼		2		5	8	8		16
5		- - - Loose.			3		3	2	4		6
		SILTY SAND (SM) - Very loose, dark gray, mostly fine sand, some low to medium plasticity fines, some clay lenses, wet.			4		2	1	1		2
10											
		SANDY FAT CLAY (CH) - Very soft, gray and tan, mostly medium to high plasticity fines, some fine sand, wet.			5		WOH	WOH	WOH		WOH
15		Boring terminated at 15 ft Target Depth									

S&ME BORING LOG \ HOLLY SHELTER IND PARK ROAD SPT LOGS.GPJ \ LIBRARY 2011_06_28.GDT \ 6/13/24

NOTES:

1. ***THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.***
2. ***BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.***
3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

Holly Shelter Industrial Park Access Road
Castle Hayne, North Carolina
S&ME Project No. 24060053

BORING LOG B-7

DATE DRILLED: **5/24/24**	ELEVATION:	NOTES:
DRILL RIG: **CME-45**	BORING DEPTH: **15.0 ft**	
DRILLER: **Mid. Atlantic/T. Bass**	WATER LEVEL: **3.5' ATD, 3.5' 24 hr**	
HAMMER TYPE: **Auto**	LOGGED BY: **J. Prevatte**	
SAMPLING METHOD: **Splti-Spoon**	NORTHING:	EASTING:
DRILLING METHOD: **Mud Rotary**		

DEPTH (feet)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE
	TOPSOIL - 6 inches.							
	SILTY SAND (SM) - Loose, dark brown, mostly fine sand, some low plasticity to non-plastic fines, moist.	1		2	1	2		3
	CLAYEY SAND (SC) - Very loose, brown and tan, mostly fine sand, some low to medium plasticity fines, wet.	2		1	1	3		4
5	**POORLY GRADED SAND WITH SILT (SP-SM)** - Medium dense, tan and brown, mostly fine sand, few low plasticity to non-plastic fines, wet.	3		8	9	9		18
	SILTY SAND (SM) - Very loose, dark gray, mostly fine sand, some low to medium plasticity fines, some clay lenses, wet.	4		2	1	1		2
10	**SANDY FAT CLAY (CH)** - Very soft, gray and tan, mostly medium to high plasticity fines, some fine sand, wet.	5		WOH	WOH	WOH		WOH
15	Boring terminated at 15 ft Target Depth							

WATER LEVEL: ▼

STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS: 10 20 30 60 80

S&ME BORING LOG \ HOLLY SHELTER IND PARK ROAD SPT LOGS.GPJ \ LIBRARY 2011_06_28.GDT \ 6/13/24

NOTES:

1. *THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.*
2. *BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.*
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Appendix III – Laboratory Results

♦ Summary of Laboratory Test Procedures

Moisture Content Testing of Soil Samples by Oven Drying

Moisture content was determined in general conformance with the methods outlined in ASTM D 2216, "*Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil or Rock by Mass*." This method is limited in scope to Group B, C, or D samples of earth materials which do not contain appreciable amounts of organic material, soluble solids such as salt or reactive solids such as cement. This method is also limited to samples which do not contain contamination.

A representative portion of the soil was divided from the sample using one of the methods described in Section 9 of ASTM D 2216. The split portion was then placed in a drying oven and heated to approximately 110 degrees C overnight or until a constant mass was achieved after repetitive weighing. The moisture content of the soil was then computed as the mass of water removed from the sample by drying, divided by the mass of the sample dry, times 100 percent. No attempt was made to exclude any particular particle size from the portion split from the sample.

Wash No. 200 Sieve

A selected specimen of soils was washed over a No. 200 sieve after being thoroughly mixed and dried. This test was conducted in general accordance with ASTM D 1140, "*Standard Test Method for Amount of Material Finer Than the No. 200 Sieve*." Method B, using a hexametaphosphate solution to pre-soak the specimen for at least 2 hours, was used to prepare the sample. The sample is then washed through the No. 200 sieve the percentage by weight of material washed through the sieve was deemed the "percent fines" or percent clay and silt fraction.

Liquid and Plastic Limits Testing

Atterberg limits of the soils was determined generally following the methods described by ASTM D 4318, "*Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.*" Albert Atterberg originally defined "limits of consistency" of fine-grained soils in terms of their relative ease of deformation at various moisture contents. In current engineering usage, the *liquid lim*it of a soil is defined as the moisture content, in percent, marking the upper limit of viscous flow and the boundary with a semi-liquid state. The *plastic limit* defines the lower limit of plastic behavior, above which a soil behaves plastically below which it retains its shape upon drying. The *plasticity index* (PI) is the range of water content over which a soil behaves plastically. Numerically, the PI is the difference between liquid limit and plastic limit values.

Representative portions of fine-grained Group A, B, C, or D samples were prepared using the wet method described in Section 11.1 of ASTM D 4318. Unless otherwise noted on the report form, the liquid limit of each sample was determined using the multipoint method (Method A) described in Section 12. The liquid limit is, by definition, the moisture content where 25 drops of a hand operated liquid limit device are required to close a standard width groove cut in a soil sample placed in the device. After each test, the moisture content of the sample was adjusted and the sample replaced in the device. The test was repeated to provide a minimum of three widely spaced combinations of N versus moisture content. When plotted on semi-log paper, the liquid limit moisture content was determined by straight line interpolation between the data points at N equals 25 blows.

The plastic limit was determined using the procedure described in Section 17 of ASTM D 4318. A selected portion of the soil used in the liquid limit test was kneaded and rolled by hand until it could no longer be rolled to a 3.2 mm thread on a glass plate. This procedure was repeated until at least 6 grams of material was accumulated, at which point the moisture content was determined using the methods described in ASTM D 2216.

Moisture-Density Relationship of Soils Using Standard Effort

Soil placed as engineering fill is compacted to a dense state to obtain satisfactory engineering properties. Laboratory moisture-density relationship tests provide the basis for determining the percent compaction and water content needed to achieve the required engineering properties, and for controlling construction to assure the required compaction and water contents are achieved. Test procedures generally followed those described by ASTM D 698, "*Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 lbf/ft^3).*"

The relationship between water content and the dry unit weight is determined for soils compacted in either 4 or 6-inch diameter molds with a 5.5 lbf rammer dropped from a height of 12 inches, producing a compactive effort of 12,400 lbf/ft^3. ASTM D 698 provides three alternative procedures depending on material gradation, designated as Methods A, B, and C. See the upper-center portion of the report form for the method selected for each sample.

Method A

- All material passes No. 4 sieve size
- 4-inch diameter mold
- Shall be used if 25 percent or less by weight is retained on No. 4 sieve
- Soil in 3 layers with 25 blows per layer

Method B

- All material passes 3/8-inch sieve
- 4-inch diameter mold
- Shall be used if 25 percent by weight, or less, is retained on the 3/8 Inch sieve.
- Soil in 3 layers with 25 blows per layer

Method C

- All material passes ¾ inch sieve
- 6-inch diameter mold
- Shall be used if more than 30 percent by weight, or less, is retained on the ¾-inch sieve
- Soil in 3 layers with 56 blows per layer

Soil is compacted in the mold in three layers of approximately equal thickness, each compacted with either 25 or 56 blows of the rammer. After compaction of the sample in the mold, the resulting dry density and moisture content is determined and the procedure repeated. Separate soils are used for each sample point, adjusting the moisture content of the soil as described in Section 10.2 (Moist Preparation Method). The procedure was repeated for a sufficient number of water content values (or "points") to allow the dry density vs. water content values to be plotted and the *maximum dry density* and *optimum moisture content* to be determined from the resulting curvilinear relationship.

Laboratory California Bearing Ratio (CBR) Tests of Compacted Samples

This method is used to evaluate the potential strength of subgrade, subbase, and base course material, including recycled materials, for use in road and airfield pavements. Laboratory CBR tests were performed in general accordance with the procedures described in ASTM D 1883, "*Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils*." Specimens were prepared in standard molds to a target level of compactive effort within plus or minus 0.5 percent of the optimum moisture content value. While embedded in the compaction mold, each sample was inundated for a minimum period of 96 hours to achieve saturation. During inundation the specimen was surcharged by a weight approximating the anticipated weight of the pavement and base course layers; see the report form for the surcharge weight selected for each sample. After removing the sample from the soaking bath, the soil was then sheared by jacking a piston having a cross sectional area of 3 square inches into the end surface of the specimen. The piston was jacked 0.5 inches into the specimen at a constant rate of 0.05 inches per minute.

The CBR is defined as the load required to penetrate a material to a predetermined depth, compared to the load required to penetrate a standard sample of crushed stone to the same depth. The CBR value is usually based on the load ratio for a penetration of 0.10 inches, after correcting the load-deflection curves for surface irregularities or upward concavity. However, where the calculated (corrected) CBR for a penetration of 0.20 inches is greater than the result obtained for a penetration of 0.10 inches, the test is repeated by reversing the specimen and shearing the opposite end surface. Where the second ("flip") test indicates a greater CBR value at 0.20 inches of penetration, the CBR for 0.20 inches penetration is used for design.

Form No: TR-D2216-T265-2
Revision No. 1
Revision Date: 08/16/17

LABORATORY DETERMINATION OF WATER CONTENT

ASTM D 2216 ☑ *AASHTO T 265* ☐

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	24060053	Report Date:	6/4/24
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s):	6/1-6/4/24
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		
Sample by:	J. Prevatte	Sample Dates:	5/24/24
Sampling Method:	Split Spoon/Bulk-Grab	Drill Rig :	CME-45

Method: **A (1%)** **B (0.1%)** ☑ Balance ID. 14862 Calibration Date: 7/1/23 Oven ID. 14603 Calibration Date: 7/24/23

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture
		ft. or m.		grams	grams	grams	grams	%
B-1	S-1	1.0'-2.5'	G	0.00	268.38	220.60	47.78	**21.7%**
B-1	S-2	3.5'-5.0'	I	0.00	275.83	227.16	48.67	**21.4%**
B-1	S-3	6.0'-7.5'	B	0.00	280.86	225.33	55.53	**24.6%**
B-1	S-5	13.5'-15.0'	#	0.00	295.81	230.97	64.84	**28.1%**
B-1	S-6	18.5'-20.0'	W	0.00	250.20	197.32	52.88	**26.8%**
B-2	S-1	1.0'-2.5'	X	0.00	298.36	259.89	38.47	**14.8%**
B-2	S-5	13.5'-15.0'	A	0.00	315.35	246.66	68.69	**27.8%**
B-3	S-4	8.5'-10.0'	Y	0.00	271.80	191.79	80.01	**41.7%**
B-4	S-1	1.0'-2.5'	Z	0.00	283.91	224.70	59.21	**26.4%**
B-1 to B-3	Bulk-1	1'-2'	K	0.00	337.51	276.24	61.27	**22.2%**
B-5 to B-7	Bulk-2	1'-2'	N	0.00	341.05	275.73	65.32	**23.7%**

Notes / Deviations / References

Tests Performed By: J.FAUCETTE

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Jason Faucette	Jason Faucette	Laboratory Supervisor	6/4/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Results shown in this report, relate only to the samples noted above.

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Form No: TR-D1140-1
Revision No. 1
Revision Date: 8/2/17

MATERIAL FINER THAN THE #200 SIEVE

ASTM D1140

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	24060053	Report Date:	6/4/24
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s):	6/1-6/4/24
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		
Sample by:	J. Prevatte	Sample Dates:	5/24/24
Sampling Method:	Split Spoon/Bulk-Grab	Drill Rig :	CME-45

Method; A ☐ **B** ☑ Soaked ☑ Soak Time 3.0 hrs

Boring #	Sample #	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Tare Wt. + Dry Wt. after Wash	% Passing #200
				grams	grams	grams	grams	%
B-1	S-2	3.5'-5.0'	I	0.00	275.83	227.16	187.63	**17.4%**
B-1	S-3	6.0'-7.5'	B	0.00	280.86	225.33	204.10	**9.4%**
B-1	S-5	13.5'-15.0'	#	0.00	295.81	230.97	182.36	**21.0%**
B-1	S-6	18.5'-20.0'	W	0.00	250.20	197.32	43.61	**77.9%**
B-2	S-1	1.0'-2.5'	X	0.00	298.36	259.89	223.84	**13.9%**
B-2	S-5	13.5'-15.0'	A	0.00	315.35	246.66	178.20	**27.8%**

Balance ID. *14862* *Calibration Date:* *7/1/23* *#200 Sieve* *17508* *Calibration Date:* *1/25/24*

Notes / Deviations / References: ASTM D1140: Amount of Material in Soil Finer Than the No. 200 (75-um)) Sieve

J.FAUCETTE
Technician

Jason Faucette	Jason Faucette	Laboratory Supervisor	6/4/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Results shown in this report, relate only to the samples noted above.

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Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

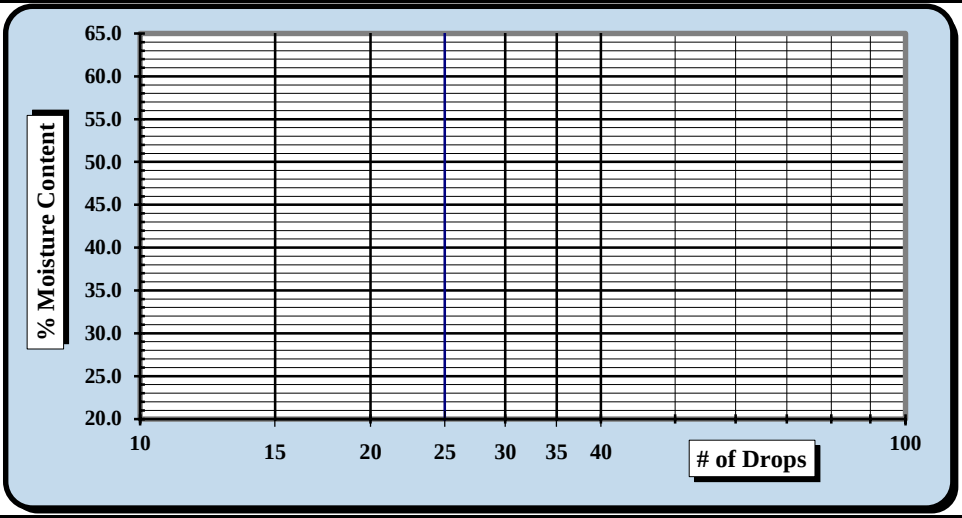
ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	24060053	Report Date:	6/4/24
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s)	6/1-6/4/24
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		
Sample Id:	66	Type: Site Material	Sample Date: 5/24/24
Location:	Roadway Alignment	Source Loc.: B-1/S-5	Depth(ft): 13.5'-15.0'
Sample Description:	Gray Silty SAND (SM)		

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	14862	7/1/2023	Grooving tool	14947(E)	7/12/2023
LL Apparatus	17515	7/12/2023	Grooving tool		
Oven	14993	7/24/2023	Grooving tool		

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	1	2	3				4	5	
A	Tare Weight									
B	Wet Soil Weight + A									
C	Dry Soil Weight + A									
D	Water Weight (B-C)									
E	Dry Soil Weight (C-A)									
F	% Moisture (D/E)*100									
N	# OF DROPS							*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*									



One Point Liquid Limit

N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☒
Liquid Limit
Plastic Limit
Plastic Index
Group Symbol **NP**

Multipoint Method ☑
One-point Method ☐

Wet Preparation | Dry Preparation | Air Dried | *Estimate the % Retained on the #40 Sieve:* N/A

Notes / Deviations / References: *ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

Tests Performed By: J.FAUCETTE ***No LL or PL could be determined, therfore classified as NP***

Jason Faucette	*Jason Faucette*	Laboratory Supervisor	6/4/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Results shown in this report, relate only to the sample noted above

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Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

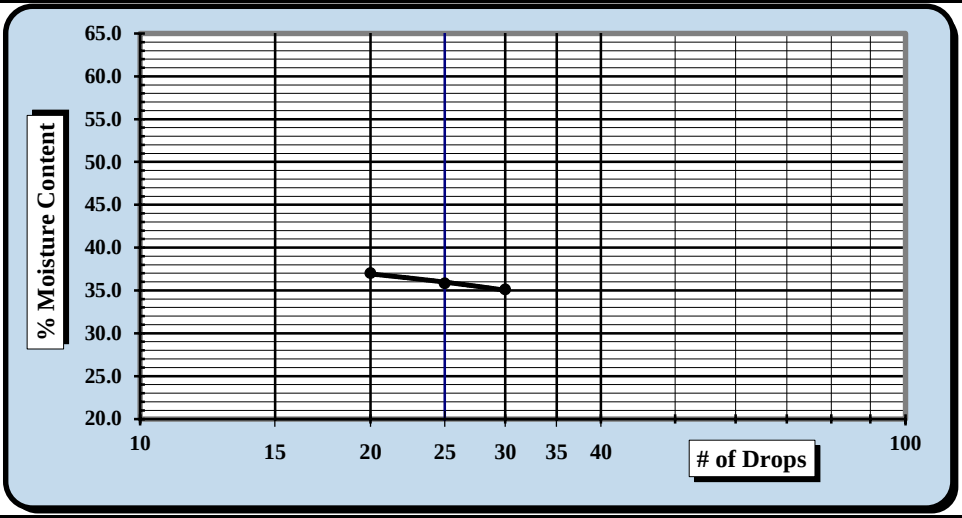
ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	24060053	Report Date:	6/4/24
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s)	6/1-6/4/24
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		
Sample Id:	66	Type: Site Material	Sample Date: 5/24/24
Location:	Roadway Alignment	Source Loc.: B-1/S-6	Depth(ft): 18.5'-20.0'
Sample Description:	Gray Lean CLAY with Sand (CL)		

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	14862	7/1/2023	Grooving tool	14947(E)	7/12/2023
LL Apparatus	17515	7/12/2023	Grooving tool		
Oven	14993	7/24/2023	Grooving tool		

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	1	2	3				4	5	
A	Tare Weight	11.07	10.67	11.62				11.37	10.73	
B	Wet Soil Weight + A	22.20	20.99	21.69				20.28	20.00	
C	Dry Soil Weight + A	19.31	18.27	18.97				18.96	18.61	
D	Water Weight (B-C)	2.89	2.72	2.72				1.32	1.39	
E	Dry Soil Weight (C-A)	8.24	7.60	7.35				7.59	7.88	
F	% Moisture (D/E)*100	35.1%	35.8%	37.0%				17.4%	17.6%	
N	# OF DROPS	30	25	20				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							**17.5%**		



One Point Liquid Limit			
N	**Factor**	**N**	**Factor**
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit	**36**
Plastic Limit	**18**
Plastic Index	**18**
Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation | Dry Preparation | Air Dried | *Estimate the % Retained on the #40 Sieve:* N/A

Notes / Deviations / References: *ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

Tests Performed By: J.FAUCETTE

Jason Faucette	*Jason Faucette*	Laboratory Supervisor	6/4/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Results shown in this report, relate only to the sample noted above

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Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

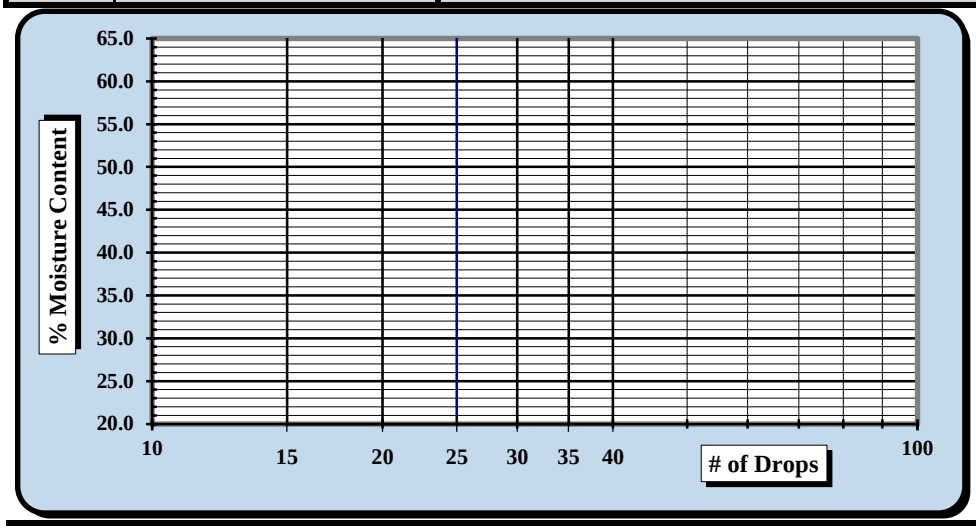
ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	24060053	Report Date:	6/4/24
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s)	6/1-6/4/24
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		
Sample Id:	66	Type: Site Material	Sample Date: 5/24/24
Location:	Roadway Alignment	Source Loc.: B-2/S-1	Depth(ft): 1.0'-2.5'
Sample Description:	Gray-Brown Silty SAND (SM)		

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	14862	7/1/2023	Grooving tool	14947(E)	7/12/2023
LL Apparatus	17515	7/12/2023	Grooving tool		
Oven	14993	7/24/2023	Grooving tool		

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	6	7	8				9	10	
A	Tare Weight									
B	Wet Soil Weight + A									
C	Dry Soil Weight + A									
D	Water Weight (B-C)									
E	Dry Soil Weight (C-A)									
F	% Moisture (D/E)*100									
N	# OF DROPS							*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*									



One Point Liquid Limit

N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☒
Liquid Limit
Plastic Limit
Plastic Index
Group Symbol **NP**

Multipoint Method ☑
One-point Method ☐

Wet Preparation | Dry Preparation | Air Dried | *Estimate the % Retained on the #40 Sieve:* N/A

Notes / Deviations / References: *ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

Tests Performed By: J.FAUCETTE ***No LL or PL could be determined, therfore classified as NP***

Jason Faucette	*Jason Faucette*	Laboratory Supervisor	6/4/2024
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

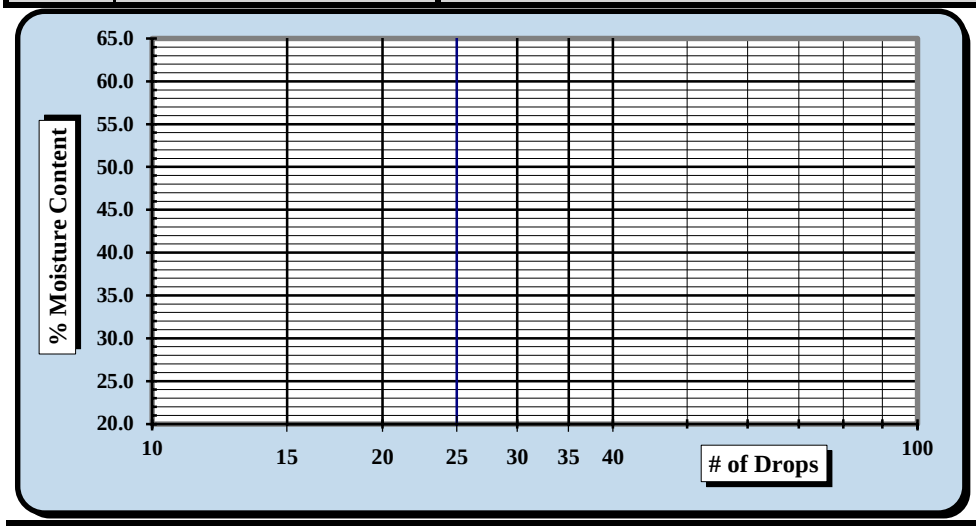
ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	24060053	Report Date:	6/4/24
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s)	6/1-6/4/24
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		
Sample Id:	66	Type: Site Material	Sample Date: 5/24/24
Location:	Roadway Alignment	Source Loc.: B-2/S-5	Depth(ft): 13.5'-15.0'
Sample Description:	Gray Silty SAND (SM) Trace Clay		

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	14862	7/1/2023	Grooving tool	14947(E)	7/12/2023
LL Apparatus	17515	7/12/2023	Grooving tool		
Oven	14993	7/24/2023	Grooving tool		

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	6	7	8				9	10	
A	Tare Weight									
B	Wet Soil Weight + A									
C	Dry Soil Weight + A									
D	Water Weight (B-C)									
E	Dry Soil Weight (C-A)									
F	% Moisture (D/E)*100									
N	# OF DROPS							*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*									



One Point Liquid Limit			
N	**Factor**	**N**	**Factor**
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☒

Liquid Limit	
Plastic Limit	
Plastic Index	
Group Symbol	**NP**

Multipoint Method ☑
One-point Method ☐

Wet Preparation | Dry Preparation | Air Dried | *Estimate the % Retained on the #40 Sieve:* N/A

Notes / Deviations / References: *ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

Tests Performed By: J.FAUCETTE ***No LL or PL could be determined, therfore classified as NP***

Jason Faucette	*Jason Faucette*	Laboratory Supervisor	6/4/2024
Technical Responsibility	*Signature*	*Position*	*Date*

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LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	24060053	Report Date:	6/4/24
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s)	6/1-6/4/24
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		

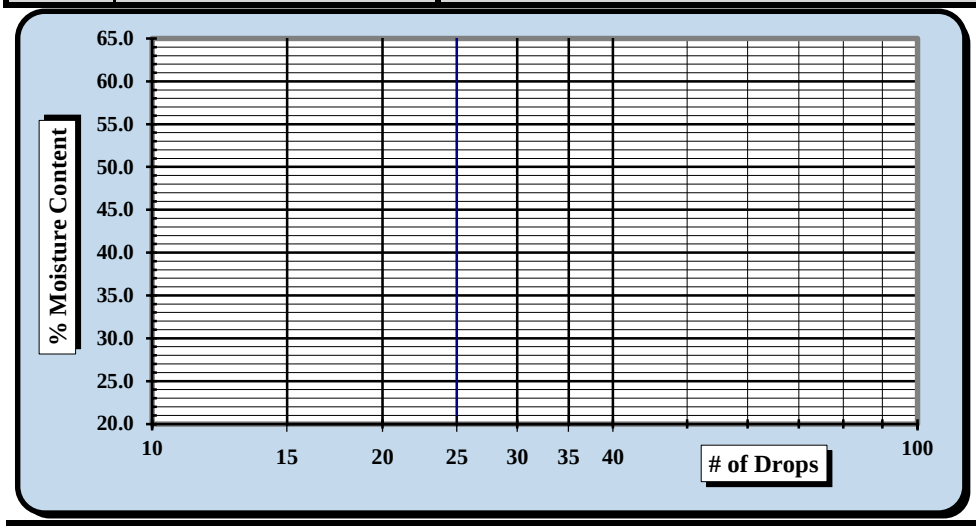
Sample Id: 66 Type: Site Material Sample Date: 5/24/24

Location: Roadway Alignment Source Loc.: B-1 to B-3/Bulk 2 Depth(ft): 1.0'-2.0'

Sample Description: Dark Gray Silty SAND (SM)

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	14862	7/1/2023	Grooving tool	14947(E)	7/12/2023
LL Apparatus	17515	7/12/2023	Grooving tool		
Oven	14993	7/24/2023	Grooving tool		

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	6	7	8				9	10	
A	Tare Weight									
B	Wet Soil Weight + A									
C	Dry Soil Weight + A									
D	Water Weight (B-C)									
E	Dry Soil Weight (C-A)									
F	% Moisture (D/E)*100									
N	# OF DROPS							*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*									



One Point Liquid Limit

N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☒

Liquid Limit	
Plastic Limit	
Plastic Index	
Group Symbol	**NP**

Multipoint Method ☑
One-point Method ☐

Wet Preparation Dry Preparation Air Dried *Estimate the % Retained on the #40 Sieve:* N/A

Notes / Deviations / References: *ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

Tests Performed By: J.FAUCETTE ***No LL or PL could be determined, therfore classified as NP***

Jason Faucette	Jason Faucette	Laboratory Supervisor	6/4/2024
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

MOISTURE - DENSITY REPORT

Quality Assurance

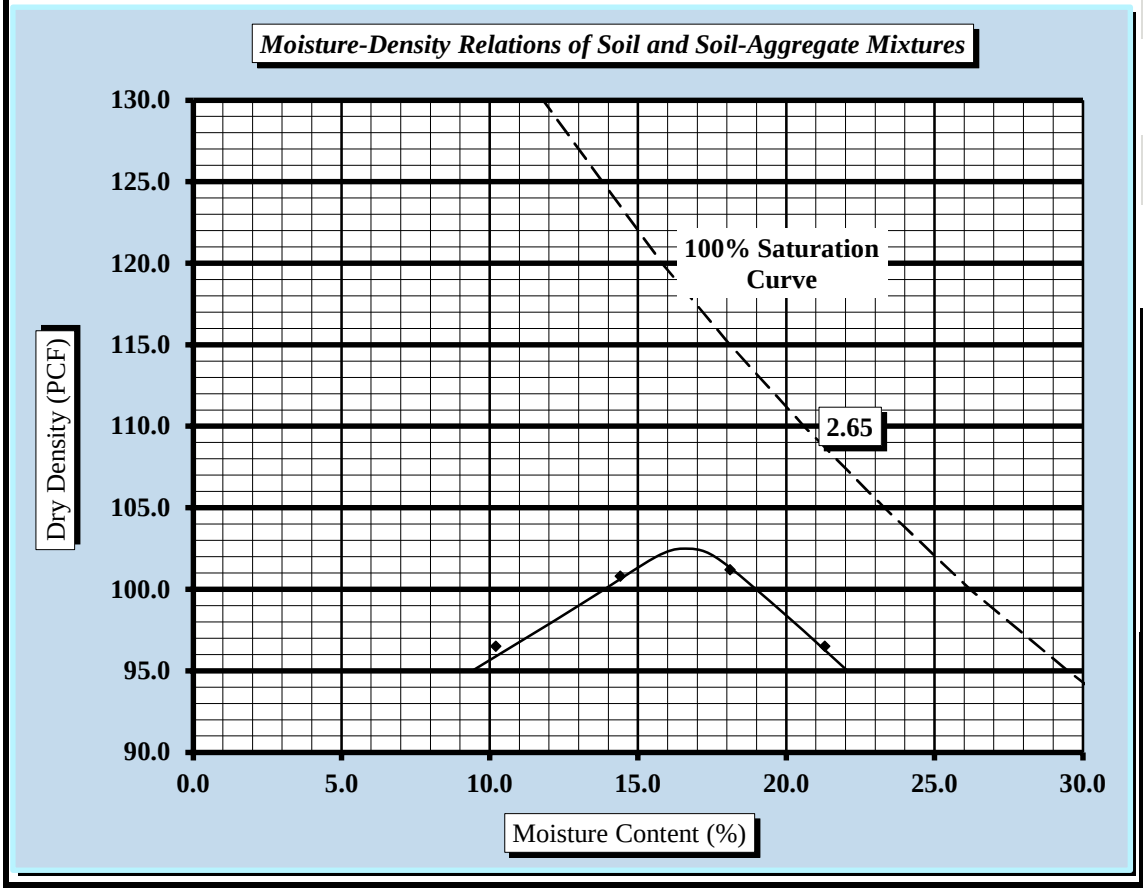
S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

S&ME Project #:	24060053	Report Date:	6/4/24
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s):	6/1-6/4/24
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		

Sample Id:	66B(2024)	Type:	Site Material	Sample Date:	5/24/2024
Location:	Roadway Alignment	Source Loc:	B-1 to B-3(Bulk)	Depth:	1'-2'
Sample Description:	Dark Gray Silty SAND (SM)				

Maximum Dry Density 102.5 PCF. Optimum Moisture Content 16.5%

ASTM D 698 - - Method A



Soil Properties	
Natural Moisture Content	22.7%
Assumed S.G. of Soil	2.650
Liquid Limit	NP
Plastic Limit	NP
Plastic Index	NP
% Passing	
3/4"	N/A
3/8"	N/A
#4	N/A
#10	N/A
#40	N/A
#60	N/A
#100	N/A
#200	18.4%
Oversize Fraction	
Bulk Gravity	
% Moisture	N/A
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☐ Manual Rammer ☒ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: **Tests Performed By: J.FAUCETTE**

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Jason Faucette	Jason Faucette	Laboratory Supervisor	6/4/2024
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

ASTM D 1883

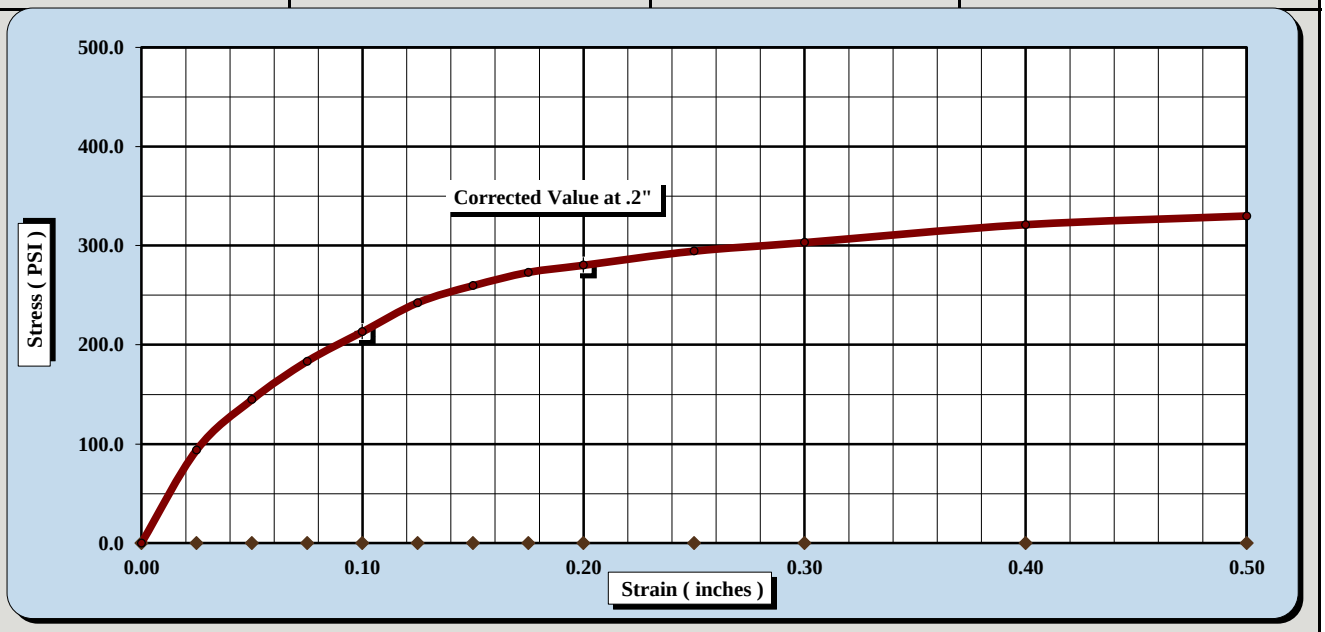
S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

Project #:	24060053	Report Date:	6/12/2024
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s)	6/7/2024
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		
Sample Id:	66B(2024)	Type: Site Material	Sample Date: 5/24/2024
Location:	Roadway Alignment	Source Loc: B-1 to B-3(Bulk)	Depth: 1'-2'
Sample Description:	Dark Gray Silty SAND (SM)		

ASTM D 698 *Method A* Maximum Dry Density: 102.5 PCF Optimum Moisture Content: 16.5%

Compaction Test performed on grading complying with CBR spec. % Retained on the 3/4" sieve: 1.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 21.3	CBR at 0.2 in. 18.7	CBR at 0.1 in. 21.3	CBR at 0.2 in. 18.7



CBR Sample Preparation:

The entire gradation was used and compacted in a 6" CBR mold in accordance with ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	43		
Initial Dry Density (PCF)	100.0	Final Dry Density (PCF)	99.8
Moisture Content of the Compacted Specimen	16.9%	Moisture Content (top 1" after soaking)	
Percent Compaction	97.6%	Percent Swell	0.3%

Soak Time: 96 hrs. Surcharge Weight 20.0 Surcharge Wt. per sq. Ft. 102.0

Liquid Limit -- Plastic Index NP Apparent Relative Density --

Notes/Deviations/References: Liquid Limit: ASTM D 4318, Specific Gravity: ASTM D 854, Classification: ASTM D 2487

Jason McGough	Jason McGough	Laboratory Supervisor	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

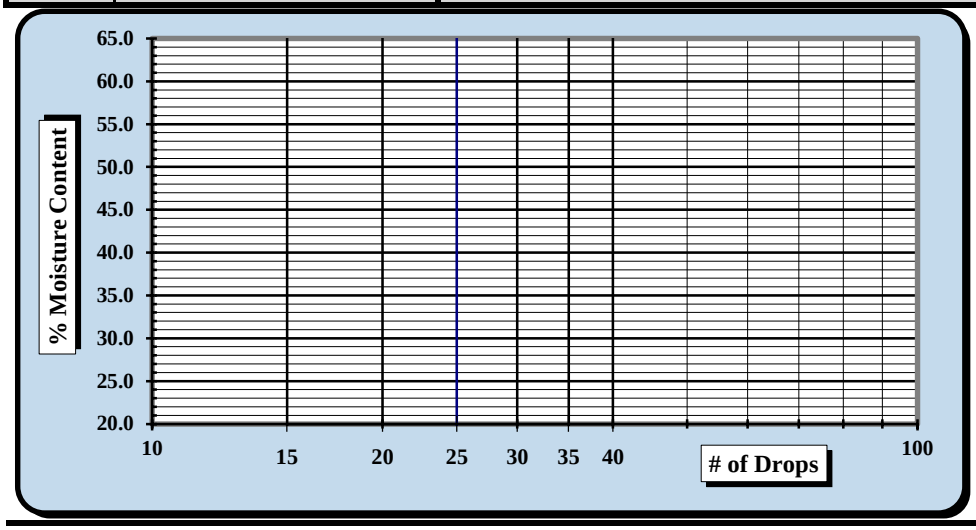
ASTM D 4318 ☒ AASHTO T 89 ☐ AASHTO T 90 ☐

S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

Project #:	24060053	Report Date:	6/4/24
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s)	6/1-6/4/24
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		
Sample Id:	66	Type: Site Material	Sample Date: 5/24/24
Location:	Roadway Alignment	Source Loc.: B-5 to B-7/Bulk 1	Depth(ft): 1.0'-2.0'
Sample Description:	Dark Gray Silty SAND (SM) Trace Organics		

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	14862	7/1/2023	Grooving tool	14947(E)	7/12/2023
LL Apparatus	17515	7/12/2023	Grooving tool		
Oven	14993	7/24/2023	Grooving tool		

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	6	7	8				9	10	
A	Tare Weight									
B	Wet Soil Weight + A									
C	Dry Soil Weight + A									
D	Water Weight (B-C)									
E	Dry Soil Weight (C-A)									
F	% Moisture (D/E)*100									
N	# OF DROPS							*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*									



One Point Liquid Limit			
N	**Factor**	**N**	**Factor**
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☒

Liquid Limit	
Plastic Limit	
Plastic Index	
Group Symbol	**NP**

Multipoint Method ☑
One-point Method ☐

Wet Preparation | Dry Preparation | Air Dried | *Estimate the % Retained on the #40 Sieve:* N/A

Notes / Deviations / References: *ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils*

Tests Performed By: J.FAUCETTE ***No LL or PL could be determined, therfore classified as NP***

Jason Faucette	Jason Faucette	Laboratory Supervisor	6/4/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Results shown in this report, relate only to the sample noted above

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Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

MOISTURE - DENSITY REPORT

Quality Assurance

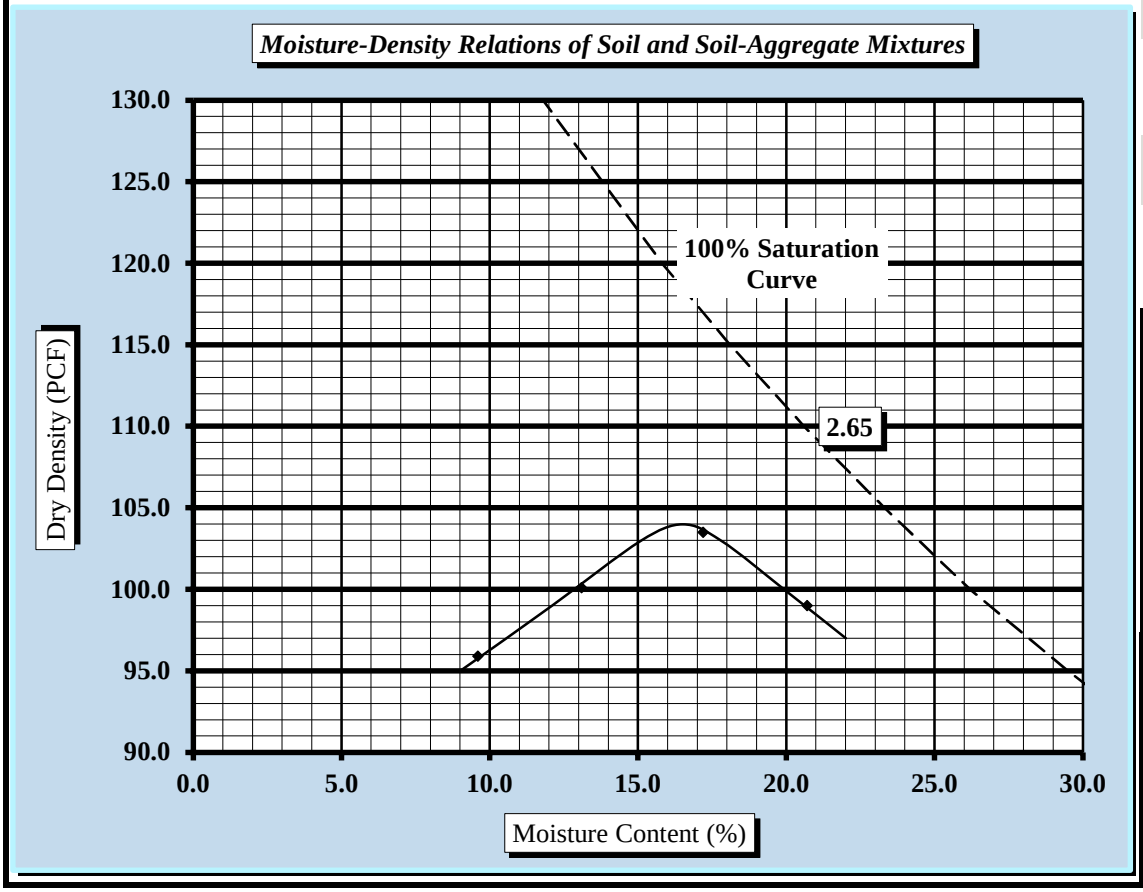
S&ME, Inc. - Wilmington: 3006 Hall Waters Drive, Suite 100, Wilmington, NC 28405

S&ME Project #:	24060053	Report Date:	6/4/24
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s):	6/1-6/4/24
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		

Sample Id:	66A(2024)	Type:	Site Material	Sample Date:	5/24/2024
Location:	Roadway Alignment	Source Loc:	B-5 to B-7(Bulk)	Depth:	1'-2'
Sample Description:	Dark Gray Silty SAND (SM) Trace Organics				

Maximum Dry Density 104.0 PCF. Optimum Moisture Content 16.5%

ASTM D 698 - - Method A



Soil Properties	
Natural Moisture Content	23.7%
Assumed S.G. of Soil	2.650
Liquid Limit	NP
Plastic Limit	NP
Plastic Index	NP
% Passing	
3/4"	N/A
3/8"	N/A
#4	N/A
#10	N/A
#40	N/A
#60	N/A
#100	N/A
#200	20.2%
Oversize Fraction	
Bulk Gravity	
% Moisture	N/A
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☒ 3/8 inch Sieve ☐ 3/4 inch Sieve ☐

Mechanical Rammer ☐ Manual Rammer ☒ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: **Tests Performed By: J.FAUCETTE**

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Jason Faucette	*Jason Faucette*	Laboratory Supervisor	6/4/2024
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No. TR-D1883-T193-3
Revision No. 2
Revision Date: 08/11/17

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

ASTM D 1883

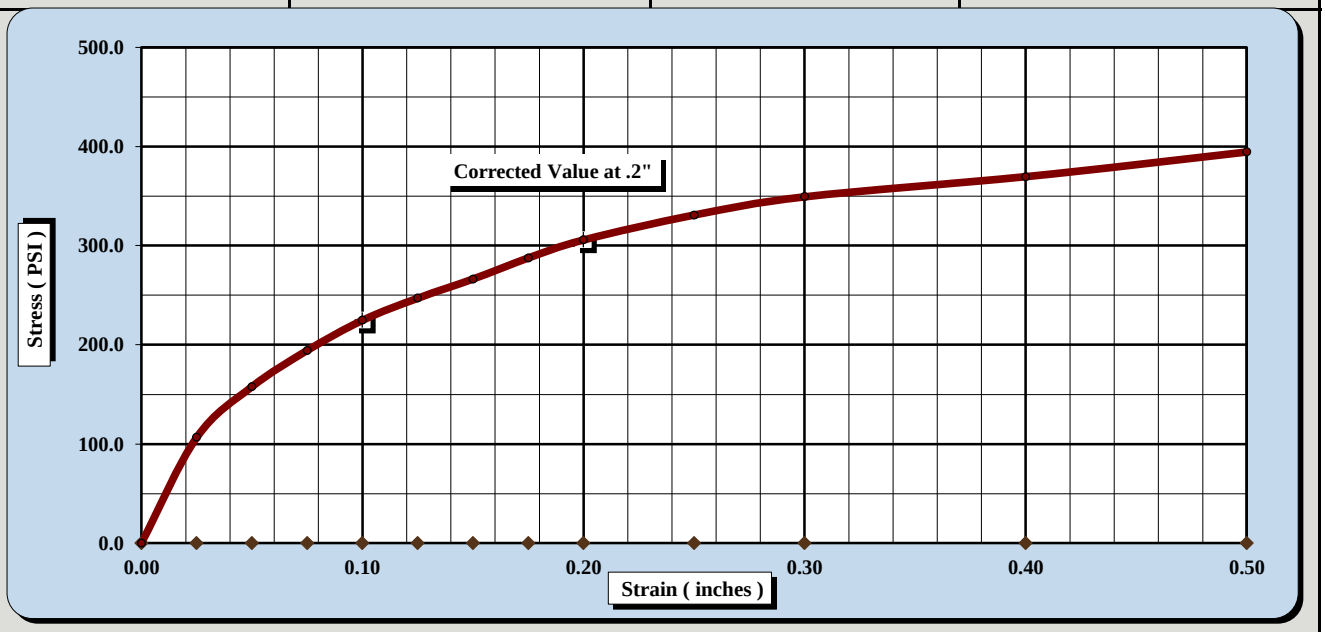
S&ME, Inc. - Myrtle Beach: 1330 Highway 501 Business, Conway, SC 29526

Project #:	24060053	Report Date:	6/12/2024
Project Name:	Holly Shelter Industrial Park-Access Road	Test Date(s)	6/7/2024
Client Name:	Wooten		
Client Address:	120 N. Boylan Ave., Raleigh, NC 27603		
Sample Id:	66A(2024)	Type: Site Material	Sample Date: 5/24/2024
Location:	Roadway Alignment	Source Loc: B-5 to B-7(Bulk)	Depth: 1'-2'
Sample Description:	Dark Gray Silty SAND (SM) Trace Organics		

ASTM D 698 *Method A* Maximum Dry Density: 104.0 PCF Optimum Moisture Content: 16.5%

Compaction Test performed on grading complying with CBR spec. % Retained on the 3/4" sieve: 1.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 22.5	CBR at 0.2 in. 20.4	CBR at 0.1 in. 22.5	CBR at 0.2 in. 20.4



CBR Sample Preparation:

The entire gradation was used and compacted in a 6" CBR mold in accordance with ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	41		
Initial Dry Density (PCF)	102.1	Final Dry Density (PCF)	101.7
Moisture Content of the Compacted Specimen	16.8%	Moisture Content (top 1" after soaking)	16.2%
Percent Compaction	98.2%	Percent Swell	0.4%

Soak Time: 96 hrs. Surcharge Weight 20.0 Surcharge Wt. per sq. Ft. 101.9

Liquid Limit -- Plastic Index NP Apparent Relative Density --

Notes/Deviations/References: Liquid Limit: ASTM D 4318, Specific Gravity: ASTM D 854, Classification: ASTM D 2487

Jason McGough	Jason McGough	Laboratory Supervisor	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

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Geotechnical Exploration Report
Holly Shelter Park Lift Station
Castle Hayne, North Carolina
S&ME Project No. 24060053A

PREPARED FOR:

The Wooten Company
272 North Front Street, Suite 401
Wilmington, North Carolina 28401

PREPARED BY:

S&ME, Inc.
3006 Hall Waters Drive, Suite 100
Wilmington, North Carolina 28405

February 14, 2025

February 14, 2025

The Wooten Company
272 North Front Street, Suite 401
Wilmington, North Carolina 28401

Attention: Mr. Lester Lowe, P.E.

Reference: **Geotechnical Exploration Report**
Holly Shelter Park Lift Pump Station
Castle Hayne, North Carolina
S&ME Project No. 24060053A
NC PE Firm License No. F-0176

Dear Lester:

S&ME, Inc. (S&ME) is pleased to submit this Geotechnical Exploration Report for the Holly Shelter Park Lift Pump Station project located in Castle Hayne, North Carolina. Our services were provided in general accordance with S&ME Proposal No. 24060053A, dated November 14, 2024, which was authorized by Mr. Brian Johnson (Wooten) on January 10, 2025, by execution of Amendment to Engineer-Consultant Agreement No. 1.

The purpose of this geotechnical exploration was to obtain subsurface information to allow us to characterize the subsurface conditions at the site and evaluate those conditions as they relate to design and construction of the structure.

This report describes our understanding of the project, presents the results of the field exploration, and discusses our geotechnical conclusions and recommendations.

S&ME appreciates the opportunity to assist you during this phase of the project. If you should have any questions concerning this report or if we may be of further assistance, please contact us.

Sincerely,

S&ME, Inc.

NORTH CAROLINA PROFESSIONAL SEAL 23923 ENGINEER THOMAS C. STILL
2/14/2025

Thomas Still, P.E.
Principal Engineer
NC Registration No. 023923

Nathan P. Buffum, P.E.
Office Principal
NC Registration No. 042575

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Appendix

1.0 Project and Site Descriptions

Project information was provided via email correspondence between Lester Lowe (Wooten) to Nate Buffum (S&ME) on November 8, 2024, and an email from Ana Wadsworth (Wooten) on November 12, 2024. The email correspondence included the Master Plan – Option 1, prepared by Wooten and undated, identifying the location of the proposed pump station.

The project site is located on the south side of Holly Shelter Road, within the proposed Holly Shelter Industrial Park, in Castle Hayne, North Carolina. We understand that a new lift pump station with wet well will be constructed to support the industrial park. Preliminary information provided by Wooten indicated that the wet well may be a rectangle or circular concrete structure, approximately 10 to 12 feet in diameter, bearing approximately 25 to 30 feet beneath existing grade.

At the time of this proposal, structural loading information and a pump station layout plan were not available. Other than the above information regarding the proposed wet well, no information regarding other planned structures was provided; therefore, this report does not address other potential structures at the site.

We were also not provided any planned elevation changes at the site; therefore, we assume that cuts or fills during grading in the vicinity of the structure location will be less than 1 foot.

2.0 Exploration Procedures

Our field exploration was initially proposed to include performance of a standard penetration test (SPT) boring at the site. After authorization of our services and consultation with drilling personnel regarding crew and equipment availability, we proceeded with exploration at the site by utilizing cone penetration test (CPT) methods in lieu of SPT boring methods.

Using the information provided, we performed a site walkover, observing features of topography, ground cover, and surface soils at the project site. At the wet well location staked at the site by Wooten surveyors, we advanced one CPT sounding (B-1) to a depth of approximately 31.2 feet below existing site grade, at which depth materials were encountered which refused further advancement to the target depth of 35 feet.

In a CPT sounding (ASTM D5778), an electronically instrumented cone penetrometer is hydraulically pushed through the soil to measure point stress, pore water pressure, and sleeve friction. The CPT data is used to determine soil stratigraphy and to estimate soil parameters such as friction angle and undrained shear strength. Soil types presented on CPT sounding logs are derived from Robertson's (1990) Soil Behavior Type (SBT) Index. The soil type determined from the SBT index is more representative of soil behavior characteristics than traditional soil classification that is based on grain size and plasticity. Sounding logs are included in the Appendix.

A Test Location Sketch which illustrates the approximate test location is attached as Figure 1 in the Appendix, along with a soil classification legend and the CPT sounding log.

3.0 Regional Geology

The *Geologic Map of North Carolina* (1985) indicates that the site is in the Coastal Plain Physiographic Province of North Carolina. The Coastal Plain Province is typically characterized by marine, eolian, and alluvial sediments that were deposited during periods of fluctuating sea levels and moving shorelines. As such, the Coastal Plain Province is characterized by subdued topographic features and flat low-lying terrain. The soils in this province are typical of those laid down in a shallow sloping sea bottom; sands, silts, and clays with irregular deposits of shells. Alluvial sands, silts, and clays are typically present near rivers and creeks. Deposits of peat, organic silt and clay are also commonly present in or near current or former tidal marsh areas in the outer portion of the Coastal Plain.

The primary geologic formation underlying the area of the site is the Castle Hayne Formation of Tertiary Age. This formation consists in part of light gray limestone, more or less consolidated, and in part of light-colored marl that varies from loose to consolidated. The limestone is dolomitic in nature and solution cavities are common. It is usually quite fossiliferous and in many places is composed of shells. At places the shells have been removed entirely, and the limestone is vuggy (has voids) or contains the casts and molds of the original organisms. The top of the Castle Hayne Formation is typically on the order of 20 to 70 feet deep in New Hanover County.

4.0 Site and Subsurface Conditions

At the time of our exploration, the site ground cover was observed to consist of recent tree removal, with existing tree stumps and underbrush. S&ME had to maneuver an existing ditch line to obtain access to the sounding location. Stumps were observed remaining after past clearing activities. Topsoil encountered at the test location was measured to be about 2 inches in thickness. Topsoil may be thicker or thinner in unexplored areas of the site.

4.1 Subsurface Conditions

The generalized subsurface conditions at the site are described below. For more detailed descriptions and stratifications at the test location, the CPT sounding log in the Appendix should be reviewed.

4.1.1 Coastal Plain Sands with Clay Layers

Beneath the topsoil, the sounding encountered Coastal Plain soils primarily consisting of sands to a depth of approximately 30 feet. A thin clay layer (less than one foot thick) was encountered at a depth of about 2 feet. Additional clay layers were encountered from approximate depth intervals of 19 to 21 feet and 25 to 30 feet.

CPT tip resistance values within the upper 7 feet of the sands ranged from approximately 20 to 80 tons per square foot (tsf), indicating generally loose relative density with a medium dense layer. Beneath this depth, tip resistance values within the sands typically ranged from about 80 to 140 tsf, indicating medium dense to dense relative densities. Within the clay layers, tip resistances ranged from about 6 to 12 tsf, indicating soft to firm consistency.

4.1.2 Castle Hayne Formation

From a depth of about 30 feet to the refusal depth of 31.2 feet, the sounding encountered very dense sands and gravelly sands exhibiting tip resistances of about 400 to 700 tsf. Based on the CPT data, local geologic mapping and our experience, this layer is interpreted to represent the Castle Hayne Formation.

4.1.3 Subsurface Water

Subsurface water was encountered in the CPT sounding at a depth of approximately 4 feet below the ground surface. Subsurface water levels may fluctuate seasonally at the site, being influenced by rainfall variation and other factors. Site construction activities can also influence groundwater elevations.

5.0 Conclusions and Recommendations

The conclusions and recommendations included in this section are based on the project information outlined previously and the data obtained during our exploration. If the construction scope is altered, the proposed layout is changed, or if conditions are encountered during construction that differ from those encountered in the boring and sounding, then S&ME should be retained to review the following recommendations based upon the new information and make any necessary changes.

5.1 Excavations and Dewatering

5.1.1 Discussion

It is our understanding that the bottom of the wet well will bear approximately 30 feet below the existing ground surface, and approximately 26 feet below subsurface water measured at the time of our exploration.

The sounding indicates that excavations will extend through low to moderate consistency soils to depths of about 30 feet. Our experience has been that low to moderate consistency soils can be excavated with conventional earth-moving equipment such as large track-mounted backhoes, etc. We anticipate, and the contractor should be prepared for, difficult excavation beneath a depth of about 30 feet at which depths we encountered very dense sands of the Castle Hayne Formation. Based on our past experience, cemented sands and weathered limestone layers within this formation often vary in thickness from several inches to several feet or more and can vary in elevation encountered across the site.

5.1.2 Temporary Excavation Shoring

Permanent and temporary retaining walls and shoring (such as trench boxes) must be capable of resisting lateral earth pressures that will be imposed on them. Final design and construction of excavation support is the responsibility of the contractor. To determine the total lateral pressure, excavation support design should consider the development of hydrostatic pressure behind the earth retaining structures and lateral earth pressures arising from surcharge loading (i.e., soil surcharge, construction equipment, traffic, etc.) or any slopes adjacent to the support of excavation.

Table 5-1 presents soil parameters based on our interpretation of the CPT sounding data that can be considered for use to design the temporary shoring. The parameters are based on published correlations and our local experience in similar soils. The soil parameters are representative of those soils encountered in the CPT soundings and no factor of safety or similar reduction in the parameters has been considered.

Table 5-1: Soil Parameters for Temporary Shoring Design

Depth Interval (ft)	Soil Description	Moist Unit Weight (pcf)	Undrained Shear Strength, Su (psf)	Effective Friction Angle, ϕ′ (deg)	Lateral Earth Pressure Coefficient		
					At-Rest, K_0	Active, K_a	Passive, K_p
0 to 7	Loose Sand	110	0	30	0.50	0.33	3.0
7 to 25	Medium Dense to Dense Sands	120	0	32	0.47	0.31	3.25
25 to 30	Soft to Firm Clays	105	500	0	1.0	1.0	1.0

All excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. Stockpiles should be placed a distance from the edge of the excavation that is greater than the depth of the excavation, and the stockpile height should be controlled so they do not surcharge the sides of the excavation. The responsibility for excavation safety and stability of temporary construction slopes should lie solely with the contractor. This information is provided only as a service, and under no circumstances should S&ME be assumed to be responsible for construction site safety.

5.1.3 Construction Dewatering

The contractor should be responsible for dewatering the proposed excavations such that existing nearby roadways, utilities and structures are not impacted. This could require cutting off subsurface water flowing toward the excavation and then dewatering within the limits of the excavation.

As a minimum, sufficient dewatering should be provided to maintain excavation bottom stability and maintain the subsurface water level a minimum of 2 feet below the bottom of the construction excavation. The wet well pump station subsurface water level should be lowered in advance of excavation to the construction subgrade. The dewatering system should be operated continuously. Loss of subsurface water control while the construction excavation subgrade is exposed may result in disturbance of the subgrade and require undercutting to repair.

Miscellaneous construction excavations may require shallow dewatering. Potential water control methods for the shallow construction excavations include pumping from strategically located, filtered sumps. For temporary excavations more than approximately 3 to 5 feet below the water table at time of construction, well points or other dewatering methods determined by the contractor may be necessary. Subsurface water should be maintained a minimum of 2 feet below the excavation bottom throughout construction to maintain bottom stability.

The responsibility for dewatering of construction excavations should lie solely with the contractor. This information is provided only as a service and under no circumstance should S&ME be assumed to be responsible for the effectiveness of the construction dewatering method(s) selected by the contractor. The contractor should take into consideration adjacent structures when developing their dewatering plan for this site.

5.2 Structural Fill

The on-site sands should be suitable for use as structural fill provided that any debris, organics, and particles greater than 3 inches in diameter are removed prior to placement. Sandy soils excavated from below the water table will require drying; however, the soil behavior types encountered are generally adaptable to draining when stockpiled based on our experience with similar soil types in the site vicinity. Drying may also be accomplished by spreading and discing to maximize exposure to sun and wind during favorable weather conditions (i.e., warm, dry months). We do not recommend that clayey sands (SC) or clays (CL, CH) be used as structural fill due to their susceptibility to moisture. However, clayey sands (SC) that have the appropriate plasticity, fines content, and moisture content, as determined by the geotechnical engineer (S&ME), may be adaptable for use.

5.2.1 Fill Placement and Compaction

Where new fill soils are to be placed, the following recommendations apply:

1. Prior to fill placement, sample and test each proposed fill material to determine grain size and plasticity characteristics, maximum dry density, optimum moisture content, and natural moisture content.

    A. Fill soils to be used as structural fill may include soils from the following ASTM soil classifications: SW, SP, SW-SM, SP-SM, SW-SC, SP-SC, and SM. The contractor should sample each fill material that they propose to use and submit it to the geotechnical engineer for determination of its suitability, and measurement of the plasticity, fines content, maximum dry density, optimum moisture content, and natural moisture content.
    B. Natural moisture content of the fill material during placement should be or be moisture conditioned to be, within 3 percent below to 2 percent above the material's optimum moisture content for compaction as determined by standard laboratory Proctor testing.

2. Where fill soil is required, structural fill should be compacted throughout to at least 95 percent of the standard Proctor maximum dry density (ASTM D 698).

    A. Compacted soils should not exhibit pumping or rutting under equipment traffic.
    B. Loose lifts of fill should be no more than 10 inches thick prior to compaction and limited to 6 inches thick if using small, walk-behind compaction equipment.
    C. Structural fill should extend at least 5 feet from the edge of structures or pavements before either sloping or being allowed to exhibit a lower level of compaction.
    D. In non-structural fill areas only, such as in landscaped areas that are located at least 5 feet outside the footprint of pavements and buildings, fill should be compacted to at least 90 percent of the maximum dry density by the standard Proctor criterion (ASTM D 698).

3. Where present, the subsurface water level should be maintained at least 2 feet below any surface to be densified prior to beginning compaction. This is to prevent the compaction operation from drawing water up to the surface and degrading it.
4. All fill placements should be observed by an S&ME soils technician working under the guidance of the geotechnical engineer. In general, at least one field density test should be conducted for each 250 cubic feet of fill placed in confined areas such as isolated excavations and in trenches, with a minimum of 1 test per lift.

5.3 Lateral Earth Pressure Coefficients

Below-grade and cast-in-place concrete walls for all structures should be designed to withstand loading from lateral earth pressures from surrounding soil and surcharge loads from nearby footings or floor slabs. The earth pressure parameters presented below are dependent on the wall backfill soils meeting the requirements presented in this report. These soils should be placed within a zone of earth pressure influence (horizontal distance off the face of the wall) equal to the depth of the wall below ground. The backfill should be compacted as recommended previously.

Table 5-2: Earth Pressure Parameters for Below Grade Walls (Granular Soils)

Support Condition	Effective Friction Angle, ϕ′ (deg)	Cohesion (psf)	Moist Unit Weight (pcf)	Drained Static Condition	
				Coeff. (K)	Equiv. Unit Weight (pcf)
Active (K_a)	30	0	120	0.33	40
At-Rest (K_o)	30	0	120	0.50	60
Passive (K_p)	30	0	120	3.0	360

- The above values represent fully drained soil conditions above the subsurface water level at or near the optimum moisture content. Where backfill soils are not fully drained, the lateral soil pressure must consider hydrostatic forces below the water level, and submerged soil unit weight.
- A coefficient of sliding friction (tan δ) of 0.36 may be used in computation of the lateral sliding resistance.

Earth pressures should be calculated by the designer assuming the moist soil unit weight above the water table. Buoyant unit weights should be used in computations for soils below the water level. Retaining walls should have adequate factors of safety against overturning, sliding, and global failure. The structural engineer should select the appropriate loading condition based on the below-grade wall configuration. The designer should consider all unbalanced water forces along with any surcharge or building loads. Note that the water levels can fluctuate and may vary at the time of construction.

The lateral earth pressure distribution presented above assumes no wall friction between the wall and soil backfill (δ = 0 degrees). Backfill should meet the material and compaction requirements stated in this report. Operating heavy compaction equipment within 5 feet of the walls can create lateral earth pressures in excess of those recommended for design. As such, hand-operated equipment should be used within 5 feet of below-grade walls.

5.4 Foundation Support

The soil profile encountered appears generally suitable to support the proposed structure with shallow foundations considering static loading conditions and the assumed maximum loads. The design engineer needs to confirm that the assumed maximum loads are correct; if actual loads or fill heights are higher, we should be notified and given a reasonable opportunity to reconsider these recommendations, because it could result in changes to the estimated available bearing pressure and static settlement magnitudes.

5.4.1 Pump Station Wet Well

The deep below ground structure is not expected to cause significant loading to the foundation bearing soils since the overall net stress increase will not be significant due to soil being removed and the overall structures and their contents weighing similar or less than the soils removed. We understand the pump station wet well slab will bear at a depth of approximately 30 feet below the existing ground surface. At that depth, we estimate the wet well excavation will provide an unloading of about 2,000 psf. Although load information was not provided to us for analysis, we assume that the wet well with water will have an applied contact pressure equal to or less than this amount and thus taking into consideration the soil unloading, the net contact pressure should be negligible. Therefore, considering an applied contact pressure of 2,000 psf at this excavation depth, we estimate the resulting settlement will be less than ½-inch.

The contractor will have to provide temporary dewatering and earth retention systems (sheeting- cantilevered or tied back, or other means) during construction of the pump station wet wells. Design of the dewatering and earth retention system will be the responsibility of the contractor. We recommend that during construction that the subsurface water level be maintained at least 2 feet below the excavation bottom. Further we recommend that a 12-inch layer of washed stone (NCDOT #57) be placed on the subgrade soils. A nonwoven geotextile should be placed below the bottom of the stone layer.

We note that a layer of soft to firm clays was encountered within the sounding from depths of about 25 to 30 feet. If planned excavation does not fully penetrate these soils and they are encountered near planned bearing elevations, additional stabilization activities will likely be necessary to provide a stable working base. Additional over-excavation under the observations of a representative of the Geotechnical Engineer may be necessary to provide a stable base. The over-excavation should be lined with a non-woven geotextile to provide separation from the underlying soils and backfilled with washed stone (NCDOT #57) materials up to the required bearing elevation. The washed stone should be placed in lifts of thickness recommended by the Geotechnical Engineer based on observed conditions.

5.4.2 Uplift Resistance – Below Grade Structures

Concrete structures that extend below groundwater must be designed to resist uplift pressures when empty or partially filled (buoyancy effect). Possible uplift control measures include installation of pressure relief valves within the structure bottoms, utilizing the dead weight of the concrete in the walls and mat bottom to provide dead weight to counteract the uplift pressure, or extending the bottom mats beyond the sidewalls. An equivalent fluid pressure of 63 pounds per cubic foot is applicable when calculating uplift resistance due to soil overburden above a footing projection.

6.0 Limitations of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty, either express or implied, is made.

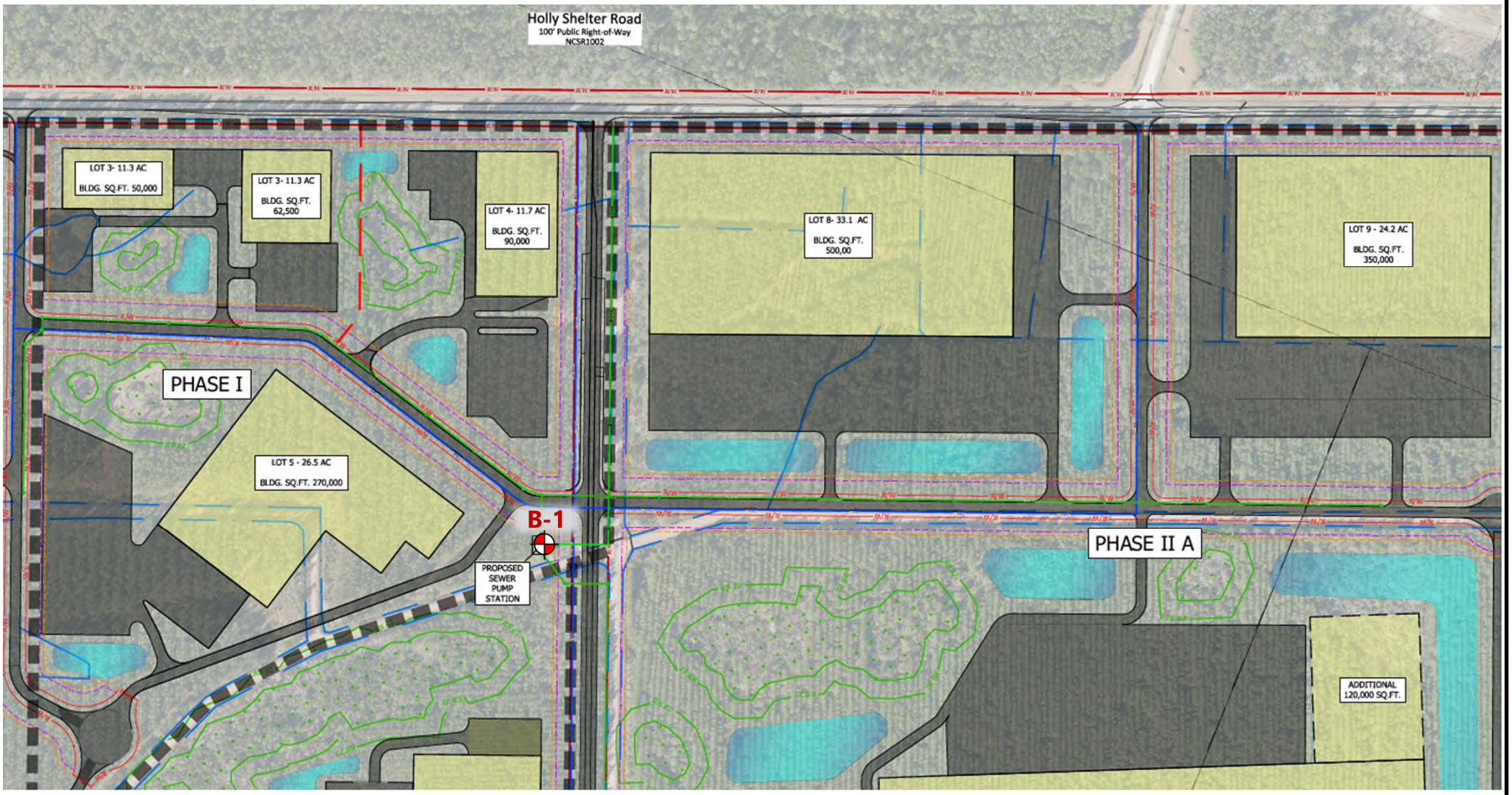
We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and foundation construction activities.

Appendix



LEGEND

CPT Sounding Location

Test Location Sketch

Holly Shelter Lift Pump Station
Castle Hayne, North Carolina

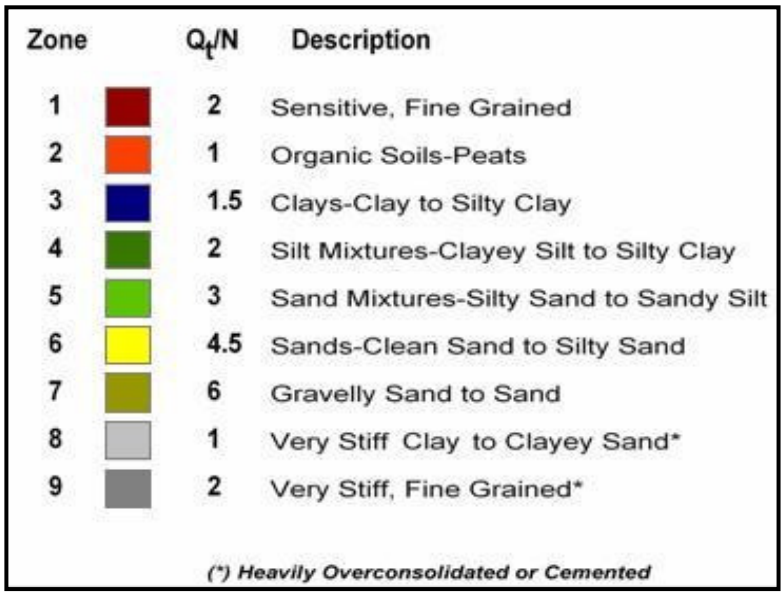
SCALE: AS SHOWN

DATE: 2/14/2025

PROJECT NUMBER 24060053A

FIGURE NO. 1

CPT Soil Classification Legend



Robertson's Soil Behavior Type (SBT), 1990			
Group #	**Description**	**Ic**	
		Min	**Max**
1	Sensitive, fine grained	N/A	
2	Organic soils - peats	3.60	N/A
3	Clays - silty clay to clay	2.95	3.60
4	Silt mixtures - clayey silt to silty clay	2.60	2.95
5	Sand mixtures - silty sand to sandy silt	2.05	2.60
6	Sands - clean sand to silty sand	1.31	2.05
7	Gravelly sand to dense sand	N/A	1.31
8	Very stiff sand to clayey sand (High OCR or cemented)	N/A	
9	Very stiff, fine grained (High OCR or cemented)	N/A	

Soil behavior type is based on empirical data and may not be representative of soil classification based on plasticity and grain size distribution.

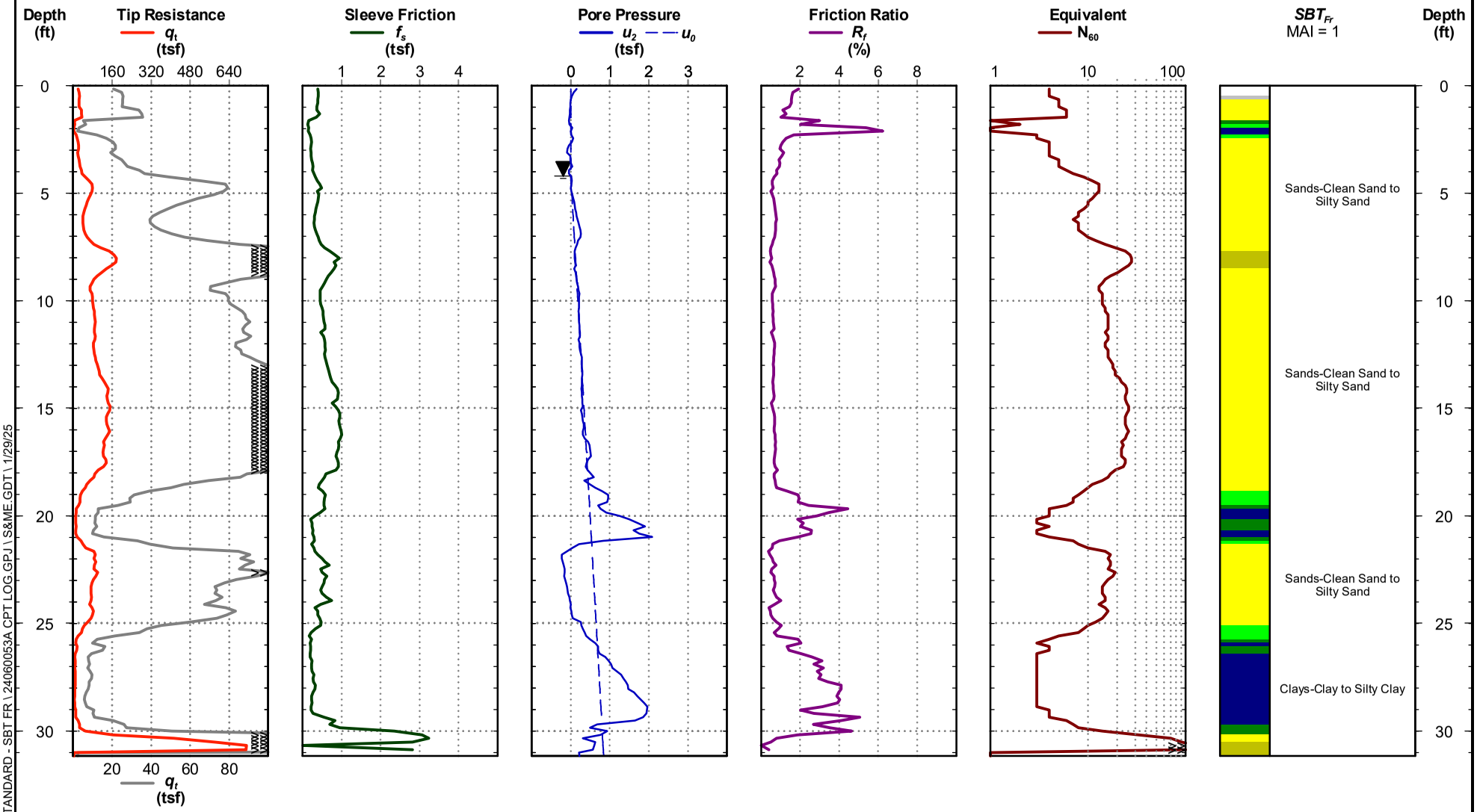
Relative Density and Consistency Table			
SANDS		SILTS and CLAYS	
Cone Tip Stress, qt (tsf)	Relative Density	Cone Tip Stress, qt (tsf)	Consistency
Less than 20	Very Loose	Less than 5	Very Soft
20 - 40	Loose	5 - 15	Soft to Firm
40 - 120	Medium Dense	15 - 30	Stiff
120 - 200	Dense	30 - 60	Very Stiff
Greater than 200	Very Dense	Greater than 60	Hard

Holly Shelter Park Lift Pump Station
Castle Hayne, North Carolina
S&ME Project No: 24060053A

Sounding ID: B-1

Date: Jan. 24, 2025
Estimated Water Depth: 4.2 ft
Rig/Operator: Jared Duffy

Total Depth: 31.2 ft
Termination Criteria: Maximum Reaction Force
Cone Size: 1.75



Cone Penetration Test

Electronic Filename: Holly Shelter Lift Pump Station B-1.cpt

CPT REPORT - STANDARD - SBT FR \ 24060053A.CPT LOG.GPJ \ S&ME.GDT \ 1/29/25

SECTION 00 31 32.10

GEOTECHNICAL REPORT

END OF SECTION

NOTICE OF AWARD

Date of Issuance: Date of Notice of Award	
Owner: New Hanover County	Owner's Project No.:
Engineer: The Wooten Company	Engineer's Project No.: 3514-A
Project: Holly Shelter Road Business Park – Roadway Infrastructure Improvements – Phase I	
Contract Name: Contract Name	
Bidder: Contractor's Legal Name	
Bidder's Address: Contractor's Street Address Contractor's City, State, Zip Code	

You are notified that Owner has accepted your Bid dated _____ - TWC for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

1. Holly Shelter road Business Park – Roadway Infrastructure Improvements – Phase I

The Contract Price of the awarded Contract is $_____. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

Enter No. of copies sent (ie Four (4)) unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner Enter No. of copies sent (ie Four (4)) counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

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

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: Owner's Legal Name	Contractor: Contractor's Legal Name
By (signature): _____	By (signature): _____
Name (print): _____	Name (print): _____
Title: _____	Title: _____
	Date: _____

copy: Engineer

END OF SECTION

2018 EJCDC® C-510, Notice of Award.

NOTICE TO PROCEED

Owner: New Hanover County	Owner's Project No.:
Engineer: The Wooten Company	Engineer's Project No.: 3514-A
Contractor: Contractor's Legal Name	Contractor's Project No.: Cont. Proj. ID
Project: Holly Shelter Road Business Park – Roadway Infrastructure Improvements – Phase I	
Contract Name: Contract Name	
Effective Date of Contract: Date of Contract	

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on Date of Notice to Proceed pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

The number of days to achieve Substantial Completion is Days to Sub. Comp. from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of Date of Sup. Comp.; and the number of days to achieve readiness for final payment is Days to Completion from the commencement date of the Contract Times, resulting in a date for readiness for final payment of Date of Completion.

Before starting any Work at the Site, Contractor must comply with the following: N/A

Owner: Owner's Legal Name	Contractor: Contractor's Legal Name
By (signature): _____	By (signature): _____
Name (print): _____	Name (print): _____
Title: _____	Title: _____
Date: _____	Date: _____

copy: Engineer

END OF SECTION

SECTION 00 62 16

CERTIFICATE OF INSURANCE

PAGE FOR ATTACHING

CERTIFICATE OF INSURANCE

END OF SECTION

SECTION 00 62 18

CERTIFICATE OF OWNER'S ATTORNEY AND PREAUDIT

ATTORNEY"S CERTIFICATE

I, the undersigned, _____, the duly authorized and acting legal representative of New Hanover County, do hereby certify as follows:

I have examined the attached Contract(s) and Performance and Payment Bonds and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions, and provisions thereof.

Date:_____

By: _____
Signature

PRE-AUDIT STATEMENT

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

New Hanover County

Date:_____

By:: _____
Signature

Title: _____

END OF SECTION

Contractor's Application for Payment

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			
Application No.:		**Application Date:**	
Application Period:	**From**	**to**	

1. Original Contract Price		$ -
2. Net change by Change Orders		$ -
3. Current Contract Price (Line 1 + Line 2)		$ -
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)		$ -
5. Retainage		
a. _____ X $ - Work Completed		$ -
b. _____ X $ - Stored Materials		$ -
c. Total Retainage (Line 5.a + Line 5.b)		$ -
6. Amount eligible to date (Line 4 - Line 5.c)		$ -
7. Less previous payments (Line 6 from prior application)		
8. Amount due this application		$ -
9. Balance to finish, including retainage (Line 3 - Line 4)		$ -

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:
(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 the Work covered by prior Applications for Payment;
(2) Title to 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 interest, or encumbrances); and
(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____

Signature: _____ **Date:** _____

Recommended by Engineer	**Approved by Owner**
By: _____	**By:** _____
Title: _____	**Title:** _____
Date: _____	**Date:** _____
Approved by Funding Agency	
By: _____	**By:** _____
Title: _____	**Title:** _____
Date: _____	**Date:** _____

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Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner: _____
Engineer: _____
Contractor: _____
Project: _____
Contract: _____

Owner's Project No.: _____
Engineer's Project No.: _____
Contractor's Project No.: _____

Application No.: _____ Application Period: From _____ to _____ Application Date: _____

A	B	C	D	E	F	G	H	I
			Work Completed					
Item No.	Description	Scheduled Value ($)	(D + E) From Previous Application ($)	This Period ($)	Materials Currently Stored (not in D or E) ($)	Work Completed and Materials Stored to Date (D + E + F) ($)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) ($)
	Original Contract							
			-			-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
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						-		-
						-		-
						-		-
	Original Contract Totals	$ -	$ -	$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment
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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: _____
Engineer: _____
Contractor: _____
Project: _____
Contract: _____

Owner's Project No.: _____
Engineer's Project No.: _____
Contractor's Project No.: _____

Application No.: _____ Application Period: From _____ to _____ Application Date: _____

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Original Contract											
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					-		-		-		-
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				Original Contract Totals	$ -		$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment
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Stored Materials Summary

Contractor's Application for Payment

Owner: _____
Engineer: _____
Contractor: _____
Project: _____
Contract: _____

Owner's Project No.: _____
Engineer's Project No.: _____
Contractor's Project No.: _____

Application No.: _____ Application Period: From _____ to _____ Application Date: _____

A	B	C	D	E	F	G	H	I	J	K	L	M
						Materials Stored			Incorporated in Work			
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Previous Amount Stored ($)	Amount Stored this Period ($)	Amount Stored to Date (G+H) ($)	Amount Previously Incorporated in the Work ($)	Amount Incorporated in the Work this Period ($)	Total Amount Incorporated in the Work (J+K) ($)	Materials Remaining in Storage (I-L) ($)
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EJCDC C-620 Contractor's Application for Payment
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NORTH CAROLINA SALES TAX AND USE REPORT

(Paid During This Estimate Period)

PAGE ____ of ____

PROJECT _____ _____ COUNTY ESTIMATE NO. _____

CONTRACTOR _____ PERIOD ENDING _____

DATE	VENDOR NAME	INVOICE NUMBER	INVOICE AMOUNT	TYPE OF PROPERTY	STATE TAX	COUNTY TAX	TOTAL TAX	COUNTY OF SALE*

I certify that the above-listed vendors were paid sales tax upon purchase of building materials during the period covered by the construction estimate, and the property upon which such taxes were paid with or will be used in the performance of this contract. No tax on purchases or rentals of supplies, tools and/or equipment is included in the above list. All of the material above became a part of or is annexed to the building(s) or structure(s) being erected, altered or repaired. I certify that, to the best of my knowledge, the information provided here is true, correct, and complete

Sworn to and subscribed to before me this _____ day of _____, 20____.

_____
Notary Public

My commission expires: _____

Seal

_____
Contractor's Signature

_____
Print or Type Name of Above

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

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner: New Hanover County	Owner's Project No.:
Engineer: The Wooten Company	Engineer's Project No.: 3514-A
Contractor: Contractor's Legal Name	Contractor's Project No.:
Project: Holly Shelter Road Business Park – Roadway Infrastructure Improvements – Phase I	
Contract Name:	

This _____ Preliminary _____ Final Certificate of Substantial Completion applies to:

_____ All Work _____ The following specified portions of the Work:

Date of Substantial Completion: Enter date, as determined by Engineer

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and 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.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner's Responsibilities: ____ None ____ As follows:

Amendments to Contractor's Responsibilities: _____ None _____ As follows:

The following documents are attached to and made a 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

By (signature):
Name (printed):
Title:

2018 EJCDC® C-625, Certificate of Substantial Completion.

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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GUIDELINES FOR USE OF EJCDC® C-700, STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

1.0 PURPOSE AND INTENDED USE OF THE DOCUMENT

EJCDC® C-700, Standard General Conditions of the Construction Contract (2018), is the foundation document for the EJCDC Construction Series. The General Conditions define the basic rights, responsibilities, risk allocations, and contractual relationship of the Owner and Contractor, and establish how the Contract is to be administered.

2.0 OTHER DOCUMENTS

EJCDC documents are intended to be used as a system and changes in one EJCDC document may require a corresponding change in other documents. Other EJCDC documents may also serve as a reference to provide insight or guidance for the preparation of this document.

These General Conditions have been prepared for use with either EJCDC® C-520, Agreement Between Owner and Contractor for Construction Contract (Stipulated Price), or EJCDC® C-525, Agreement Between Owner and Contractor for Construction Contract (Cost-Plus-Fee) (2018 Editions). The provisions of the General Conditions and the Agreement are interrelated, and a change in one may necessitate a change in the other.

To prepare supplementary conditions that are coordinated with the General Conditions, use EJCDC® C-800, Supplementary Conditions of the Construction Contract (2018).

The full EJCDC Construction series of documents is discussed in the EJCDC® C-001, Commentary on the 2018 EJCDC Construction Documents (2018).

3.0 ORGANIZATION OF INFORMATION

All parties involved in a construction project benefit significantly from a standardized approach in the location of subject matter throughout the documents. Experience confirms the danger of addressing the same subject matter in more than one location; doing so frequently leads to confusion and unanticipated legal consequences. Careful attention should be given to the guidance provided in EJCDC® N-122/AIA® A521, Uniform Location of Subject Matter (2012 Edition) when preparing documents. EJCDC® N-122/AIA® A521 is available at no charge from the EJCDC website, www.ejcdc.org, and from the websites of EJCDC's sponsoring organizations.

If CSI MasterFormat™ is used for organizing the Project Manual, consult CSI MasterFormat™ for the appropriate document number (e.g., under 00 11 00, Advertisements and Invitations), and accordingly number the document and its pages.

4.0 EDITING THIS DOCUMENT

Remove these Guidelines for Use. Some users may also prefer to remove the two cover pages.

Although it is permissible to revise the Standard EJCDC Text of C-700 (the content beginning at page 1 and continuing to the end), it is common practice to leave the Standard EJCDC Text of C-700 intact and unaltered, with modifications and supplementation of C-700's provisions set forth in EJCDC® C-800, Supplementary Conditions of the Construction Contract (2018). If the Standard Text itself is revised, the

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user must comply with the terms of the License Agreement, Paragraph 4.0, Document-Specific Provisions, concerning the tracking or highlighting of revisions. The following is a summary of the relevant License Agreement provisions:

1. The term "Standard EJCDC Text" for C-700 refers to all text prepared by EJCDC in the main body of the document. Document covers, logos, footers, instructions, or copyright notices are not Standard EJCDC Text for this purpose.
2. During the drafting or negotiating process for C-700, it is important that the two contracting parties are both aware of any changes that have been made to the Standard EJCDC Text. Thus, if a draft or version of C-700 purports to be or appears to be an EJCDC document, the user must plainly show all changes to the Standard EJCDC Text, using "Track Changes" (redline/strikeout), highlighting, or other means of clearly indicating additions and deletions.
3. If C-700 has been revised or altered and is subsequently presented to third parties (such as potential bidders, grant agencies, lenders, or sureties) as an EJCDC document, then the changes to the Standard EJCDC Text must be shown, or the third parties must receive access to a version that shows the changes.
4. Once the document is ready to be finalized (and if applicable executed by the contracting parties), it is no longer necessary to continue to show changes to the Standard EJCDC Text. The user may produce a final version of the document in a format in which all changes are accepted, and the document at that point does not need to include any "Track Changes," redline/strikeout, highlighting, or other indication of additions and deletions to the Standard EJCDC Text.

5.0 LICENSE AGREEMENT

This document is subject to the terms and conditions of the **License Agreement, 2018 EJCDC® Construction Series Documents**. A copy of the License Agreement was furnished at the time of purchase of this document, and is available for review at www.ejcdc.org and the websites of EJCDC's sponsoring organizations.

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

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requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

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recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

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33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

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

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—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, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, 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 of such Work.

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43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, 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 a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

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

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

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1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the 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 is not intended to and shall not be effective to assign to Engineer 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 Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means 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. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

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F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

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into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

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ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of 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.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

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inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

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B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. 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 Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer'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

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established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer 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 professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

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D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing 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.

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B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

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and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, 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;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

4. 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 as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

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Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

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 Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

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3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then 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 as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

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or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. 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 Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, 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

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of construction to be employed by Contractor, and safety precautions and programs incident thereto;

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.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. 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 Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. 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

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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, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, 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, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, 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 arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

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Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

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Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

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L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is 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; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

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4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

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Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

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6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

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B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. 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 will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

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2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

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3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

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H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, 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 arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, 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 arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

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7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. 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 the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *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 place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, 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 arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

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7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

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I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as 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.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

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3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

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document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

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d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

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9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused 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 any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, 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, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will 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 benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

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D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

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E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

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B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

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9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor 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. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

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ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer 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, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer'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, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer 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.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer 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 Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

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E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer 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, Engineer 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.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer 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 Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer 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. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer 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.

D. Engineer'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 other documentation required to be delivered by Contractor under Paragraph 15.06.A, 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.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

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ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

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B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

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1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

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11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

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Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

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and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

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2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

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consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

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g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

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Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. 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. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. 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.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

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thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

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D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

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losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. 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, then Owner may order Contractor to stop the Work,

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or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will 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.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or 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, 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 Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

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establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

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4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work;

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

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b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

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submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

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significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

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d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

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appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;

2. correct such defective Work;

3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

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attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. 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. 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. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

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provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

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18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard 00 72 00, General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, “Paragraph SC-4.05.”

ARTICLE 1 DEFINITIONS AND TERMINOLOGY

The Specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

SC-1.01.A.8 – Add the following at the end of the Paragraph:

The Change Order form to be used on this Project is EJCDC C-941 (2018). Agency approval is required before Change Orders are effective.

SC-1.01.A.53 -57 – Add the following new paragraph immediately after Paragraph 1.01.A.52:

A.53 Notice of Violation - A written notification from a governmental agency that the Owner has violated a law or regulation that the agency has jurisdiction over. Notice will take the form used by the agency and may outline action to be taken by the Owner to correct the violation and may include a monetary fine.

A.54 The term "minority business" means a business:

A In which at least fifty-one percent (51%) is owned by one or more minority persons or socially and economically disadvantaged individuals, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and

B Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.

A.55 The term "minority person" means 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;

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;

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, or the Pacific Islands;

D American Indian, that is, a person having origins in any of the original Indian peoples of North America; or

E Female.

Document prepared in accordance with EJCDC No. C-800 (2018) & RUS Bulletin 1780-26(2019) Exhibit B, Attachment 6

A.56 The term "socially and economically disadvantaged individual" means the same as defined in 15 U.S.C. 637; “Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities”. “Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged.”

A.57 Regular Working Hours: Regular working hours for the project are defined as 8:00 am to 5:00 pm, Eastern Standard Time.

ARTICLE 2 PRELIMINARY MATTERS

2.02 *Copies of Documents*

SC-2.02 Amend the first sentence of Paragraph 2.02.A. to read as follows:

A Owner shall furnish to Contractor two printed copies of the Contract Documents (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF).

ARTICLE 3 CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

SC-3.01.F Add the following paragraph after 3.01.F:

3.01.G Division 1, General Requirements, govern the execution of all sections of the specifications.

ARTICLE SC-4 COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.01.A – Delete the last sentence of paragraph and add the following to the second sentence of the paragraph:

unless a later date is agreed to by the Owner and Contractor.

4.05 *Delays in Contractor’s Progress*

SC-4.05 Amend Paragraph 4.05.C by adding the following subparagraphs:

5. Weather-Related Delays

A If “abnormal weather conditions” as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled. Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered abnormal weather conditions. Requests for time extensions due to abnormal weather conditions will be submitted to the Engineer within five days of the end of the abnormal weather condition event. It is the responsibility of the Contractor to provide the information listed in SC 4.05.C.5.b.

B The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:

1. Every workday on which one or more of the following conditions exist will be considered a “bad weather day”:

a. Total precipitation (as rain equivalent) occurring between 7:00 p.m. on the preceding day (regardless of whether such preceding day is a workday) through 7:00 p.m. on the workday in question equals or exceeds [threshold precipitation quantity] of precipitation (as rain equivalent, based on the snow/rain conversion indicated in the table entitled Foreseeable Bad Weather Days; such table is hereby incorporated in this SC-4.05.C by reference.

b. Ambient outdoor air temperature at 11:00 a.m. is equal to or less than the following low temperature threshold: [temperature] degrees Fahrenheit; or, at 3:00 p.m. the ambient outdoor temperature is equal to or greater than the following high temperature threshold: [temperature] degrees Fahrenheit.

2. Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded by [name of the entity operating the weather station] weather monitoring station at [location of the weather monitoring station].
3. Contractor shall anticipate the number of foreseeable bad weather days per month indicated in the table in Exhibit [exhibit number]—Foreseeable Bad Weather Days.
4. In each month, every bad weather day exceeding the number of foreseeable bad weather days established in the table in Exhibit [exhibit number]—Foreseeable Bad Weather Days will be considered as "abnormal weather conditions." The existence of abnormal weather conditions will not relieve Contractor of the obligation to demonstrate and document that delays caused by abnormal weather are specific to the planned work activities or that such activities thus delayed were on Contractor's then-current Progress Schedule's critical path for the Project.

ARTICLE 5 SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Geotechnical Report – Holly Shelter Industrial Park Phase I Access Road	July 29, 2024	
Geotechnical Report – Holly Shelter Park Lift Station	February 14, 2025	

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
TBD		

G. Contractor may download copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents at [location] during regular business hours, or may request copies from Engineer.

5.05 *Underground Facilities*

SC-5.05 Add the following to paragraph 5.05.A.2

Follow North Carolina General Statutes, Chapter 87, Article 8A Underground Utility Safety and Damage Prevention Act. Contact NC811.org before the start of excavation.

5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
NONE		

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
NONE		

ARTICLE 6 BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.A:

1. *Required Performance Bond Form*: The performance bond that Contractor furnishes will be in the form provided in this contract manual.
2. *Required Payment Bond Form*: The payment bond that Contractor furnishes will be in the form provided in this contract manual.

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.B:

1. Provide the following Bonds in addition to the Performance and Payment Bonds required in the General Conditions.
   a. TBD

6.02 *Insurance—General Provisions*

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.H.2 of the General Conditions:

3. For the following Subcontractors, Suppliers, or categories of Subcontractor or Supplier, Contractor shall require the following specified insurance, with policy limits as stated: [Identify Subcontractors, Suppliers, or categories of same, and insert specific insurance requirements and policy limits]

6.03 *Contractor's Insurance*

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

D. Other Additional Insureds: As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following: [Here list by legal name (not category, role, or classification) other persons or entities to be included as additional insureds. See GC-6.03.C.]

E. Workers' Compensation and Employer's Liability: Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Jones Act (if applicable)	
Bodily injury by accident—each accident	$
Bodily injury by disease—aggregate	$
Employer's Liability	
Each accident	$
Each employee	$
Policy limit	$
Stop-gap Liability Coverage	
For work performed in monopolistic states, stop-gap liability coverage must be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	$

F Commercial General Liability—Claims Covered: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,

2. damages insured by reasonably available personal injury liability coverage, and

3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G Commercial General Liability—Form and Content: Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

A Products and completed operations coverage.

1. Such insurance must be maintained for three years after final payment.
2. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

B Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

C Severability of interests and no insured-versus-insured or cross-liability exclusions.

D Underground, explosion, and collapse coverage.

E Personal injury coverage.

F Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.

G For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

H Commercial General Liability—Excluded Content: The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
2. Any exclusion for water intrusion or water damage.
3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
4. Any exclusion of coverage relating to earth subsidence or movement.
5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
6. Any limitation or exclusion based on the nature of Contractor's work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I Commercial General Liability—Minimum Policy Limits

Commercial General Liability	Policy limits of not less than:
General Aggregate	$2,000,000.00
Products—Completed Operations Aggregate	$1,000,000.00
Personal and Advertising Injury	$1,000,000.00
Bodily Injury and Property Damage—Each Occurrence	$1,000,000.00

J Automobile Liability: Contractor shall purchase and maintain automobile liability insurance 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. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	Policy limits of not less than:
Bodily Injury	
Each Person	$1,000,000.00
Each Accident	$1,000,000.00
Property Damage	
Each Accident	$1,000,000.00
[or]	
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000.00

K Umbrella or Excess Liability: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$5,000,000.00
General Aggregate	$5,000,000.00

L Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements: Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of $[specify amount] after accounting for partial attribution of its limits to underlying policies, as allowed above.

M Contractor's Pollution Liability Insurance: Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	$2,000,000.00

General Aggregate	$2,000,000.00

O Railroad Protective Liability Insurance: Prior to commencing any Work within 50 feet of railroad-owned and controlled property, Contractor shall (1) endorse its commercial general liability policy with ISO CG 24 17, removing the contractual liability exclusion for work within 50 feet of a railroad, (2) purchase and maintain railroad protective liability insurance meeting the following requirements, (3) furnish a copy of the endorsement to Owner, and (4) submit a copy of the railroad protective policy and other railroad-required documentation to the railroad, and notify Owner of such submittal.

ARTICLE 7 CONTRACTOR'S RESPONSIBILITIES

7.03 *Labor; Working Hours*

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

A Regular working hours will be 8:00 am to 5:00 pm.

B Owner's legal holidays are New Year's Day, MLK Day, Presidents' Day, Good Friday, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day, Christmas Eve, Christmas Day, and Day after Christmas.

ARTICLE 8 -- OTHER WORK AT THE SITE

No suggested Supplementary Conditions in this Article.

ARTICLE 9 -- OWNER'S RESPONSIBILITIES

No suggested Supplementary Conditions in this Article.

ARTICLE 11 -- CHANGES TO THE CONTRACT

No suggested Supplementary Conditions in this Article.

ARTICLE 12 -- CLAIMS

No suggested Supplementary Conditions in this Article.

ARTICLE 13 -- COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.01 *Cost of the Work*

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:

a. For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at a retail would be less than $500.

SC-13.02.C - Delete paragraph in its entirety and insert "Deleted"

13.03 *Unit Price Work*

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. Adjustment in Unit Price

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the extended price of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and

the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14 -- TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCCEPTANCE OF DEFECTIVE WORK

No suggested Supplementary Conditions in this Article.

ARTICLE 15 -- PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 *Progress Payments*

SC-15.01 Add the following new Paragraph 15.01.F:

F. For contracts in which the Contract Price is based on the Cost of Work, if Owner determines that progress payments made to date substantially exceed the actual progress of the Work (as measured by reference to the Schedule of Values), or present a potential conflict with the Guaranteed Maximum Price, then Owner may require that Contractor prepare and submit a plan for the remaining anticipated Applications for Payment that will bring payments and progress into closer alignment and take into account the Guaranteed Maximum Price (if any), through reductions in billings, increases in retainage, or other equitable measures. Owner will review the plan, discuss any necessary modifications, and implement the plan as modified for all remaining Applications for Payment.

SC-15.02.A – Amend paragraph by striking out the following text: "7 days after".

15.03 *Substantial Completion*

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

A If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

ARTICLE 16 -- SUSPENSION OF WORK AND TERMINATION

No suggested Supplementary Conditions in this Article.

ARTICLE 17 -- FINAL RESOLUTIONS OF DISPUTES

SC-17.01.B, Delete Paragraph 17.01.B in its entirety and replace it with the following:

B. Disputes shall be resolved in accordance with the dispute resolution process adopted on February 26, 2002, by the N. C. State Building Commission. The "Rules Implementing Mediated Settlement Conferences in North Carolina Public Construction Projects" are attached to this section.

SC-17.01.C, Delete Paragraph 17.01.C in its entirety and replace it with the following

C. All parties agree that only the North Carolina courts shall have jurisdiction over the Contract and any controversies arising out of this Contract and this agreement shall be governed by and construed in accordance with the laws of the State of North Carolina.

END OF SECTION

SECTION 00 73 84

PROJECT PERMITS

JOSH STEIN
Governor
D. REID WILSON
Secretary
WILLIAM E. TOBY VINSON, JR
Director

NORTH CAROLINA
Environmental Quality

10-20-2025

LETTER OF APPROVAL

New Hanover County
230 Government Center Drive
Wilmington, NC 28403

RE: Project Name: Roadway Infrastructure Improvements - Phase 1
Permit Number: NEWHA-2026-0140
Permit Application ID: PA-039309
Acres Approved: 15.30
County: New Hanover
City: Castle Hayne
Address: Holly Shelter Road
River Basin: Cape Fear
Stream Classification: B: Primary Contact Recreation, Fresh Water; SW: Swamp Waters
Plan Type: New Plan
Date Complete Plan Received by LQS: 09-24-2025

Dear New Hanover County,

This office has received and reviewed the subject erosion and sedimentation control plan. We find the plan to be acceptable and hereby issue this Letter of Approval. The enclosed Certificate of Approval must be posted at the job site. This plan shall expire three (3) years following the date of approval, if no land disturbing activity has been undertaken, as is required by Title 15A NCAC 4B .0129.

As of April 1, 2019, all new construction activities are required to complete and submit an electronic Notice of Intent (eNOI) form requesting a COC under the NCG010000 Construction Stormwater General Permit. You must apply for coverage by submitting a "Construction Stormwater – NCG01 (Subject to the SPCA) in the AccessDEQ Portal. Once your application is complete, you will receive an invoice for the $127 annual permit fee and can submit payment through the AccessDEQ Portal. Once the fee is processed and the application approved, you will receive the COC via email. As the Financially Responsible Party shown on the FRO form submitted for this project, you MUST obtain the COC prior to commencement of any land disturbing activity. Please direct questions about the eNOI form to the

Stormwater Program staff in the Raleigh central office. If the owner/operator of this project changes in the future, the new responsible party must obtain a new COC.

Title 15A NCAC 4B .0118(a) and the NCG01 permit require that the following documentation be kept on file at the job site:

1. The approved E&SC plan as well as any approved deviation.
2. The NCG01 permit and the COC, once it is received.
3. Records of inspections made during the previous 12 months.

Also, this letter gives the notice required by G.S. 113A-61.1(a) of our right of periodic inspection to ensure compliance with the approved plan.

North Carolina's Sedimentation Pollution Control Act is performance-oriented, requiring protection of existing natural resources and adjoining properties. If, following the commencement of this project, the erosion and sedimentation control plan is inadequate to meet the requirements of the Sedimentation Pollution Control Act of 1973 (North Carolina General Statute 113A-51 through 66), this office may require revisions to the plan and implementation of the revisions to ensure compliance with the Act.

Acceptance and approval of this plan is conditioned upon your compliance with Federal and State water quality laws, regulations, and rules. In addition, local city or county ordinances or rules may also apply to this land-disturbing activity. This approval does not supersede any other permit or approval.

Please note that this approval is based in part on the accuracy of the information provided in the Financial Responsibility Form and on the plan, which you provided. You are requested to file an amended form if there is any change in the information included on the form.

Your cooperation is appreciated.

Sincerely,

Mike Cook

Mike Cook
Engineer II
Division of Energy, Mineral and Land Resources
Land Quality Section
Phone: (910) 796-7315
Email: mike.cook@deq.nc.gov
127 Cardinal Drive Extension
Wilmington, NC 28405

Approval Letter and Conditions

Project Name: Roadway Infrastructure Improvements - Phase 1
Permit Number: NEWHA-2026-0140
Permit Application ID: PA-039309
County: New Hanover

1. This plan approval shall expire three (3) years following the date of approval, if no land-disturbing activity has been undertaken, as is required by Title 15A NCAC 4B .0129.

2. The developer is responsible for the control of sediment on-site. If the approved erosion and sedimentation control measures prove insufficient, the developer must take those additional steps necessary to stop sediment from leaving this site (NCGS 113A-57(3)). Each sediment storage device must be inspected after each storm event (NCGS 113A-54.1(e)). Maintenance and/or clean out is necessary anytime the device is at 50% capacity. All sediment storage measures will remain on site and functional until all grading and final landscaping of the project is complete (15A NCAC 04B .0113).

3. Any and all existing ditches on this project site are assumed to be left undisturbed by the proposed development unless otherwise noted. The removal of vegetation within any existing ditch or channel is prohibited unless the ditch or channel is to be regarded with side slopes of 2 horizontal to 1 vertical or less steep (15A NCAC 04B .0124 (d)). Bank slopes may be mowed, but stripping of vegetation is considered new earth work and is subject to the same erosion control requirements as new ditches (NCGS 113A-52(6)).

4. The developer is responsible for obtaining any and all permits and approvals necessary for the development of this project prior to the commencement of this land disturbing activity. This could include our agency's Stormwater regulations and the Division of Water Resources' enforcement requirements within Section 401 of the Clean Water Act, the U.S. Army Corps of Engineers' jurisdiction of Section 404 of the Clean Water Act, the Division of Coastal Management's CAMA requirements, the Division of Solid Waste Management's landfill regulations, the Environmental Protection Agency and/or The U.S. Army Corps of Engineers jurisdiction of the Clean Water Act, local County or Municipalities' ordinances, or others that may be required. This approval cannot supersede any other permit or approval; however, in the case of a Cease and Desist Order from the Corps of Engineers, that Order would only apply to wetland areas. All highland would still have to be in compliance with the N.C. Sedimentation Pollution Control Act.

5. If any area on site falls within the jurisdiction of Section 401 or 404 of the Clean Water Act, the developer is responsible for compliance with the requirements of the Division of Water Resources (DWR), the Corps of Engineers and the Environmental Protection Agency (EPA) respectively. Any erosion control measures that fall within jurisdictional wetland areas must be approved by the aforementioned agencies prior to installation. The Land Quality Section must be notified of a relocation of the measures in question to the transition point between the wetlands and the uplands to assure that the migration of sediment will not occur. If that relocation presents a problem or contradicts any requirements of either DWR, the Corps, or the EPA, it is the responsibility of the developer to inform the Land Quality Section regional office so that an adequate contingency plan can be made to assure sufficient erosion control remains on site. Failure to do so will be considered a violation of this approval (NCGS 113A-54.1(b)).

6. Any borrow material brought onto this site must be from a legally operated mine or other approved source. Any soil waste that leaves this site can be transported to a permitted mine or separately permitted construction sites without additional permits under NCGS 74-49(7)(d). Disposal at any other location would have to be included as a permit revision for this approval.

7. This permit allows for a land disturbance, as called for on the application plan, not to exceed **15.30 acres.** Land disturbance should be conducted in a manner to minimize land exposure, preferably limited exposure to approximately 20 acres at a time. Exceeding that acreage will be a violation of this permit and would require a revised plan and additional application fee. Any addition in impervious surface, over that already noted on the approved plan, would also require a revised plan to verify the appropriateness of the erosion control measures and stormwater retention measures (NCGS 113A-54.1(b)).

8. The construction detail for the proposed silt fence requires reinforcing wire and **steel** posts a maximum of eight (8) feet apart. Omission of the reinforcing wire is a construction change that necessitates more posts for support, i.e., the spacing distance needs to be reduced to no greater than six (6) feet apart (E&SC Planning & Design Manual 6.63, Rev. 6/06).

9. Because the sediment traps and basins are shown on the plan as the primary sedimentation and erosion control devices on this project, it is necessary that the traps and basins and their collection systems be installed before any other grading takes place on site, and that every structure that receives more than one acre of drainage is built so that each dewaters only from the surface (NCG010000). If that proves to be impractical, a revised plan must be submitted and approved that addresses erosion and sediment control needs during the interim period until the traps and basins are fully functioning (113A-54.1(b)).

10. A graveled construction entrance must be located at each point of access and egress available to construction vehicles during the grading and construction phases of this project. Access and egress from the project site at a point without a graveled entrance will be considered a violation of this approval. Routine maintenance of the entrances is critical (113A-54.1(b)).

11. As a condition of the NPDES General Stormwater Permit (NCG010000), the financially responsible party shall comply with the NCG01 Ground Stabilization And Materials Handling requirements that became effective April 1, 2019. The NCG01 Ground Stabilization And Materials Handling standard detail can be printed from the deq.nc.gov/NCG01 website.

12. As a condition of the NPDES General Stormwater Permit (NCG010000), the financially responsible party shall comply with the NCG01 Self-Inspection, Recordkeeping and Reporting requirements that became effective April 1, 2019. The NCG01 Self-Inspection, Recordkeeping and Reporting standard detail can be printed from the deq.nc.gov/NCG01 website.

13. As a part of routine monitoring of the approved land-disturbing activity, the financially responsible party shall assure inspections of the area covered by the approved plan after each phase of the plan has been completed and after establishment of temporary ground cover in accordance with North Carolina General Statute 113A-54.1(e).

14. In order to comply with the basic control objectives of the SPCA (15A NCAC 04B .0106), both exposed area and time of exposure should be limited. We recommend this project be phased so that uncovered area is limited to a maximum of 20 acres at any given time. As per North Carolina General Statute 113A-57(5), the land-disturbing activity shall be conducted in accordance with the approved erosion and sedimentation control plan.

Ref: G.S. 113A-54.1 through G.S. 113A-57
Sections 15A NCAC 04A.0101 through 15A NCAC 04E.0504
General Permit NCG 010000 NPDES for Construction Activities

FINANCIAL RESPONSIBILITY/OWNERSHIP FORM
SEDIMENTATION POLLUTION CONTROL ACT

No person may initiate any land-disturbing activity on one or more acres as covered by the Act, including any activity under a common plan of development of this size as covered by the NCG01 permit, before this form and an acceptable erosion and sedimentation control plan have been completed and approved by the Land Quality Section, N.C. Department of Environmental Quality. Submit the completed form to the appropriate Regional Office. (Please type or print and, if the question is not applicable or the e-mail address or phone number is unavailable, place N/A in the blank.)

Part A.

1. Project Name: Roadway Infrastructure Improvements - Phase 1

**If this project involves American Rescue Plan Act (ARPA) funds, list the Project Name below under which you applied for funding through the Division of Water Infrastructure (DWI).*

Is Project ARPA Funded	ARPA Project Name	ARPA Project #
No		

Is Project SL 2023-134 Funded	SL 2023-134 Project Number
No	

2. Location of land-disturbing activity: County: New HanoverCity or Township: Castle Hayne

   Highway/Street: Holly Shelter Road Latitude: 34.3621 Longitude: -77.8474

3. Approximate date land-disturbing activity will commence: 01/26/2026

4. Purpose of development (residential, commercial, industrial, institutional, etc.): Commercial

5. Total acreage disturbed or uncovered (including off-site borrow and waste areas): 15.3

6. The application fee of $119.00 per acre (rounded up to the next acre) is assessed without a ceiling amount (Example: An 8.10 acre application fee is $1,071).

7. Has an erosion and sediment control plan been filed? No

8. Person to contact should erosion and sediment control issues arise during land-disturbing activity:

   Name: Galen Jamison E-mail Address: gjamison@nhcgov.com

   Phone: Mobile: 910-798-7072

9. Landowner(s) of Record:

Landowner(s) of Record			
Name	**Email**	**Business Phone**	**Mobile Phone**
Sidbury Land & Property Company, LLC	hill@cameronco.com	(910) 512-3263	
Physical Address		**Mailing Address**	
P.O. Box 3649 Wilmington, NC 28406		P.O. Box 3649 Wilmington, NC 28406	

Part B.

1. Company(ies) who are financially responsible for the land-disturbing activity (Provide a comprehensive list of all responsible parties on accompanied page.) *If the company is a sole proprietorship or if the landowner(s) is an individual(s), the name(s) of the owner(s) may be listed as the financially responsible party(ies).*

Primary Financially Responsible Party			
Company Name	**Email**	**Business Phone**	**Mobile Phone**
New Hanover County	gjamison@nhcgov.com	(910) 798-7072	
Physical Address		**Mailing Address**	
230 Government Center Drive Suite 160 Wilmington, NC 28403		230 Government Center Drive Suite 160 Wilmington, NC 28403	

Additional Financially Responsible Parties			
Company Name	**Email**	**Business Phone**	**Mobile Phone**
Galen Jamison	gjamison@nhcgov.com		910-798-7072
Physical Address		**Mailing Address**	

Note: If the Financially Responsible Party is not the owner of the land to be disturbed, include with this form the landowner's signed and dated written consent for the applicant to submit a draft erosion and sedimentation control plan and to conduct the anticipated land disturbing activity.

2. (a) If the Financially Responsible Party is a domestic company registered on the NC Secretary of State business registry, give name and street address of the Registered Agent:

Registered Agent Information			
Name	**Email**	**Business Phone**	**Mobile Phone**
New Hanover County	gjamison@nhcgov.com	(910) 798-7072	
Physical Address		**Mailing Address**	
230 Government Center Drive Suite 160 Wilmington, NC 28403		230 Government Center Drive Suite 160 Wilmington, NC 28403	

(b) If the Financially Responsible Party is not a resident of North Carolina, give name and street address of the designated North Carolina agent who is registered on the NC Secretary of State business registry:

North Carolina Agent Information			
Name	**Email**	**Business Phone**	**Mobile Phone**
Physical Address		**Mailing Address**	

Engineering/Consulting Firm Information			
Name	**Email**	**Business Phone**	**Mobile Phone**
The Wooten Company	awadsworth@thewootencompany.com		
Physical Address		**Mailing Address**	
120 N. Boylan Ave. Raleigh, NC 27603		120 N. Boylan Ave. Raleigh, NC 27603	

Additional Details

1. Stream Classification: B: Primary Contact Recreation, Fresh Water, SW: Swamp Waters
2. Was Express Review Requested: No

The above information is true and correct to the best of my knowledge and belief and was provided by me under oath. (This form must be signed by the Financially Responsible Person if an individual(s) or his attorney-in-fact, or if not an individual, by an officer, director, partner, or registered agent with the authority to execute instruments for the Financially Responsible Party). I agree to provide corrected information should there be any change in the information provided herein.

CERTIFICATE OF PLAN APPROVAL

The posting of this certificate certifies that an erosion and sedimentation control plan has been approved for this project by the North Carolina Department of Environmental Quality in accordance with North Carolina General Statute 113A – 57 (4) and 113A – 54 (d) (4) and North Carolina Administrative Code, Title 15A, Chapter 4B.0107 (c). This certificate must be posted at the primary entrance of the job site before construction begins and until establishment of permanent groundcover as required by North Carolina Administrative Code, Title 15A, Chapter 4B.0127 (b).

Roadway Infrastructure Improvements - Phase 1
Holly Shelter Road Castle Hayne, NC 28429

10/20/2025	NEWHA-2026-0140
Date of Plan Approval	**Project Identifier**

Certificate of Coverage Number: _____

Nationwide Permit 39
Commercial and Institutional Developments
Effective Date: March 15, 2021 / Expiration Date: March 15, 2026
Authorities: Sections 10 and 404

Discharges of dredged or fill material into non-tidal waters of the United States for the construction or expansion of commercial and institutional building foundations and building pads and attendant features that are necessary for the use and maintenance of the structures. Attendant features may include, but are not limited to, roads, parking lots, garages, yards, utility lines, storm water management facilities, wastewater treatment facilities, and recreation facilities such as playgrounds and playing fields. Examples of commercial developments include retail stores, industrial facilities, restaurants, business parks, and shopping centers. Examples of institutional developments include schools, fire stations, government office buildings, judicial buildings, public works buildings, libraries, hospitals, and places of worship. The construction of new golf courses and new ski areas is not authorized by this NWP.

The discharge must not cause the loss of greater than 1/2-acre of non-tidal waters of the United States. This NWP does not authorize discharges of dredged or fill material into non-tidal wetlands adjacent to tidal waters.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity. (See general condition 32.) (Authorities: Sections 10 and 404)

Note: For any activity that involves the construction of a wind energy generating structure, solar tower, or overhead transmission line, a copy of the PCN and NWP verification will be provided by the Corps to the Department of Defense Siting Clearinghouse, which will evaluate potential effects on military activities.

GENERAL CONDITIONS

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. **Navigation.** (a) No activity may cause more than a minimal adverse effect on navigation.

(b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.

(c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his or her authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. **Aquatic Life Movements.** No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3. **Spawning Areas.** Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. **Migratory Bird Breeding Areas.** Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. **Shellfish Beds.** No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. **Suitable Material.** No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

7. **Water Supply Intakes.** No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. **Adverse Effects From Impoundments.** If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. **Management of Water Flows.** To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. **Fills Within 100-Year Floodplains.** The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. **Equipment.** Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. **Soil Erosion and Sediment Controls.** Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow, or during low tides.

13. **Removal of Temporary Structures and Fills.** Temporary structures must be removed, to the maximum extent practicable, after their use has been discontinued. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. **Proper Maintenance.** Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. **Single and Complete Project.** The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. **Wild and Scenic Rivers.** (a) No NWP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a “study river” for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for

such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status.

(b) If a proposed NWP activity will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, the permittee must submit a pre-construction notification (see general condition 32). The district engineer will coordinate the PCN with the Federal agency with direct management responsibility for that river. Permittees shall not begin the NWP activity until notified by the district engineer that the Federal agency with direct management responsibility for that river has determined in writing that the proposed NWP activity will not adversely affect the Wild and Scenic River designation or study status.

(c) Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: http://www.rivers.gov/.

17. **Tribal Rights.** No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

18. **Endangered Species.** (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify designated critical habitat or critical habitat proposed for such designation. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless ESA section 7 consultation addressing the consequences of the proposed activity on listed species or critical habitat has been completed. See 50 CFR 402.02 for the definition of "effects of the action" for the purposes of ESA section 7 consultation, as well as 50 CFR 402.17, which provides further explanation under ESA section 7 regarding "activities that are reasonably certain to occur" and "consequences caused by the proposed action."

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA (see 33 CFR 330.4(f)(1)). If pre-construction notification is required for the proposed activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species (or species proposed for listing) or designated critical

habitat (or critical habitat proposed such designation) might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat or critical habitat proposed for such designation, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation), the pre-construction notification must include the name(s) of the endangered or threatened species (or species proposed for listing) that might be affected by the proposed activity or that utilize the designated critical habitat (or critical habitat proposed for such designation) that might be affected by the proposed activity. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. For activities where the non-Federal applicant has identified listed species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation) that might be affected or is in the vicinity of the activity, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification that the proposed activity will have "no effect" on listed species (or species proposed for listing or designated critical habitat (or critical habitat proposed for such designation), or until ESA section 7 consultation or conference has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(d) As a result of formal or informal consultation or conference with the FWS or NMFS the district engineer may add species-specific permit conditions to the NWPs.

(e) Authorization of an activity by an NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

(f) If the non-federal permittee has a valid ESA section 10(a)(1)(B) incidental take permit with an approved Habitat Conservation Plan for a project or a group of projects that includes the proposed NWP activity, the non-federal applicant should provide a copy of that ESA section 10(a)(1)(B) permit with the PCN required by paragraph (c) of this general condition. The district engineer will coordinate with the agency that issued the ESA section 10(a)(1)(B) permit to determine whether the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7

consultation conducted for the ESA section 10(a)(1)(B) permit. If that coordination results in concurrence from the agency that the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation for the ESA section 10(a)(1)(B) permit, the district engineer does not need to conduct a separate ESA section 7 consultation for the proposed NWP activity. The district engineer will notify the non-federal applicant within 45 days of receipt of a complete pre-construction notification whether the ESA section 10(a)(1)(B) permit covers the proposed NWP activity or whether additional ESA section 7 consultation is required.

(g) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the FWS and NMFS or their world wide web pages at http://www.fws.gov/ or http://www.fws.gov/ipac and http://www.nmfs.noaa.gov/pr/species/esa/ respectively.

19. **Migratory Birds and Bald and Golden Eagles.** The permittee is responsible for ensuring that an action authorized by an NWP complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting the appropriate local office of the U.S. Fish and Wildlife Service to determine what measures, if any, are necessary or appropriate to reduce adverse effects to migratory birds or eagles, including whether "incidental take" permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

20. **Historic Properties.** (a) No activity is authorized under any NWP which may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)(1)). If pre-construction notification is required for the proposed NWP activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation is not submitted, then additional consultation under section 106 may be necessary. The respective federal agency is responsible for fulfilling its obligation to comply with section 106.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the NWP activity might have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties might have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of,

or potential for, the presence of historic properties can be sought from the State Historic Preservation Officer, Tribal Historic Preservation Officer, or designated tribal representative, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts commensurate with potential impacts, which may include background research, consultation, oral history interviews, sample field investigation, and/or field survey. Based on the information submitted in the PCN and these identification efforts, the district engineer shall determine whether the proposed NWP activity has the potential to cause effects on the historic properties. Section 106 consultation is not required when the district engineer determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). Section 106 consultation is required when the district engineer determines that the activity has the potential to cause effects on historic properties. The district engineer will conduct consultation with consulting parties identified under 36 CFR 800.2(c) when he or she makes any of the following effect determinations for the purposes of section 106 of the NHPA: no historic properties affected, no adverse effect, or adverse effect.

(d) Where the non-Federal applicant has identified historic properties on which the proposed NWP activity might have the potential to cause effects and has so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects to historic properties or that NHPA section 106 consultation has been completed. For non-federal permittees, the district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA section 106 consultation is required. If NHPA section 106 consultation is required, the district engineer will notify the non-Federal applicant that he or she cannot begin the activity until section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(e) Prospective permittees should be aware that section 110k of the NHPA (54 U.S.C. 306113) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties

of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. **Discovery of Previously Unknown Remains and Artifacts.** Permittees that discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by an NWP, they must immediately notify the district engineer of what they have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. **Designated Critical Resource Waters.** Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.

(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, 52, 57 and 58 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38, and 54, notification is required in accordance with general condition 32, for any activity proposed by permittees in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after she or he determines that the impacts to the critical resource waters will be no more than minimal.

23. **Mitigation.** The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless

the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects.

(d) Compensatory mitigation at a minimum one-for-one ratio will be required for all losses of stream bed that exceed 3/100-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. This compensatory mitigation requirement may be satisfied through the restoration or enhancement of riparian areas next to streams in accordance with paragraph (e) of this general condition. For losses of stream bed of 3/100-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects. Compensatory mitigation for losses of streams should be provided, if practicable, through stream rehabilitation, enhancement, or preservation, since streams are difficult-to-replace resources (see 33 CFR 332.3(e)(3)).

(e) Compensatory mitigation plans for NWP activities in or near streams or other open waters will normally include a requirement for the restoration or enhancement, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, the restoration or maintenance/protection of riparian areas may be the only compensatory mitigation required. If restoring riparian areas involves planting vegetation, only native species should be planted. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to restore or maintain/protect a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or maintaining/protecting a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of minimization or compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(f) Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in no more than minimal adverse environmental effects. For the NWPs, the preferred mechanism for providing compensatory mitigation is mitigation bank credits or in-lieu fee program credits (see 33 CFR 332.3(b)(2) and (3)). However, if an appropriate number and type of mitigation bank or in-lieu credits are not available at the time the PCN is submitted to the district engineer, the district engineer may approve the use of permittee-responsible mitigation.

(2) The amount of compensatory mitigation required by the district engineer must be sufficient to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). (See also 33 CFR 332.3(f).)

(3) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, aquatic resource restoration should be the first compensatory mitigation option considered for permittee-responsible mitigation.

(4) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) through (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)). If permittee-responsible mitigation is the proposed option, and the proposed compensatory mitigation site is located on land in which another federal agency holds an easement, the district engineer will coordinate with that federal agency to determine if proposed compensatory mitigation project is compatible with the terms of the easement.

(5) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan needs to address only the baseline conditions at the impact site and the number of credits to be provided (see 33 CFR 332.4(c)(1)(ii)).

(6) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan (see 33 CFR 332.4(c)(1)(ii)).

(g) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any NWP activity resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is

provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that an NWP activity already meeting the established acreage limits also satisfies the no more than minimal impact requirement for the NWPs.

(h) Permittees may propose the use of mitigation banks, in-lieu fee programs, or permittee-responsible mitigation. When developing a compensatory mitigation proposal, the permittee must consider appropriate and practicable options consistent with the framework at 33 CFR 332.3(b). For activities resulting in the loss of marine or estuarine resources, permittee-responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(i) Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. **Safety of Impoundment Structures.** To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state or federal, dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. **Water Quality.** (a) Where the certifying authority (state, authorized tribe, or EPA, as appropriate) has not previously certified compliance of an NWP with CWA section 401, a CWA section 401 water quality certification for the proposed discharge must be obtained or waived (see 33 CFR 330.4(c)). If the permittee cannot comply with all of the conditions of a water quality certification previously issued by certifying authority for the issuance of the NWP, then the permittee must obtain a water quality certification or waiver for the proposed discharge in order for the activity to be authorized by an NWP.

(b) If the NWP activity requires pre-construction notification and the certifying authority has not previously certified compliance of an NWP with CWA section 401, the proposed discharge is not authorized by an NWP until water quality certification is obtained or waived. If the certifying authority issues a water quality certification for the proposed discharge, the permittee must submit a copy of the certification to the district engineer. The discharge is not authorized by an NWP until the district engineer has notified the permittee that the water quality certification requirement has been satisfied by the issuance of a water quality certification or a waiver.

(c) The district engineer or certifying authority may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. **Coastal Zone Management.** In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). If the permittee cannot comply with all of the conditions of a coastal zone management consistency concurrence previously issued by the state, then the permittee must obtain an individual coastal zone management consistency concurrence or presumption of concurrence in order for the activity to be authorized by an NWP. The district engineer or a state may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. **Regional and Case-By-Case Conditions.** The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its CWA section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. **Use of Multiple Nationwide Permits.** The use of more than one NWP for a single and complete project is authorized, subject to the following restrictions:

(a) If only one of the NWPs used to authorize the single and complete project has a specified acreage limit, the acreage loss of waters of the United States cannot exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

(b) If one or more of the NWPs used to authorize the single and complete project has specified acreage limits, the acreage loss of waters of the United States authorized by those NWPs cannot exceed their respective specified acreage limits. For example, if a commercial development is constructed under NWP 39, and the single and complete project includes the filling of an upland ditch authorized by NWP 46, the maximum acreage loss of waters of the United States for the commercial development under NWP 39 cannot exceed 1/2-acre, and the total acreage loss of waters of United States due to the NWP 39 and 46 activities cannot exceed 1 acre.

29. **Transfer of Nationwide Permit Verifications.** If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification

must be attached to the letter, and the letter must contain the following statement and signature:

"When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."

_____
(Transferee)

_____
(Date)

30. **Compliance Certification.** Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

(a) A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;

(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and

(c) The signature of the permittee certifying the completion of the activity and mitigation.

The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. **Activities Affecting Structures or Works Built by the United States.** If an NWP activity also requires review by, or permission from, the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a "USACE project"), the prospective permittee must submit a pre-construction notification. See paragraph

(b)(10) of general condition 32. An activity that requires section 408 permission and/or review is not authorized by an NWP until the appropriate Corps office issues the section 408 permission or completes its review to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. **Pre-Construction Notification.** (a) *Timing*. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) *Contents of Pre-Construction Notification*: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed activity;

(3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposed activity;

(4) (i) A description of the proposed activity; the activity's purpose; direct and indirect adverse environmental effects the activity would cause, including the anticipated amount of loss of wetlands, other special aquatic sites, and other waters expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; a description of any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed activity; and any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings for linear projects that require Department of the Army authorization but do not require pre-construction notification. The description of the proposed activity and any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the need for compensatory mitigation or other mitigation measures.

(ii) For linear projects where one or more single and complete crossings require pre-construction notification, the PCN must include the quantity of anticipated losses of wetlands, other special aquatic sites, and other waters for each single and complete crossing of those wetlands, other special aquatic sites, and other waters (including those single and complete crossings authorized by an NWP but do not require PCNs). This information will be used by the district engineer to evaluate the cumulative adverse environmental effects of the proposed linear project, and does not change those non-PCN NWP activities into NWP PCNs.

(iii) Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the activity and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(5) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial and intermittent streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. Furthermore, the 45-day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(6) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands or 3/100-acre of stream bed and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(7) For non-federal permittees, if any listed species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation) might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat (or critical habitat proposed for such designation), the PCN must include the name(s) of those endangered or threatened species (or species proposed for listing) that might be affected by the proposed activity or utilize the designated critical habitat (or critical habitat proposed for such designation) that might be affected by the proposed activity. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with the Endangered Species Act;

(8) For non-federal permittees, if the NWP activity might have the potential to cause effects to a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, the PCN must state which historic property might have the potential to be affected by the proposed activity or include a vicinity map indicating the location of the historic property. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with section 106 of the National Historic Preservation Act;

(9) For an activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a “study river” for possible inclusion in the system while the river is in an official study status, the PCN must identify the Wild and Scenic River or the “study river” (see general condition 16); and

(10) For an NWP activity that requires permission from, or review by, the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, the pre-construction notification must include a statement confirming that the project proponent has submitted a written request for section 408 permission from, or review by, the Corps office having jurisdiction over that USACE project.

(c) *Form of Pre-Construction Notification*: The nationwide permit pre-construction notification form (Form ENG 6082) should be used for NWP PCNs. A letter containing the required information may also be used. Applicants may provide electronic files of PCNs and supporting materials if the district engineer has established tools and procedures for electronic submittals.

(d) *Agency Coordination*: (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the activity's adverse environmental effects so that they are no more than minimal.

(2) Agency coordination is required for: (i) all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States; (ii) NWP 13 activities in excess of 500 linear feet, fills greater than one cubic yard per running foot, or involve discharges of dredged or fill material into special aquatic sites; and (iii) NWP 54 activities in excess of 500 linear feet, or that extend into the waterbody more than 30 feet from the mean low water line in tidal waters or the ordinary high water mark in the Great Lakes.

(3) When agency coordination is required, the district engineer will immediately provide (e.g., via e-mail, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (FWS, state natural resource or water quality agency, EPA, and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to notify the district engineer via telephone, facsimile transmission, or e-mail that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse environmental effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure that the net adverse environmental effects of the proposed activity are no more than minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(4) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(5) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

District Engineer's Decision

1. In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. If a project proponent requests authorization by a specific NWP, the district engineer should issue the NWP verification for that activity if it meets the terms and conditions of that NWP, unless he or she determines, after considering mitigation, that the proposed activity will result in more than minimal individual and cumulative adverse effects on the aquatic environment and other aspects of the public interest and exercises discretionary authority to require an individual permit for the proposed activity. For a linear project, this determination will include an evaluation of the single and complete crossings of waters of the United States that require PCNs to determine whether they individually satisfy the terms and conditions of the NWP(s), as well as the cumulative effects caused by all of the crossings of waters of the United States authorized by an NWP. If an applicant requests a waiver of an applicable limit, as provided for in NWPs 13, 36, or 54, the district engineer will only grant the waiver upon a written determination that the NWP activity will result in only minimal individual and cumulative adverse environmental effects.

2. When making minimal adverse environmental effects determinations the district engineer will consider the direct and indirect effects caused by the NWP activity. He or she will also consider the cumulative adverse environmental effects caused by activities authorized by an NWP and whether those cumulative adverse environmental effects are no more than minimal. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type of resource that will be affected by the NWP activity, the functions provided by the aquatic resources that will be affected by the NWP activity, the degree or magnitude to which the aquatic resources perform those functions, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic resource functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. If an appropriate functional or condition assessment method is available and practicable to use, that assessment method may be used by the district engineer to assist in the minimal adverse environmental effects determination. The district engineer may add case-specific special conditions to the NWP authorization to address site-specific environmental concerns.

3. If the proposed activity requires a PCN and will result in a loss of greater than 1/10-acre of wetlands or 3/100-acre of stream bed, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for NWP activities with smaller impacts, or for impacts to other types of waters. The district engineer will consider any proposed compensatory mitigation or other mitigation measures the applicant has included in the proposal in determining whether the net adverse environmental effects of the proposed activity are no more than minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district

engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse environmental effects are no more than minimal, after considering mitigation, the district engineer will notify the permittee and include any activity-specific conditions in the NWP verification the district engineer deems necessary. Conditions for compensatory mitigation requirements must comply with the appropriate provisions at 33 CFR 332.3(k). The district engineer must approve the final mitigation plan before the permittee commences work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the proposed compensatory mitigation plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure that the NWP activity results in no more than minimal adverse environmental effects. If the net adverse environmental effects of the NWP activity (after consideration of the mitigation proposal) are determined by the district engineer to be no more than minimal, the district engineer will provide a timely written response to the applicant. The response will state that the NWP activity can proceed under the terms and conditions of the NWP, including any activity-specific conditions added to the NWP authorization by the district engineer.

4. If the district engineer determines that the adverse environmental effects of the proposed activity are more than minimal, then the district engineer will notify the applicant either: (a) that the activity does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (b) that the activity is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal; or (c) that the activity is authorized under the NWP with specific modifications or conditions. Where the district engineer determines that mitigation is required to ensure no more than minimal adverse environmental effects, the activity will be authorized within the 45-day PCN period (unless additional time is required to comply with general conditions 18, 20, and/or 31), with activity-specific conditions that state the mitigation requirements. The authorization will include the necessary conceptual or detailed mitigation plan or a requirement that the applicant submit a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal. When compensatory mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan or has determined that prior approval of a final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation.

Further Information

1. District engineers have authority to determine if an activity complies with the terms and conditions of an NWP.

2. NWPs do not obviate the need to obtain other federal, state, or local permits, approvals, or authorizations required by law.

3. NWPs do not grant any property rights or exclusive privileges.

4. NWPs do not authorize any injury to the property or rights of others.

5. NWPs do not authorize interference with any existing or proposed Federal project (see general condition 31).

Definitions

Best management practices (BMPs): Policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects on surface water quality resulting from development. BMPs are categorized as structural or non-structural.

Compensatory mitigation: The restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

Currently serviceable: Useable as is or with some maintenance, but not so degraded as to essentially require reconstruction.

Direct effects: Effects that are caused by the activity and occur at the same time and place.

Discharge: The term "discharge" means any discharge of dredged or fill material into waters of the United States.

Ecological reference: A model used to plan and design an aquatic habitat and riparian area restoration, enhancement, or establishment activity under NWP 27. An ecological reference may be based on the structure, functions, and dynamics of an aquatic habitat type or a riparian area type that currently exists in the region where the proposed NWP 27 activity is located. Alternatively, an ecological reference may be based on a conceptual model for the aquatic habitat type or riparian area type to be restored, enhanced, or established as a result of the proposed NWP 27 activity. An ecological reference takes into account the range of variation of the aquatic habitat type or riparian area type in the region.

Enhancement: The manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area.

Establishment (creation): The manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area.

High Tide Line: The line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm.

Historic Property: Any prehistoric or historic district, site (including archaeological site), building, structure, or other object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria (36 CFR part 60).

Independent utility: A test to determine what constitutes a single and complete non-linear project in the Corps Regulatory Program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility.

Indirect effects: Effects that are caused by the activity and are later in time or farther removed in distance, but are still reasonably foreseeable.

Loss of waters of the United States: Waters of the United States that are permanently adversely affected by filling, flooding, excavation, or drainage because of the regulated activity. The loss of stream bed includes the acres of stream bed that are permanently adversely affected by filling or excavation because of the regulated activity. Permanent adverse effects include permanent discharges of dredged or fill material that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the United States is a threshold measurement of the impact to jurisdictional waters or wetlands for determining whether a project may qualify for an NWP; it is not a net threshold that is calculated after considering compensatory mitigation that may be used to offset losses of aquatic functions and services. Waters of the United States temporarily filled, flooded,

excavated, or drained, but restored to pre-construction contours and elevations after construction, are not included in the measurement of loss of waters of the United States. Impacts resulting from activities that do not require Department of the Army authorization, such as activities eligible for exemptions under section 404(f) of the Clean Water Act, are not considered when calculating the loss of waters of the United States.

Navigable waters: Waters subject to section 10 of the Rivers and Harbors Act of 1899. These waters are defined at 33 CFR part 329.

Non-tidal wetland: A non-tidal wetland is a wetland that is not subject to the ebb and flow of tidal waters. Non-tidal wetlands contiguous to tidal waters are located landward of the high tide line (i.e., spring high tide line).

Open water: For purposes of the NWPs, an open water is any area that in a year with normal patterns of precipitation has water flowing or standing above ground to the extent that an ordinary high water mark can be determined. Aquatic vegetation within the area of flowing or standing water is either non-emergent, sparse, or absent. Vegetated shallows are considered to be open waters. Examples of "open waters" include rivers, streams, lakes, and ponds.

Ordinary High Water Mark: The term ordinary high water mark means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

Perennial stream: A perennial stream has surface water flowing continuously year-round during a typical year.

Practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Pre-construction notification: A request submitted by the project proponent to the Corps for confirmation that a particular activity is authorized by nationwide permit. The request may be a permit application, letter, or similar document that includes information about the proposed work and its anticipated environmental effects. Pre-construction notification may be required by the terms and conditions of a nationwide permit, or by regional conditions. A pre-construction notification may be voluntarily submitted in cases where pre-construction notification is not required and the project proponent wants confirmation that the activity is authorized by nationwide permit.

Preservation: The removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

Re-establishment: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions.

Rehabilitation: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: re-establishment and rehabilitation.

Riffle and pool complex: Riffle and pool complexes are special aquatic sites under the 404(b)(1) Guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a course substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.

Riparian areas: Riparian areas are lands next to streams, lakes, and estuarine-marine shorelines. Riparian areas are transitional between terrestrial and aquatic ecosystems, through which surface and subsurface hydrology connects riverine, lacustrine, estuarine, and marine waters with their adjacent wetlands, non-wetland waters, or uplands. Riparian areas provide a variety of ecological functions and services and help improve or maintain local water quality. (See general condition 23.)

Shellfish seeding: The placement of shellfish seed and/or suitable substrate to increase shellfish production. Shellfish seed consists of immature individual shellfish or individual shellfish attached to shells or shell fragments (i.e., spat on shell). Suitable substrate may consist of shellfish shells, shell fragments, or other appropriate materials placed into waters for shellfish habitat.

Single and complete linear project: A linear project is a project constructed for the purpose of getting people, goods, or services from a point of origin to a terminal point, which often involves multiple crossings of one or more waterbodies at separate and distant locations. The term “single and complete project” is defined as that portion of the total linear project proposed or accomplished by one owner/developer or partnership or other association of owners/developers that includes all crossings of a single water of the United States (i.e., a single waterbody) at a specific location. For linear projects crossing a single or multiple waterbodies several times at separate and distant locations, each crossing is considered a single and complete project for purposes of

NWP authorization. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies, and crossings of such features cannot be considered separately.

Single and complete non-linear project: For non-linear projects, the term "single and complete project" is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers. A single and complete non-linear project must have independent utility (see definition of "independent utility"). Single and complete non-linear projects may not be "piecemealed" to avoid the limits in an NWP authorization.

Stormwater management: Stormwater management is the mechanism for controlling stormwater runoff for the purposes of reducing downstream erosion, water quality degradation, and flooding and mitigating the adverse effects of changes in land use on the aquatic environment.

Stormwater management facilities: Stormwater management facilities are those facilities, including but not limited to, stormwater retention and detention ponds and best management practices, which retain water for a period of time to control runoff and/or improve the quality (i.e., by reducing the concentration of nutrients, sediments, hazardous substances and other pollutants) of stormwater runoff.

Stream bed: The substrate of the stream channel between the ordinary high water marks. The substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed.

Stream channelization: The manipulation of a stream's course, condition, capacity, or location that causes more than minimal interruption of normal stream processes. A channelized jurisdictional stream remains a water of the United States.

Structure: An object that is arranged in a definite pattern of organization. Examples of structures include, without limitation, any pier, boat dock, boat ramp, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, artificial island, artificial reef, permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other manmade obstacle or obstruction.

Tidal wetland: A tidal wetland is a jurisdictional wetland that is inundated by tidal waters. Tidal waters rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by other waters, wind, or other effects. Tidal wetlands are located channelward of the high tide line.

Tribal lands: Any lands title to which is either: 1) held in trust by the United States for the benefit of any Indian tribe or individual; or 2) held by any Indian tribe or individual subject to restrictions by the United States against alienation.

Tribal rights: Those rights legally accruing to a tribe or tribes by virtue of inherent sovereign authority, unextinguished aboriginal title, treaty, statute, judicial decisions, executive order or agreement, and that give rise to legally enforceable remedies.

Vegetated shallows: Vegetated shallows are special aquatic sites under the 404(b)(1) Guidelines. They are areas that are permanently inundated and under normal circumstances have rooted aquatic vegetation, such as seagrasses in marine and estuarine systems and a variety of vascular rooted plants in freshwater systems.

Waterbody: For purposes of the NWPs, a waterbody is a "water of the United States." If a wetland is adjacent to a waterbody determined to be a water of the United States, that waterbody and any adjacent wetlands are considered together as a single aquatic unit (see 33 CFR 328.4(c)(2)).

REGIONAL CONDITIONS:

The following Regional Conditions have been approved by the Wilmington District for the Nationwide Permits (NWPs) published in the January 13, 2021, *Federal Register* (86 FR 2744) announcing the reissuance of 12 existing (NWPs) and four new NWPs, as well as the reissuance of NWP general conditions and definitions with some modifications.

A. EXCLUDED WATERS AND/OR AREAS

The Corps has identified waters that will be excluded from the use of all NWP's during certain timeframes. These waters are:

1. **Anadromous Fish Spawning Areas.** Work in waters of the U.S. designated by either the North Carolina Division of Marine Fisheries (NCDMF) or the North Carolina Wildlife Resources Commission (NCWRC) as anadromous fish spawning areas are prohibited from February 15th through June 30th, without prior written approval from the Corps and the appropriate wildlife agencies (NCDMF, NCWRC and/or the National Marine Fisheries Service (NMFS)). Work in waters of the U.S. designated by NCWRC as primary nursery areas in inland waters are prohibited from February 15th through September 30th, without prior written approval from the Corps and the appropriate wildlife agencies. Work in waters of the U.S. designated by NCDMF as primary nursery areas shall be coordinated with NCDMF prior to being authorized by this NWP. Coordination with NCDMF may result in a required construction moratorium during periods of significant biological productivity or critical life stages.

2. **Trout Waters Moratorium.** Work in waters of the U.S. in the designated trout watersheds of North Carolina are prohibited from October 15th through April 15th

without prior written approval from the NCWRC, or from the Eastern Band of Cherokee Indians (EBCI) Fisheries and Wildlife Management (FWM) office if the project is located on EBCI trust land. (See Section C.3. above for information on the designated trout watersheds).

3. **Sturgeon Spawning Areas.** No in-water work shall be conducted in waters of the U.S. designated by the National Marine Fisheries Service as Atlantic sturgeon critical habitat from February 1st through June 30th. No in-water work shall be conducted in waters of the U.S. in the Roanoke River designated as Atlantic sturgeon critical habitat from February 1st through June 30th, and August 1st through October 31st, without prior written approval from NMFS.

4. **Submerged Aquatic Vegetation.** Impacts to Submerged Aquatic Vegetation (SAV) are not authorized by any NWP, except NWP 48, NWP 55 and NWP 56, unless Essential Fish Habitat (EFH) consultation has been completed pursuant to the Magnuson-Stevens Fisheries Conservation and Management Act (Magnuson-Stevens Act). Permittees shall submit a PCN (See NWP General Condition 32) to the District Engineer prior to commencing the activity if the project would affect SAV. The permittee may not begin work until notified by the Corps that the requirements of the Magnuson-Stevens Act have been satisfied and that the activity is verified.

B. REGIONAL CONDITIONS APPLICABLE TO ALL NWP's

1. **Critical Habitat in Western NC.** For proposed activities within waters of the U.S. that require a Pre-Construction Notification (PCN) and are located in the thirteen counties listed below, permittees must provide a copy of the PCN to the U.S. Fish and Wildlife Service (USFWS), 160 Zillicoa Street, Asheville, North Carolina 28801 and the Corps Asheville Regulatory Field Office. Please see General Condition 18 for specific PCN requirements related to the Endangered Species Act and the below website for information on the location of designated critical habitat.

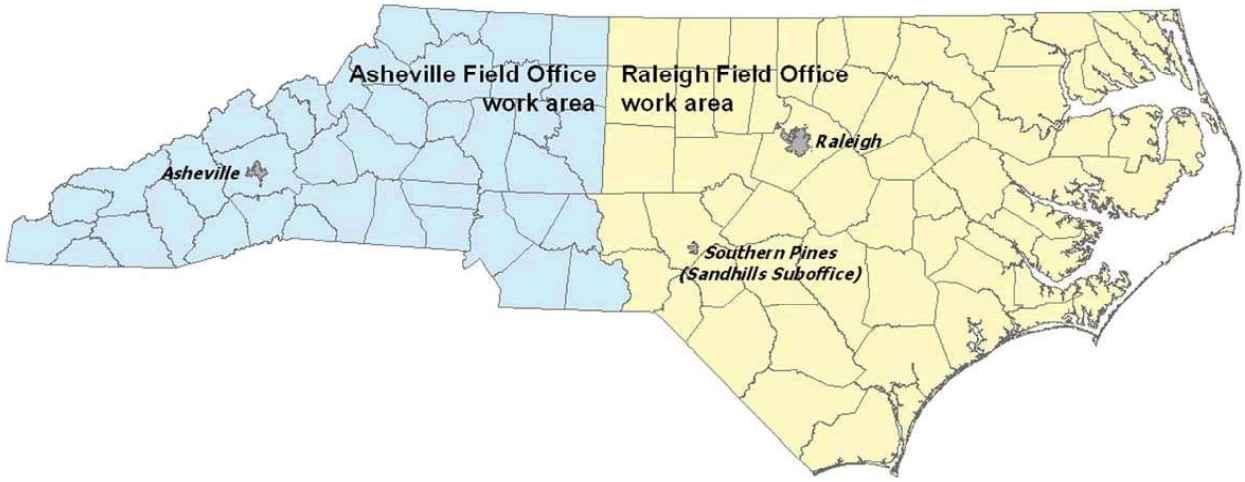
Counties with tributaries that drain to designated critical habitat that require notification to the Asheville U.S. Fish and Wildlife Service: Avery, Cherokee, Graham, Haywood, Henderson, Jackson, Macon, Mecklenburg, Mitchell, Swain, Transylvania, Union and Yancey.

Website and office addresses for Endangered Species Act Information:

The Wilmington District has developed the following website for permittees which provides guidelines on how to review linked websites and maps in order to fulfill NWP General Condition 18 (Endangered Species) requirements:
http://www.saw.usace.army.mil/Missions/RegulatoryPermitProgram/AgencyCoordination/ESA.aspx.

Permittees who do not have internet access may contact the appropriate U.S. Fish and Wildlife Service offices listed below or Corps at (910) 251-4850.

Below is a map of the USFWS Field Office Boundaries:



Asheville U.S. Fish and Wildlife Service Office counties: All counties west of and including Anson, Stanly, Davidson, Forsythe and Stokes Counties.

U.S. Fish and Wildlife Service
Asheville Field Office
160 Zillicoa Street
Asheville, NC 28801
Telephone: (828) 258-3939

Raleigh U.S. Fish and Wildlife Service Office counties: All counties east of and including Richmond, Montgomery, Randolph, Guilford, and Rockingham Counties.

U.S. Fish and Wildlife Service
Raleigh Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
Telephone: (919) 856-4520

2. **Special Designation Waters.** Prior to the use of any NWP that involves a discharge of dredged or fill material in any of the following identified waters and/or adjacent wetlands in North Carolina, permittees shall submit a PCN to the District Engineer prior to commencing the activity (see General Condition 32). The North Carolina waters and wetlands that require additional PCN requirements are:

"Primary Nursery Areas" (PNA), including inland PNA, as designated by the North Carolina Marine Fisheries Commission and/or the North Carolina Wildlife Resources Commission. The definition of and designated PNA waters can be found in the North Carolina State Administrative Code at Title 15A, Subchapters 3R and 10C (15A NCAC

03R .0103; 15A NCAC 10C .0502; and 15A NCAC 10C .0503) and at the following web pages:

- http://reports.oah.state.nc.us/ncac/title%2015a%20-%20environmental%20quality/chapter%2003%20-%20marine%20fisheries/subchapter%20r/15a%20ncac%2003r%20.0103.pdf

- http://reports.oah.state.nc.us/ncac/title%2015a%20-%20environmental%20quality/chapter%2010%20-%20wildlife%20resources%20and%20water%20safety/subchapter%20c/15a%20ncac%2010c%20.0502.pdf

- http://reports.oah.state.nc.us/ncac/title%2015a%20-%20environmental%20quality/chapter%2010%20-%20wildlife%20resources%20and%20water%20safety/subchapter%20c/15a%20ncac%2010c%20.0503.pdf

3. **Trout Waters.** Prior to any discharge of dredge or fill material into streams, waterbodies or wetlands within the 294 designated trout watersheds of North Carolina, the permittee shall submit a PCN (see General Condition 32) to the District Engineer prior to commencing the activity. The permittee shall also provide a copy of the PCN to the appropriate NCWRC office, or to the EBCI FWM Office (if the project is located on EBCI trust land), to facilitate the determination of any potential impacts to designated Trout Waters.

NCWRC and NC Trout Watersheds:

NCWRC Contact**	**Counties that are entirely within Trout Watersheds***		**Counties that are partially within Trout Watersheds***	
Mountain Coordinator 645 Fish Hatchery Rd., Building B Marion, NC 28752 828-803-6054 For NCDOT Projects: NCDOT Coordinator	Alleghany Ashe Avery Graham Haywood	Jackson Macon Swain Transylvania Watauga	Burke Buncombe Caldwell Cherokee Clay Henderson Madison	McDowell Mitchell Polk Rutherford Surry Wilkes Yancey

12275 Swift Rd. Oakboro, NC 28129 704-984-1070		
EBCI Contact**	**Counties that are within Trout Watersheds***	
Office of Natural Resources P.O. Box 1747, Cherokee, NC 28719 (828) 359-6113	Qualla Boundary and non-contiguous tracts of trust land located in portions of Swain, Jackson, Haywood, Graham and Cherokee Counties.	

*NOTE: To determine PCN requirements, contact the Corps Asheville Regulatory Field Office at (828) 271-7980 or view maps showing trout watersheds in each County at the following webpage: http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Agency-Coordination/Trout/.

**If a project is located on EBCI trust land, submit the PCN in accordance with Regional Condition C.16. Contact the Corps Asheville Regulatory Field Office at (828) 271-7980 with questions.

4. **Western NC Waters and Corridors.** The permittee shall submit a PCN (see General Condition 32) to the District Engineer prior to commencing the activity in waters of the U.S. if the activity will occur within any of the following identified waters in western North Carolina, within 0.5 mile on either side of these waters, or within 0.75 mile of the Little Tennessee River, as measured from the top of the bank of the respective water (i.e., river, stream, or creek):

Brasstown Creek
Burningtown Creek
Cane River
Caney Fork
Cartoogechaye Creek
Chattooga River
Cheoah River
Cowee Creek
Cullasaja River
Deep Creek

Ellijay Creek
French Broad River
Garden Creek
Hiwassee River
Hominy Creek
Iotla Creek
Little Tennessee River (within the river or within 0.75 mile on either side of this river)
Nantahala River
Nolichucky River
North Fork French Broad River
North Toe River
Nottley River
Oconaluftee River (portion not located on trust/EBCI land)
Peachtree Creek
Shooting Creek
Snowbird Creek
South Toe River
Stecoah Creek
Swannanoa River
Sweetwater Creek
Tuckasegee River (also spelled Tuckaseegee or Tuckaseigee)
Valley River
Watauga Creek
Watauga River
Wayah Creek
West Fork French Broad River

To determine PCN requirements, contact the Corps Asheville Regulatory Field Office at (828) 271-7980 or view maps for all corridors at the following webpage: http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Agency-Coordination/Designated-Special-Waters.aspx .

5. **Limitation of Loss of Stream Bed.** NWPs may not be used for activities that may result in the loss of more than 0.05 acres of stream bed, except for NWP 32.

6. **Pre-Construction Notification for Loss of Stream Bed Exceeding 0.02 acres.** The permittee shall submit a PCN to the District Engineer prior to commencing the activity (see General Condition 32) prior to the use of any NWP for any activity that results in the loss of more than 0.02 acres of stream bed. This applies to NWPs that do not have PCN requirements as well as those NWPs that require a PCN.

7. **Mitigation for Loss of Stream Bed.** For any NWP that results in a loss of more than 0.02 acres of stream bed, the permittee shall provide a mitigation proposal to compensate for more than minimal individual and cumulative adverse impacts to the aquatic environment, unless the District Engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse

effects of the proposed activity are minimal. For stream bed losses of 0.02 acres or less that require a PCN, the District Engineer may determine, on a case-by-case basis, that compensatory mitigation is required to ensure that the activity results in minimal adverse effect on the aquatic environment.

8. **Riprap.** For all NWPs that allow for the use of riprap material for bank stabilization, the following conditions shall be applied:

a. Filter cloth must be placed underneath the riprap as an additional requirement of its use in North Carolina waters. The placement of filter fabric is not required if the riprap will be pushed or "keyed" into the bank of the waterbody. A waiver from the specifications in this Regional Condition must be requested in writing.

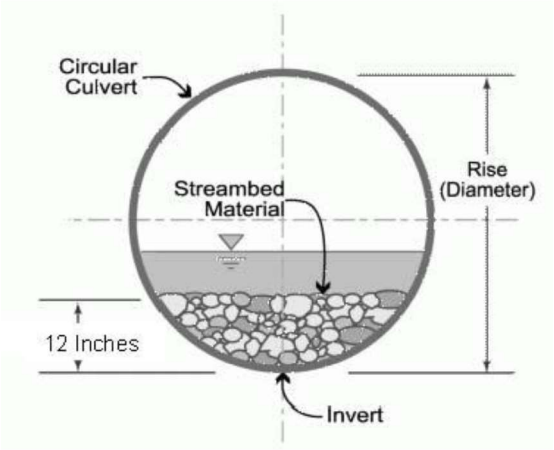
b. Riprap shall be placed only on the stream banks, or, if it is necessary to be placed in the stream bed, the finished top elevation of the riprap should not exceed that of the original stream bed.

9. **Culvert Placement.** For all NWPs that allow for culvert placement, the following conditions shall be applied:

a. For all NWPs that involve the construction/installation of culverts, measures shall be included in the construction/installation that will promote the safe passage of fish and other aquatic organisms

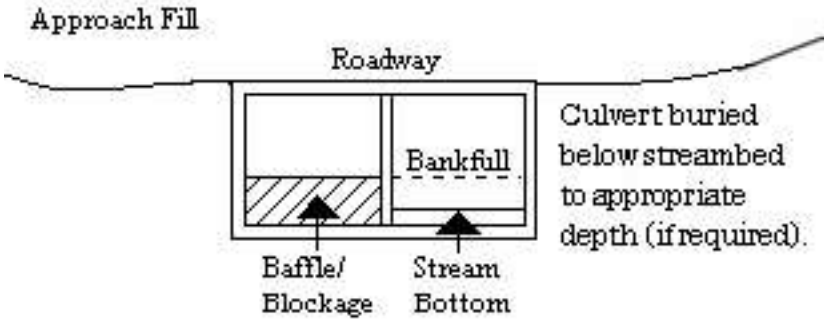
Placement of culverts and other structures in streams shall be below the elevation of the streambed by one foot for all culverts with a diameter greater than 48 inches, and 20% of the culvert diameter for culverts having a diameter less than or equal to 48 inches. If the culvert outlet is submerged within a pool or scour hole and designed to provide for aquatic passage, then culvert burial into the streambed is not required.
Culvert burial is not required for structures less than 72 inch diameter/width, where the slope of the culvert will be greater than 2.5%, provided that all alternative options for flattening the slope have been investigated and aquatic life movement/connectivity has been provided when possible (e.g., rock ladders, cross vanes, sills, baffles etc.). Culvert burial is not required when bedrock is present in culvert locations.

Installation of culverts in wetlands shall ensure continuity of water movement and be designed to adequately accommodate high water or flood conditions. When roadways, causeways, or other fill projects are constructed across FEMA-designated floodways or wetlands, openings such as culverts or bridges shall be provided to maintain the natural hydrology of the system as well as prevent constriction of the floodway that may result in destabilization of streams or wetlands.



A waiver from the depth specifications in this condition may be requested, in writing, by the permittee and issued by the Corp. This waiver request must be specific as to the reasons(s) for the request. The waiver will be issued if it can be demonstrated that the proposed design would result in less impacts to the aquatic environment. Culverts placed across wetland fills purely for the purposes of equalizing surface water do not have to be buried, but the culverts must be of adequate size and/or number to ensure unrestricted transmission of water.

b. Bank-full flows (or less) shall be accommodated through maintenance of the existing bank-full channel cross sectional area. Additional culverts or culvert barrels at such crossings shall be allowed only to receive bank-full flows.



c. Culverts shall be designed and installed in such a manner that the original stream profiles are not altered and allow for aquatic life movement during low flows. The dimension, pattern, and profile of the stream above and below a pipe or culvert shall not be modified by widening the stream channel or by reducing the depth of the stream in connection with the construction activity. The width, height, and gradient of a proposed culvert shall be such as to pass the average historical low flow and spring flow without adversely altering flow velocity. If the width of the culvert is wider than the stream channel, the culvert shall include multiple boxes/pipes, baffles, benches and/or sills to maintain the natural width of the stream channel. If multiple culverts/pipes/barrels are used, low flows shall be accommodated in one culvert/pipe and additional culverts/pipes shall be installed such that they receive only flows above bankfull.

10. **Utility Lines.** For all NWPs that allow for the construction and installation of utility lines, the following conditions shall be applied:

a. Utility lines consisting of aerial electric power transmission lines crossing navigable waters of the U.S. (which are defined at 33 CFR part 329) must comply with the applicable minimum clearances specified in 33 CFR 322.5(i).

b. The work area authorized by this permit, including temporary and/or permanent fills, will be minimized to the greatest extent practicable. Justification for work corridors exceeding forty (40) feet in width is required and will be based on pipeline diameter and length, size of equipment required to construct the utility line, and other construction information deemed necessary to support the request. The permittee is required to provide this information to the Corps with the initial PCN package.

c. A plan to restore and re-vegetate wetland areas cleared for construction must be submitted with the required PCN. Cleared wetland areas shall be re-vegetated, as appropriate, with species of canopy, shrub, and herbaceous species. The permittee shall not use fescue grass or any other species identified as invasive or exotic species by the NC Native Plant Society (NCNPS): https://ncwildflower.org/invasive-exotic-species-list/.

d. Any permanently maintained corridor along the utility right of way within forested wetlands shall be considered a loss of aquatic function. A compensatory mitigation plan will be required for all such impacts associated with the requested activity if the activity requires a PCN and the cumulative total of permanent conversion of forested wetlands exceeds 0.1 acres, unless the District Engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse effects of the proposed activity are minimal.

Where permanently maintained corridor within forested wetlands is 0.1 acres or less, the District Engineer may determine, on a case-by-case basis, that compensatory mitigation is required to ensure that the activity results in minimal adverse effects on the aquatic environment.

e. When directional boring or horizontal directional drilling (HDD) under waters of the U.S., including wetlands, permittees shall closely monitor the project for hydraulic fracturing or “fracking.” Any discharge from hydraulic fracturing or “fracking” into waters of the U.S., including wetlands, shall be reported to the appropriate Corps Regulatory Field Office within 48 hours. Restoration and/or compensatory mitigation may be required as a result of any unintended discharges.

11. **Temporary Access Fills.** The permittee shall submit a PCN to the District Engineer prior to commencing the activity if the activity will involve the discharge of dredged or fill material into more than 0.1 acres of wetlands or 0.02 acres of stream channel for the construction of temporary access fills and/or temporary road crossings. The PCN must

include a restoration plan that thoroughly describes how all temporary fills will be removed, how pre-project conditions will be restored, and include a timetable for all restoration activities.

12. **Federal Navigation Channel Setbacks.** Authorized structures and fills located in or adjacent to Federally authorized waterways must be constructed in accordance with the latest setback criteria established by the Wilmington District Engineer. You may review the setback policy at http://www.saw.usace.army.mil/Missions/Navigation/Setbacks.aspx. This general permit does not authorize the construction of hardened or permanently fixed structures within the Federally Authorized Channel Setback, unless the activity is approved by the Corps. The permittee shall submit a PCN (see General Condition 32) to the District Engineer to obtain a written verification prior to the construction of any structures or fills within the Federally Authorized Channel Setback.

13. **Northern Long-eared Bat – Endangered Species Act Compliance**

The Wilmington District, U.S. Army Corps of Engineers has consulted with the United States Fish and Wildlife Service (USFWS) in regard to the threatened Northern long-eared bat (NLEB) (*Myotis septentrionalis*) and Standard Local Operating Procedures for Endangered Species (SLOPES) have been approved by the Corps and the USFWS. This condition concerns effects to the NLEB only and does not address effects to other federally listed species and/or federally designated critical habitat.

A. Procedures when the Corps is the lead federal* agency for a project:

The permittee must comply with (1) and (2) below when:

• the project is located in the western 41 counties of North Carolina, to include non-federal aid North Carolina Department of Transportation (NCDOT) projects, OR;
• the project is located in the 59 eastern counties of North Carolina and is a non-NCDOT project.

*Generally, if a project is located on private property or on non-federal land, and the project is not being funded by a federal entity, the Corps will be the lead federal agency due to the requirement to obtain Department of the Army authorization to impact waters of the U.S. If the project is located on federal land, contact the Corps to determine the lead federal agency.

(1) A permittee using an NWP must check to see if their project is located in the range of the NLEB by using the following website: http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf. If the project is within the range of the NLEB, or if the project includes percussive activities (e.g., blasting, pile driving, etc.), the permittee is then required to check the appropriate website in the paragraph below to discover if their project:

• is located in a 12-digit Hydrologic Unit Code area ("red HUC" - shown as red areas on the map), AND/OR;
• involves percussive activities within 0.25 mile of a red HUC.

Red HUC maps - for the western 41 counties in NC (covered by the Asheville Ecological Services Field Office), check the project location against the electronic maps found at: http://www.fws.gov/asheville/htmls/project_review/NLEB_in_WNC.html. For the eastern 59 counties in NC (covered by the Raleigh Ecological Services Field Office), check the project location against the electronic maps found at: https://www.fws.gov/raleigh/NLEB_RFO.html.

(2) A permittee must submit a PCN to the District Engineer, and receive written verification from the District Engineer, prior to commencing the activity, if the activity will involve any of the following:

• tree clearing/removal and/or, construction/installation of wind turbines in a red HUC, AND/OR;
• bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, (applies anywhere in the range of the NLEB), AND/OR:
• percussive activities in a red HUC, or within 0.25 mile of a red HUC.

The permittee may proceed with the activity without submitting a PCN to either the Corps or the USFWS, provided the activity complies with all applicable NWP terms and general and regional conditions, if the permittee's review under A.(1) and A.(2) above shows that the project is:

• located outside of a red HUC (and there are no percussive activities), and the activity will NOT include bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, OR;
• located outside of a red HUC and there are percussive activities, but the percussive activities will not occur within 0.25-mile of a red HUC boundary, and the activity will NOT include bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, OR;
• located in a red HUC, but the activity will NOT include tree clearing/removal; construction/installation of wind turbines; bridge removal or maintenance, unless the bridge has been inspected and there is no evidence of bat use, and/or; any percussive activities.

B. Procedures when the USACE is not the lead federal agency:

For projects where another federal agency is the lead federal agency - if that other federal agency has completed project-specific ESA Section 7(a)(2) consultation for the NLEB, and has (1) determined that the project would not cause prohibited incidental take of the NLEB, and (2) completed coordination/consultation that is required by the USFWS (per the directions on the respective USFWS office's website), that project may

proceed without PCN to either the USACE or the USFWS, provided all General and Regional Permit Conditions are met.

The NLEB SLOPES can be viewed on the USACE website at: http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Agency-Coordination/ESA/. Permittees who do not have internet access may contact the USACE at (910) 251- 4633.

14. **West Indian Manatee Protection.** In order to protect the endangered West Indian manatee (*Trichechus manatus*) the Permittee shall implement the USFWS' Manatee Guidelines, and strictly adhere to all requirements therein. The guidelines can be found at https://www.fws.gov/raleigh/pdfs/ManateeGuidelines2017.pdf.

15. **ESA Programmatic Biological Opinions.** The Wilmington District, USFWS, NCDOT, and the FHWA have conducted programmatic Section 7(a)(2) consultation for a number of federally listed species and designated critical habitat (DCH), and programmatic consultation concerning other federally listed species and/or DCH may occur in the future. The result of completed programmatic consultation is a Programmatic Biological Opinion (PBO) issued by the USFWS. These PBOs contain mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take" of whichever species or critical habitat is covered by a specific PBO. Authorization under NWPs is conditional upon the permittee's compliance with all the mandatory terms and conditions associated with incidental take of the applicable PBO (or PBOs), which are incorporated by reference in the NWPs. Failure to comply with the terms and conditions associated with incidental take of an applicable PBO, where a take of the federally listed species occurs, would constitute an unauthorized take by the permittee, and would also constitute permittee non-compliance with the authorization under the NWPs. If the terms and conditions of a specific PBO (or PBOs) apply to a project, the Corps will include this/these requirements in any NWP verification that may be issued for a project. For an activity/project that does not require a PCN, the terms and conditions of the applicable PBO(s) also apply to that non-notifying activity/project. The USFWS is the appropriate authority to determine compliance with the terms and conditions of its PBO and the ESA. All PBOs can be found on our website at: https://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Agency-Coordination/ESA/.

16. **Work on Eastern Band of Cherokee Land.**

Notifying NWPs - All PCNs submitted for activities in waters of the U.S. on Eastern Band of Cherokee Indians (EBCI) trust land (i.e., Qualla Boundary and non-contiguous tracts of trust land located in portions of Swain, Jackson, Haywood, Graham and Cherokee Counties), must comply with the requirements of the latest MOU between the Wilmington District and the EBCI.

Non-notifying NWPs - Prior to the use of any non-notifying NWP for activities in

waters of the U.S. on EBCI trust land (i.e., Qualla Boundary and non-contiguous tracts of trust land located in portions of Swain, Jackson, Haywood, Graham and Cherokee Counties), all prospective permittees must comply with the requirements of the latest MOU between the Wilmington District and the EBCI; this includes coordinating the proposed project with the EBCI Natural Resources Program and obtaining a Tribal Approval Letter from the Tribe.

The EBCI MOU can be found at the following URL: http://saw-reg.usace.army.mil/FO/Final-MOU-EBCI-USACE.pdf

17. **Sedimentation and Erosion Control Structures and Measures**
All PCNs will identify and describe sedimentation and erosion control structures and measures proposed for placement in waters of the U.S. The structures and measures should be depicted on maps, surveys or drawings showing location and impacts to jurisdictional wetlands and streams.

C. REGIONAL CONDITIONS APPLICABLE TO NWP 39

a. Discharges in streams and wetlands for stormwater management facilities are prohibited under this NWP.

b. Discharges of dredged or fill material into waters of the U.S., including wetlands, within the floodway* or mapped FEMA 100-year floodplain resulting in permanent above-grade fills are not authorized by this NWP.

* NOTE: Floodway means the area designated and/or regulated by Federal, State, or local requirements to provide for the discharge of the base flood so the cumulative increase in water surface elevation is no more than a designated height identified by the regulating entity within the 100-year floodplain.

D. SECTION 401 WATER QUALITY CERTIFICATION (WQC) AND/OR COASTAL ZONE MANAGEMENT ACT (CZMA) CONSISTENCY DETERMINATION SUMMARY AND APPLICABLE CONDITIONS

The CZMA Consistency Determination and all Water Quality Certifications for the NWPs can be found at: https://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Permits/2017-Nationwide-Permits/

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, WILMINGTON DISTRICT
WILMINGTON FIELD OFFICE
69 DARLINGTON AVE
WILMINGTON NC 28403

October 27, 2025

Regulatory Division
SAW-2022-01846

Sent Via email: hill@cameronco.com

Hill Rogers
Cameron Management, Inc.
1201 Glen Meade Rd
Wilmington, NC 28401

Dear Mr. Rogers:

This letter is in response to the Pre-Construction Notification (PCN) you submitted to the Wilmington District, Wilmington Field Office on August 28, 2025, for a Department of the Army Nationwide permit (NWP) verification. This project has been assigned the file number SAW-2022-01846 and is known as Holly Shelter Business Park – Phase 1. This file number should be referenced in all correspondence concerning this project.

A review of the information provided indicates that the proposed work would include the discharge of fill into 0.020 of an acre of wetlands and 0.42 of an acre of open water tributaries (non-streams) for infrastructure associated with the development of the Holly Shelter Business Park. The project area for this determination includes a 321 acre(s) area which is illustrated on the enclosed site plans/maps. The project/review area is located at Latitude 34.358510 and Longitude -77.845780; in Castle Hayne, New Hanover County, North Carolina.

We have determined that the proposed work is authorized by Nationwide 39 pursuant to authorities under Section 404 of the Clean Water Act (33 U.S.C § 1344). The proposed work must be accomplished in strict accordance with the general permit conditions, any regional conditions, the application materials, and the enclosed plans. If the extent of the project area and/or nature of the authorized impacts to waters are modified, a revised PCN must be submitted to this office for written approval before work is initiated. Any violation of permit conditions or deviation from your submitted plans may subject the permittee to enforcement action.

This verification is valid until March 15, 2026, unless prior to this date the subject NWP(s) is suspended, revoked, or is modified such that the activity no longer complies with the terms and conditions of this NWP. If you commence or are under contract to commence this activity before the date that the relevant NWP is modified or revoked,

you will have 12 months from the date of the modification or revocation of the NWP to complete the activity under the present terms and conditions of this NWP.

This NWP verification does not preclude the necessity to obtain any other Federal, State, or local permits, licenses, and/or certifications, which may be required.

If you have any questions related to this verification or have issues accessing documents referenced in this letter, please contact Brad Shaver, Project Manager of the Wilmington Field Office at 910-251-4611, by mail at the above address, or by email at brad.e.shaver@usace.army.mil. Please take a moment to complete our customer satisfaction survey located at https://regulatory.ops.usace.army.mil/customer-service-survey/.

Sincerely,

Brad Shaver

Digitally signed by Brad Shaver
Date: 2025.10.27 14:47:04 -04'00'

Brad Shaver
Project Manager

Enclosures

Cc (w/enclosures)
Ashley Bentz, S&ME Inc. (via abentz@smeinc.com)

Special Conditions:
Holly Shelter Business Park
Nationwide 39

1. Work Limits: All work authorized by this permit shall be performed in strict compliance with the attached permit plans EN-1-23 dated August 2025, which are a part of this permit. The Permittee shall ensure that the construction design plans for this project do not deviate from the permit plans attached to this authorization. Any modification to the attached permit plans must be approved by the U.S. Army Corps of Engineers (Corps) prior to any active construction in waters or wetlands.

2. **Unauthorized Dredge and/or Fill:** Except as authorized by this permit or any Corps-approved modification to this permit, no excavation, fill or mechanized land-clearing activities shall take place at any time in the construction or maintenance of this project, within waters or wetlands. This permit does not authorize temporary placement or double handling of excavated or fill material within waters or wetlands outside the permitted area. This prohibition applies to all borrow and fill activities connected with this project.

3. **Notification of Construction Commencement and Completion:** The Permittee shall notify the U.S. Army Corps of Engineers in writing prior to beginning the work authorized by this permit and again upon completion of the work authorized by this permit.

4. **Reporting Violations:** Violation of these permit conditions or violation of Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act shall be reported to the Corps in writing and by telephone at: 910-251-4611 or email at: brad.e.shaver@usace.army.mil within 24 hours of the Permittee's discovery of the violation.

5. **Maintain Flows and Circulation Patterns of Waters:** Except as specified in the plans attached to this permit, no excavation, fill or mechanized land-clearing activities shall take place at any time in the construction or maintenance of this project, in such a manner as to impair normal flows and circulation patterns within waters or wetlands or to reduce the reach of waters and/or wetlands.

6. **Sediment and Erosion Control:**

1) During the clearing phase of the project, heavy equipment shall not be operated in surface waters or stream channels. Temporary stream crossings will be used to access the opposite sides of stream channels. All temporary diversion

channels and stream crossings will be constructed of non-erodible materials. Grubbing of riparian vegetation will not occur until immediately before construction begins on a given segment of stream channel.

2) No fill or excavation impacts for the purposes of sedimentation and erosion control shall occur within jurisdictional waters, including wetlands, unless the impacts are included on the plan drawings and specifically authorized by this permit. This includes, but is not limited to, sediment control fences and other barriers intended to catch sediment losses.

3) The Permittee shall remove all sediment and erosion control measures placed in waters and/or wetlands, and shall restore natural grades on those areas, prior to project completion.

4) The Permittee shall use appropriate sediment and erosion control practices which equal or exceed those outlined in the most recent version of the "North Carolina Sediment and Erosion Control Planning and Design Manual" to ensure compliance with the appropriate turbidity water quality standard. Erosion and sediment control practices shall be in full compliance with all specifications governing the proper design, installation and operation and maintenance of such Best Management Practices in order to ensure compliance with the appropriate turbidity water quality standards. This shall include, but is not limited to, the immediate installation of silt fencing or similar appropriate devices around all areas subject to soil disturbance or the movement of earthen fill, and the immediate stabilization of all disturbed areas. Additionally, the project shall remain in full compliance with all aspects of the Sedimentation Pollution Control Act of 1973 (North Carolina General Statutes Chapter 113A Article 4). Adequate sedimentation and erosion control measures shall be implemented prior to any ground disturbing activities to minimize impacts to downstream aquatic resources. These measures shall be inspected and maintained regularly, especially following rainfall events. All fill material shall be adequately stabilized at the earliest practicable date to prevent sediment from entering into adjacent waters or wetlands.

7. **Clean Fill:** The Permittee shall use only clean fill material for this project. The fill material shall be free of items such as trash, construction debris, metal and plastic products, and concrete block with exposed metal reinforcement bars. Soils used for fill shall not be contaminated with any toxic substance in concentrations governed by Section 307 of the Clean Water Act. Unless otherwise authorized by this permit, all fill material placed in waters or wetlands shall be generated from an upland source.

8. **Permit Distribution:** The Permittee shall require its contractors and/or agents to comply with the terms and conditions of this permit in the construction and maintenance of this project, and shall provide each of its contractors and/or agents associated with the construction or maintenance of this project with a copy of this permit. A copy of this permit, including all conditions and drawings shall be available at the project site during construction and maintenance of this project.

9. **Phasd project:** This verification is for phase 1 of this multi-year project. Any future impacts associated with subsequent phases will be considered cumulative as it relates to authorization type (ie Nationwide vs Standard Permit).

10. **ESA**: Suitable habitat for tricolored bat (Perimyotis subflavus) may be present at the site. On September 14, 2022, the USFWS published a proposal in the Federal Register to list the tricolored bat as endangered under the Endangered Species Act (ESA). The permittee understands and agrees that all work associated with the clearing and removal of trees and removal or modification of culverts must be completed prior to the effective date of the final listing in the Federal Register. Work associated with the aforementioned activities not completed by that time must cease and the permittee must contact the Corps' (Brad Shaver at brad.e.shaver@usace.army.mil) to determine if additional coordination with the United States Fish and Wildlife Service is required under Section 7 of the Endangered Species Act prior to continuing work.

Brad Shaver

Digitally signed by Brad Shaver
Date: 2025.10.27 14:47:37 -04'00'

U.S. Army Corps of Engineers (USACE)

CERTIFICATION OF COMPLIANCE WITH DEPARTMENT OF THE ARMY PERMIT

For use of this form, see Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act of 1899, and Section 103 of the Marine Protection, Research, and Sanctuaries Act; the proponent agency is CECW-COR.

Form Approved -
OMB No. 0710-0003
Expires 2027-10-31

The Agency Disclosure Notice (ADN)

The Public reporting burden for this collection of information, 0710-0003, is estimated to average 10 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PURPOSE: This form is used by recipients of U.S. Army Corps of Engineer Regulatory permits to certify compliance with the permit terms and conditions.

Your permitted activity is subject to a compliance inspection by a U.S. Army Corps of Engineers representative. If you fail to comply with this permit, you are subject to permit suspension, modification, or revocation.

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the U.S. Army Corps of Engineers, Wilmington District, Regulatory Office.

The certification can be submitted by email at brad.e.shaver@usace.army.mil or by mail at the below address:

U.S. Army Corps of Engineers
Wilmington District Office
Street Address: 69 Darlington Ave
City: Wilmington State: NC Zip Code: 28411

COMPLETED BY THE CORPS

Corps Action Number: SAW-2022-01846

Permit Type: General Permit

General Permit Number and Name (*if applicable*):

Name of Permittee: Hill Rogers

Project Name: Holly Shelter Business Park – Phase 1

Project Location (*physical address*): Holly Shelter Road
Castle Hayne, North Carolina

PERMITTEE'S CERTIFICATION

Date Work Started:

Date Work Completed:

Enclose photographs showing the completed project (*if available*).

I _____ hereby certify that the work authorized by the above referenced permit has been completed in accordance with all of the permit terms and conditions, and that any required compensatory mitigation has been completed in accordance with the permit conditions.

Name	Date	Signature

LEGEND

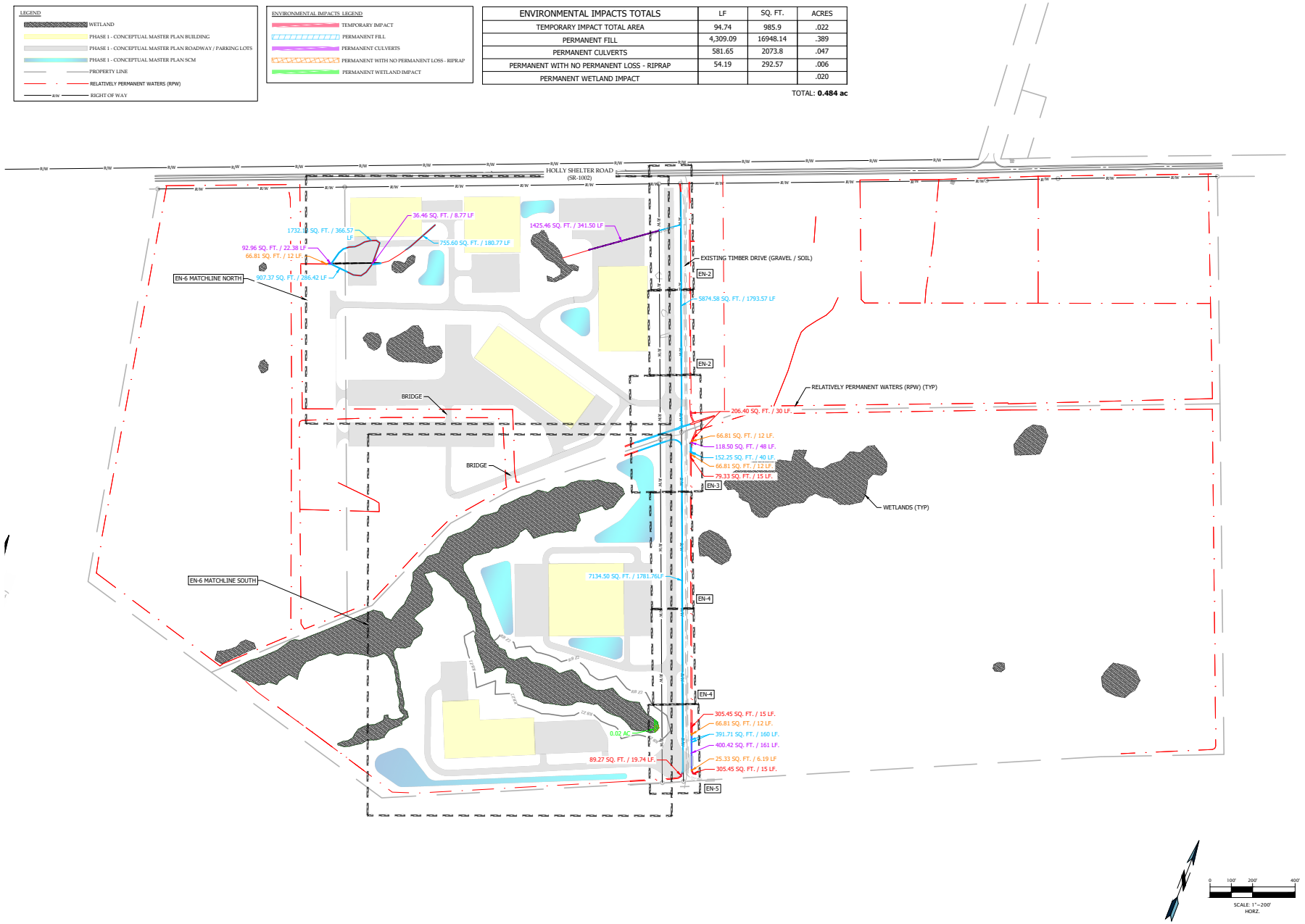
- WETLAND
- PHASE 1 - CONCEPTUAL MASTER PLAN BUILDING
- PHASE 1 - CONCEPTUAL MASTER PLAN ROADWAY / PARKING LOTS
- PHASE 1 - CONCEPTUAL MASTER PLAN SCM
- PROPERTY LINE
- RELATIVELY PERMANENT WATERS (RPW)
- R/W RIGHT OF WAY

ENVIRONMENTAL IMPACTS LEGEND

- TEMPORARY IMPACT
- PERMANENT FILL
- PERMANENT CULVERTS
- PERMANENT WITH NO PERMANENT LOSS - RIPRAP
- PERMANENT WETLAND IMPACT

ENVIRONMENTAL IMPACTS TOTALS	LF	SQ. FT.	ACRES
TEMPORARY IMPACT TOTAL AREA	94.74	985.9	.022
PERMANENT FILL	4,309.09	16948.14	.389
PERMANENT CULVERTS	581.65	2073.8	.047
PERMANENT WITH NO PERMANENT LOSS - RIPRAP	54.19	292.57	.006
PERMANENT WETLAND IMPACT			.020

TOTAL: **0.484 ac**



0 100' 200' 400'
SCALE: 1"=200' HORZ.

REVISIONS

Wooten
119 Brookstown Ave, Suite 100 • Winston-Salem, NC 27101
(336) 722-5326 • thewootencompany.com
License Number: F-0315

NEW HANOVER COUNTY
NEW HANOVER COUNTY NORTH CAROLINA
HOLLY SHELTER BUSINESS PARK – PHASE 1

OVERALL IMPACT MAP

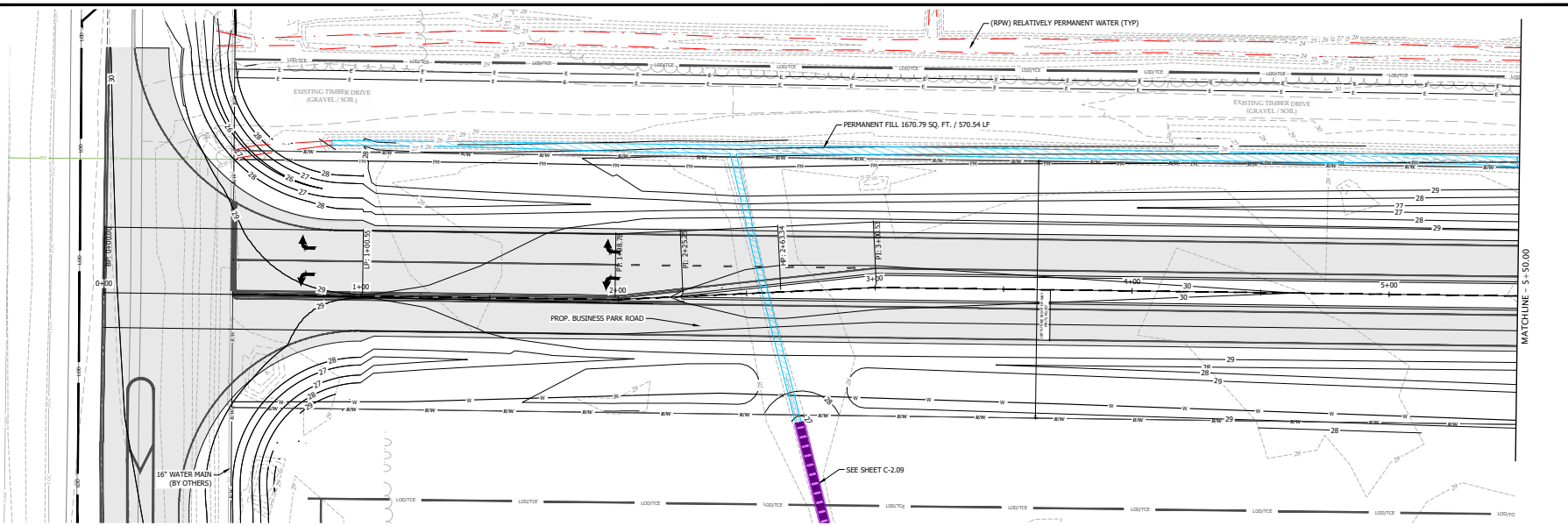
FINAL DRAWING
FOR REVIEW PURPOSES ONLY

ISSUED FOR:
90% PROGRESS
DATE: 08/2025

DESIGNED BY: AMW
DRAWN BY: MMS
CHECKED BY: LVL
PROJECT NO.: 3514-A

EN-1

T:\Projects\New_Hanover_County-3514\A-HollyShelterBusiness_CADD\SheetSets\3514-IMPACT_MAPS.dwg MSORRENTINO 9/26/2025 10:30 AM



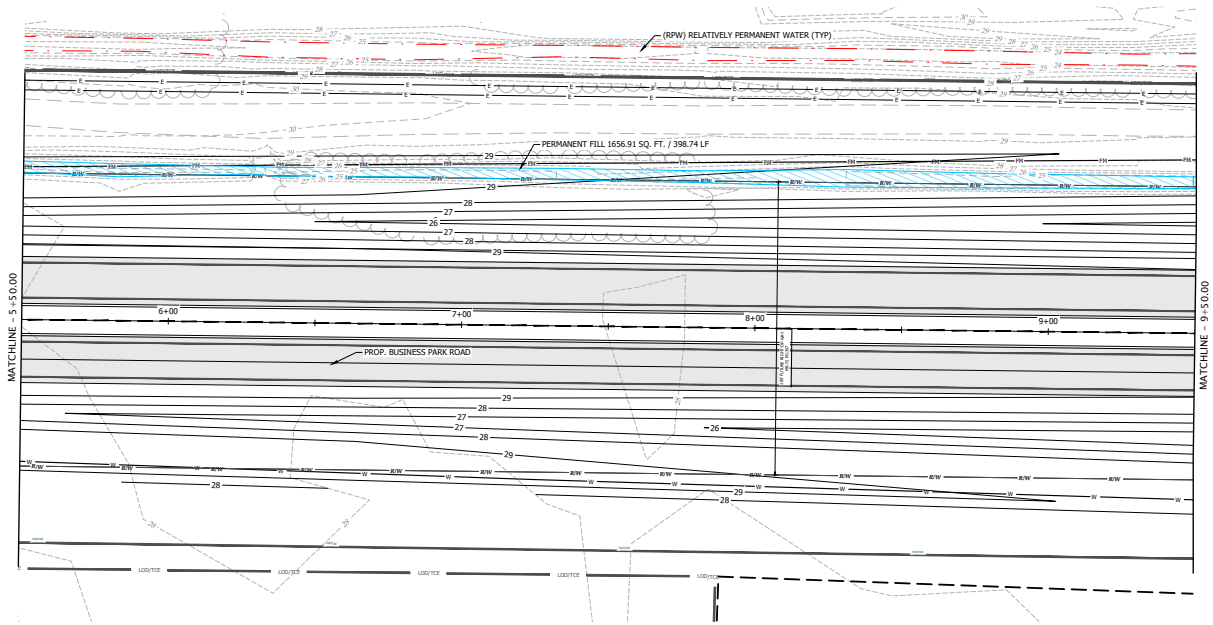
ENVIRONMENTAL IMPACTS LEGEND

- TEMPORARY IMPACT
- PERMANENT FILL
- PERMANENT CULVERTS
- PERMANENT WITH NO PERMANENT LOSE - RIPRAP
- PERMANENT WETLAND IMPACT

LEGEND

- LOD/TCE — LIMITS OF DISTURBANCE / TEMPORARY CONSTRUCTION EASEMENT
- PERMANENT UTILITY EASEMENT / PERMANENT ACCESS EASEMENT
- R/W — RIGHT OF WAY
- UNDERGROUND ELECTRIC
- WATER MAIN
- FORCE MAIN
- RELATIVELY PERMANENT WATER (RPW)
- FUTURE DRAINAGE CULVERTS (BY OTHER)

ROADWAY IMPACTS



SCALE: 1"=20' HORZ.

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NEW HANOVER COUNTY NORTH CAROLINA

HOLLY SHELTER BUSINESS PARK – PHASE I

ROADWAY IMPACT MAP

0+00.00 – 9+50.00

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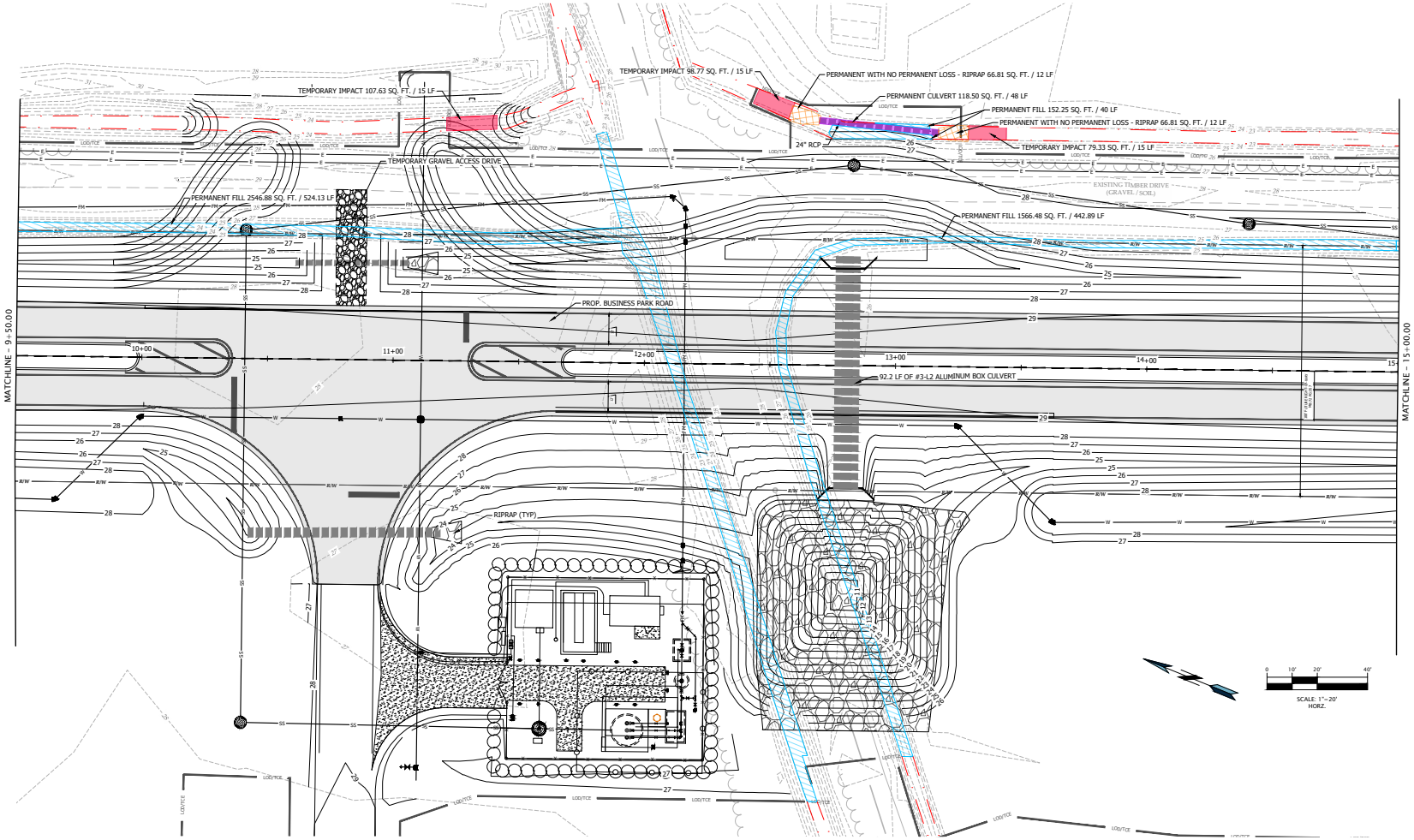
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ROADWAY IMPACTS

ENVIRONMENTAL IMPACTS LEGEND
- TEMPORARY IMPACT
- PERMANENT FILL
- PERMANENT CULVERTS
- PERMANENT WITH NO PERMANENT LOSS - RIPRAP
- PERMANENT WETLAND IMPACT

LEGEND
- LOD/TCE — LIMITS OF DISTURBANCE / TEMPORARY CONSTRUCTION EASEMENT
- PERMANENT UTILITY EASEMENT / PERMANENT ACCESS EASEMENT
- R/W — RIGHT OF WAY
- UNDERGROUND ELECTRIC
- WATER MAIN
- FORCE MAIN
- RELATIVELY PERMANENT WATER (RPW)
- NEW DRAINAGE CULVERTS

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NEW HANOVER COUNTY
NORTH CAROLINA
HOLLY SHELTER BUSINESS PARK – PHASE I
NEW HANOVER COUNTY

ROADWAY IMPACT MAP
9+50.00 – 15+00.00

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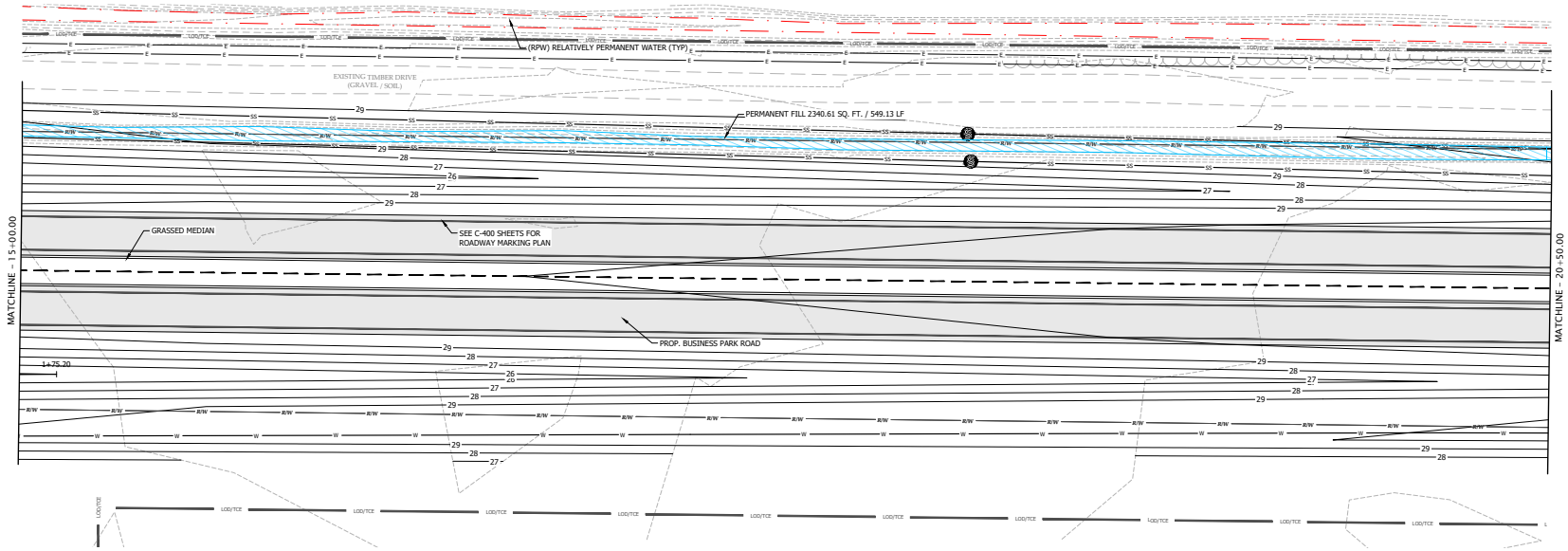
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ENVIRONMENTAL IMPACTS LEGEND

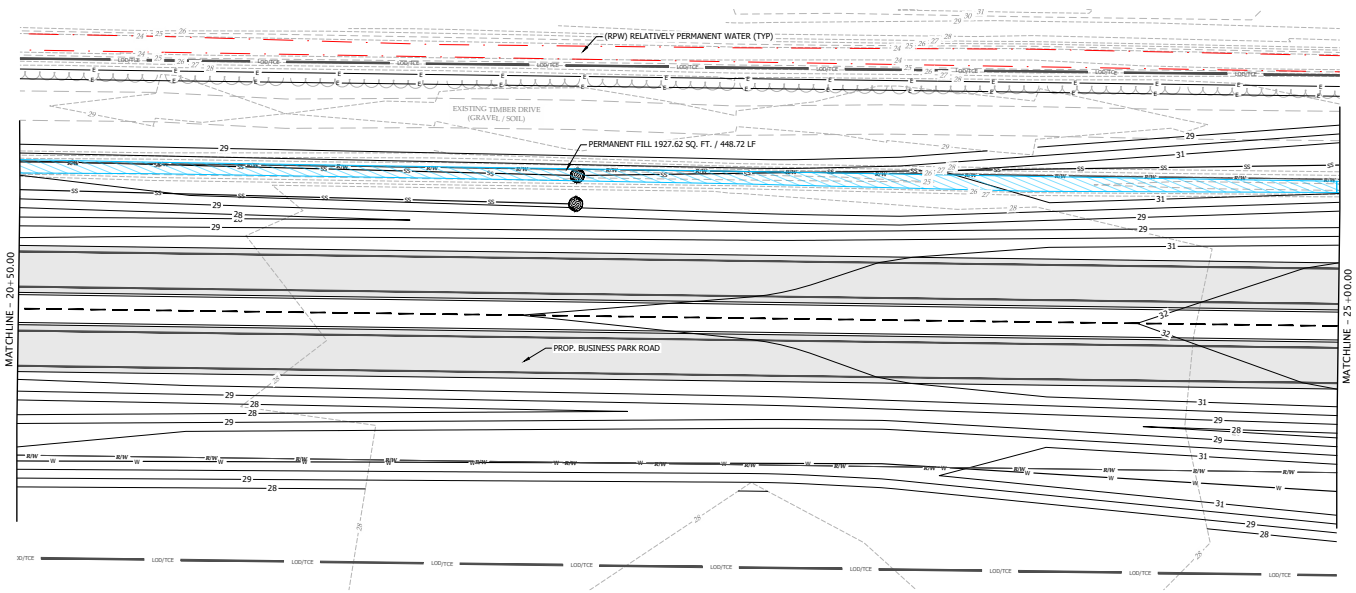
- TEMPORARY IMPACT
- PERMANENT FILL
- PERMANENT CULVERTS
- PERMANENT WITH NO PERMANENT LOSS - RIPRAP
- PERMANENT WETLAND IMPACT

LEGEND

- LOD/TCE — LIMITS OF DISTURBANCE / TEMPORARY CONSTRUCTION EASEMENT
- PERMANENT UTILITY EASEMENT / PERMANENT ACCESS EASEMENT
- R/W — RIGHT OF WAY
- UNDERGROUND ELECTRIC
- WATER MAIN
- FORCE MAIN
- RELATIVELY PERMANENT WATER (RPW)
- NEW DRAINAGE CULVERTS

ROADWAY IMPACTS

SCALE: 1"=20' HORZ.



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NEW HANOVER COUNTY
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HOLLY SHELTER BUSINESS PARK – PHASE I

ROADWAY IMPACT MAP
15+00.00 – 25+00.00

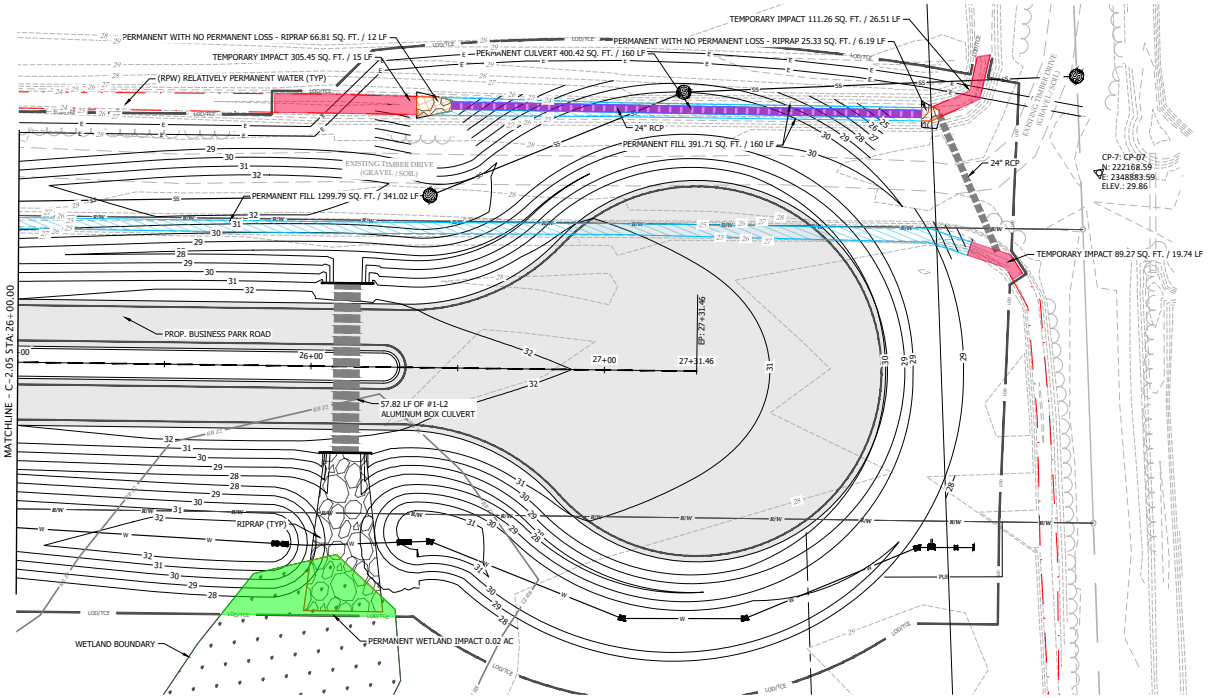
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ROADWAY IMPACTS

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NEW HANOVER COUNTY NORTH CAROLINA

NEW HANOVER COUNTY:

HOLLY SHELTER BUSINESS PARK – PHASE I

ROADWAY IMPACT MAP

26+00.00 – 27+31.46

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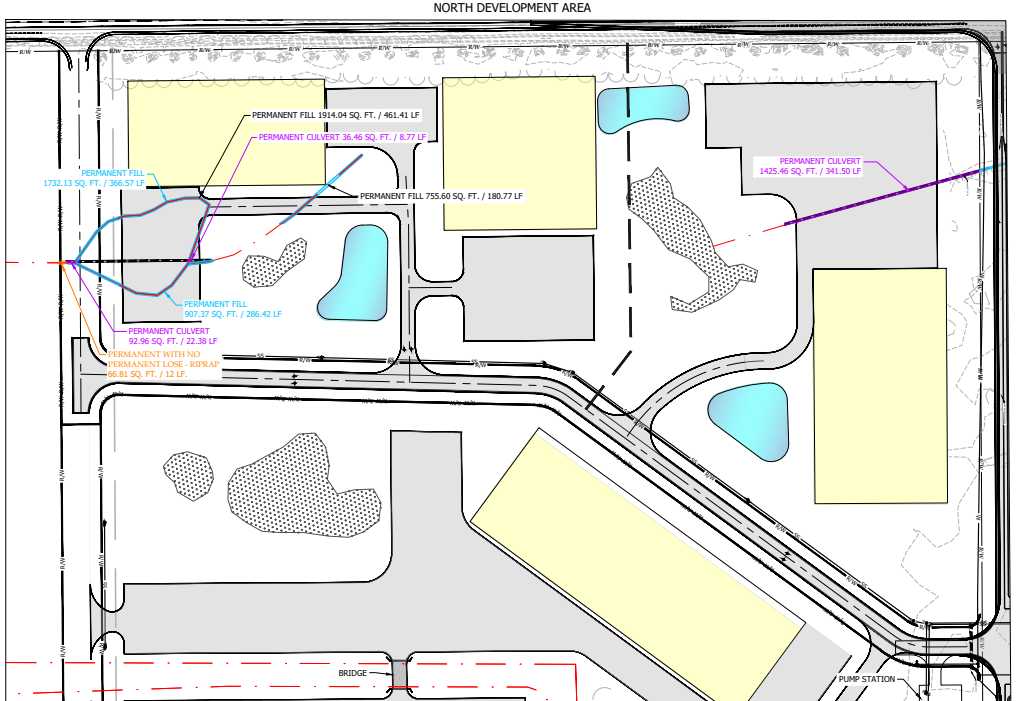
ENVIRONMENTAL IMPACTS LEGEND

- TEMPORARY IMPACT
- PERMANENT FILL
- PERMANENT CULVERTS
- PERMANENT WITH NO PERMANENT LOSE - RIPRAP
- PERMANENT WETLAND IMPACT

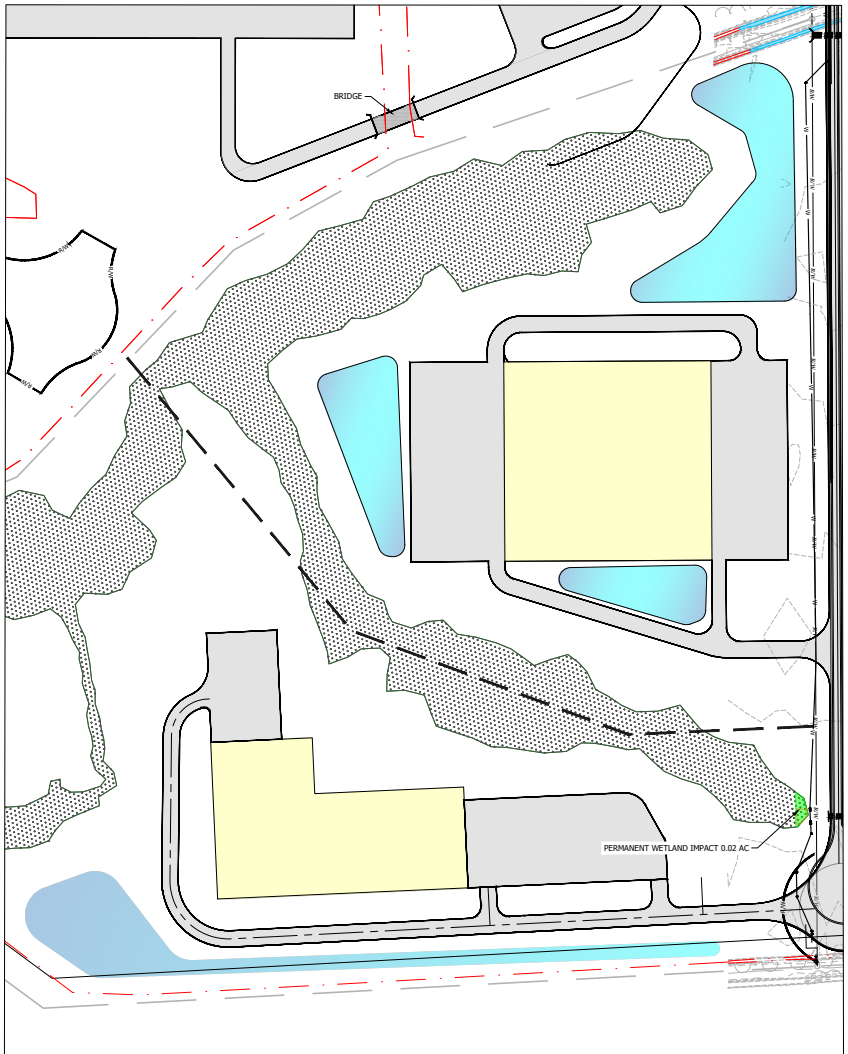
LEGEND

- WETLAND
- PHASE 1 - CONCEPTUAL MASTER PLAN BUILDING
- PHASE 1 - CONCEPTUAL MASTER PLAN ROADWAY / PARKING LOTS
- PHASE 1 - CONCEPTUAL MASTER PLAN SCM
- PROPERTY LINE
- FUTURE PROPERTY LINE
- RELATIVELY PERMANENT WATERS (RPW)
- R/W — RIGHT OF WAY
- LOD/TCE — LIMITS OF DISTURBANCE / TEMPORARY CONSTRUCTION EASEMENT
- PUE/PAE — PERMANENT UTILITY EASEMENT / PERMANENT ACCESS EASEMENT
- R/W — RIGHT OF WAY
- E — UNDERGROUND ELECTRIC
- W — WATER MAIN
- FM — FORCE MAIN
- FUTURE DRAINAGE CULVERTS (BY OTHER)

NORTH DEVELOPMENT AREA



SOUTH DEVELOPMENT AREA



SCALE: 1"=100' HORZ.

SCALE: 1"=100' HORZ.

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NEW HANOVER COUNTY — HOLLY SHELTER BUSINESS PARK – PHASE I

DEVELOPMENT IMPACT MAP

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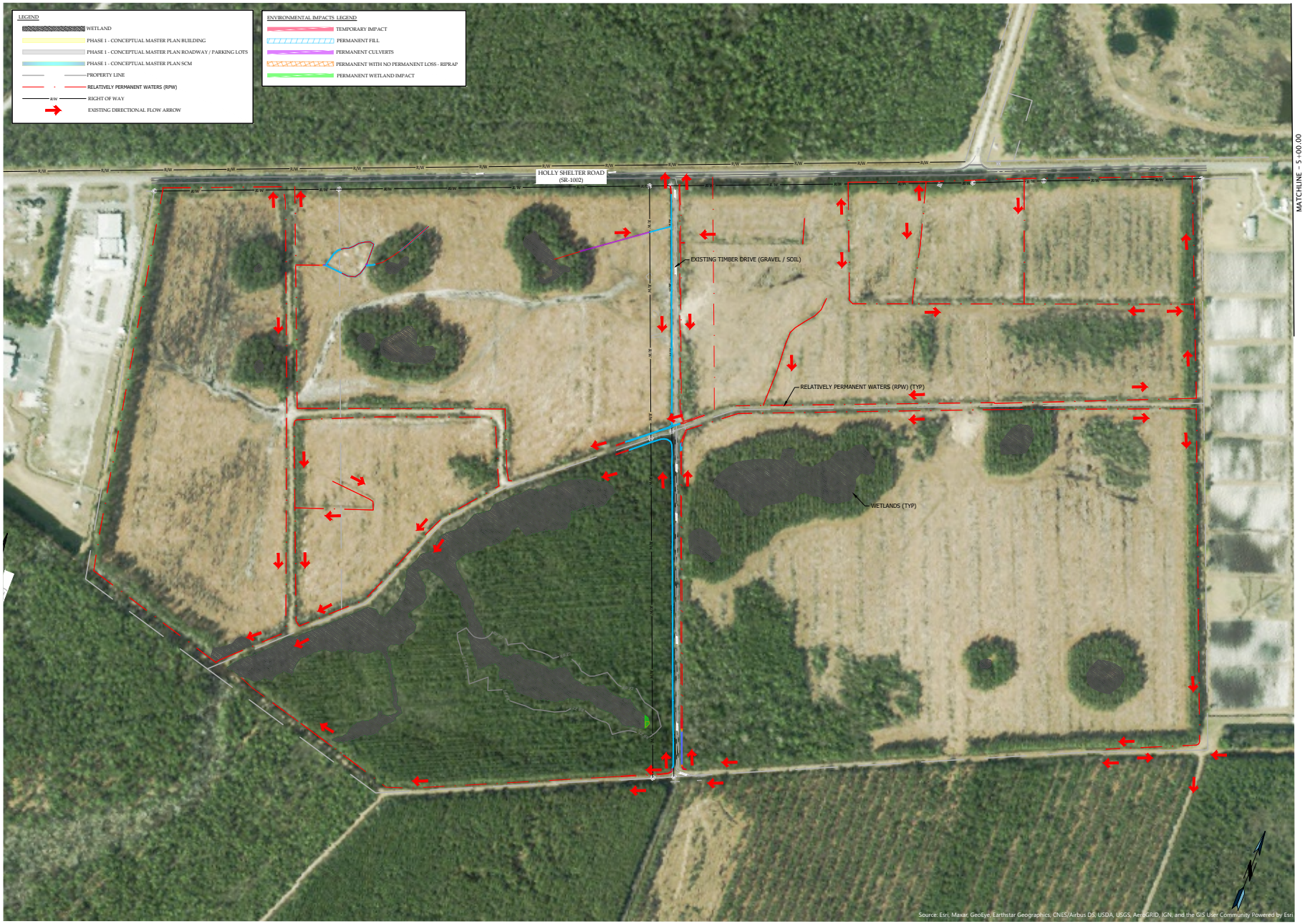
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HOLLY SHELTER BUSINESS PARK – PHASE 1

EXISTING CONDITIONS
OVERALL DRAINAGE AREA MAP

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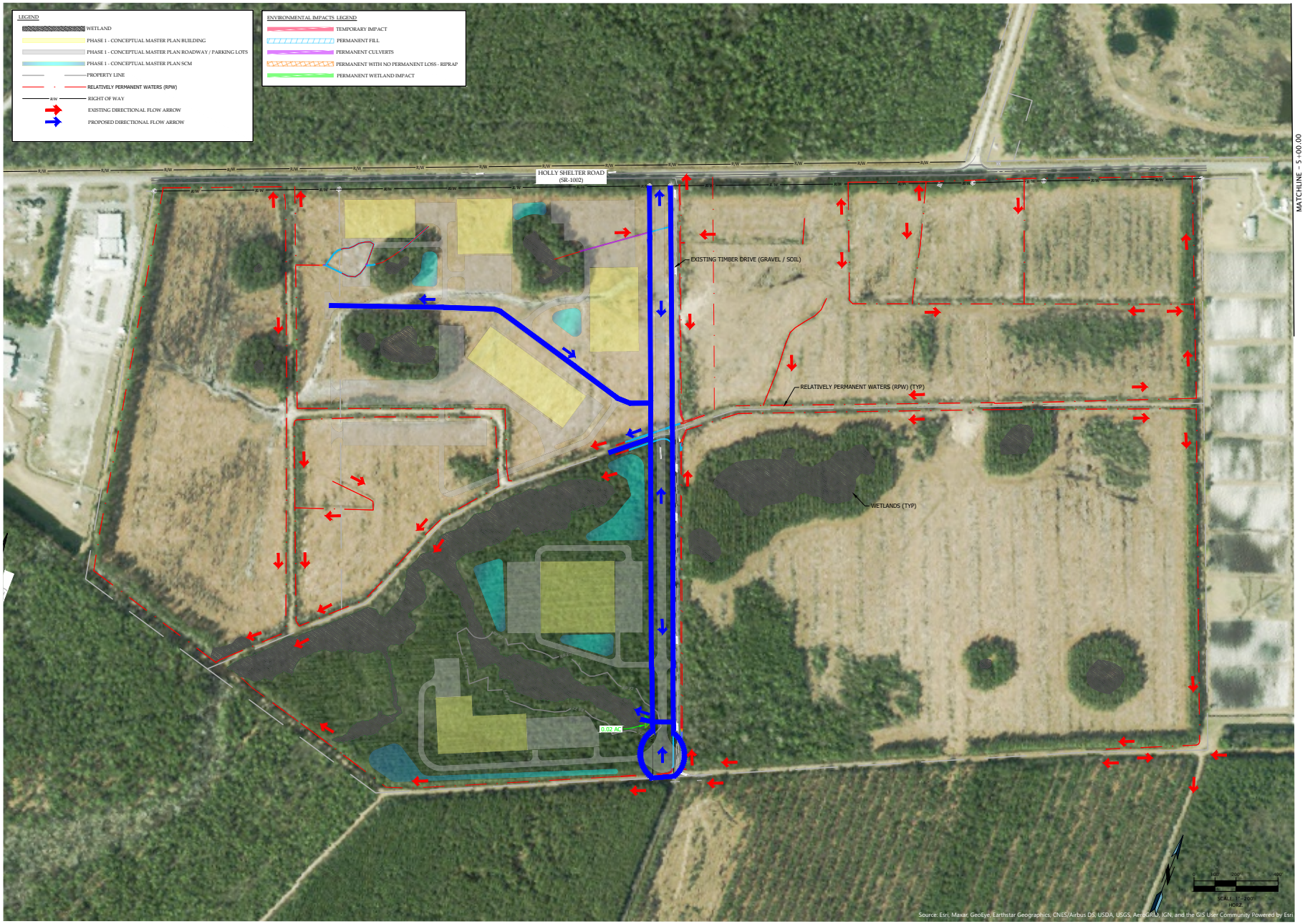
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HOLLY SHELTER BUSINESS PARK – PHASE I

PROPOSED CONDITIONS
MASTER PLAN DRAINAGE AREA MAP

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BUSINESS PARK ROADWAY CROSS SECTIONS

NOTE:
ALL ROADWAY, SHOULDER, AND DITCH SLOPES ARE TYPICAL UNLESS OTHERWISE SPECIFIED

SCALE: 1"=10' VERT.

SCALE: 1"=10' HORZ.



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HOLLY SHELTER BUSINESS PARK – PHASE I
BUSINESS PARK ROADWAY CROSS SECTIONS

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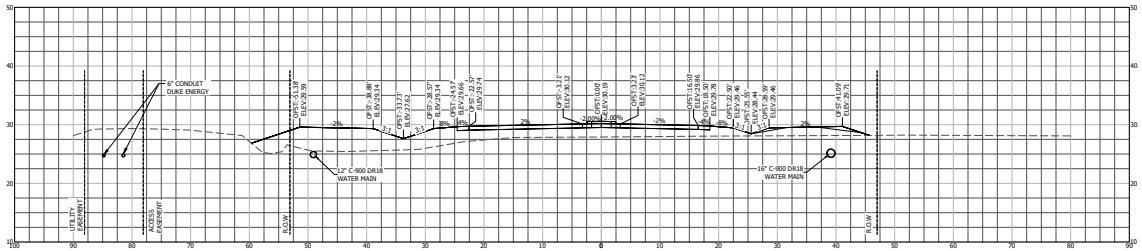
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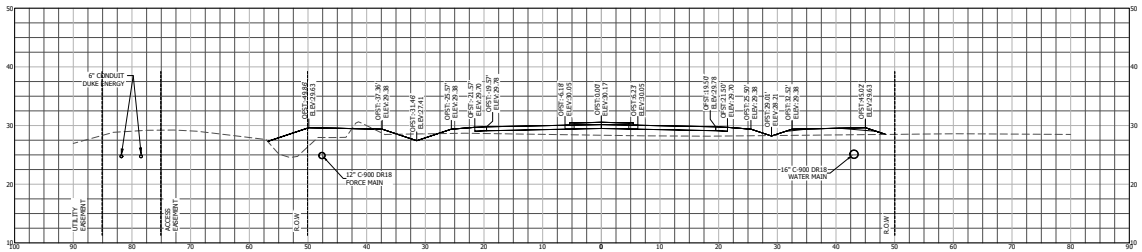
BUSINESS PARK ROADWAY CROSS SECTIONS

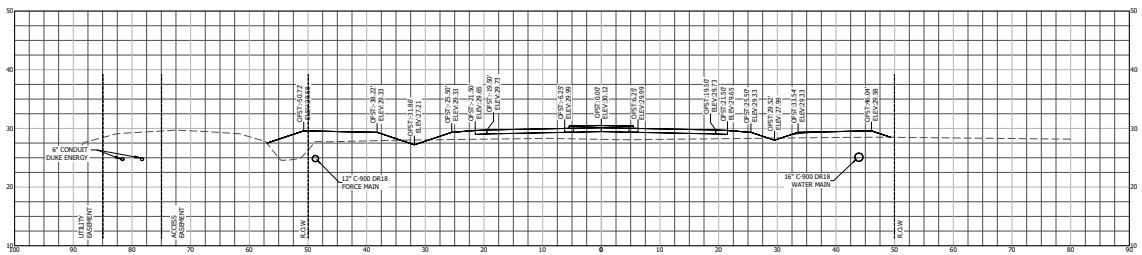
NOTE:
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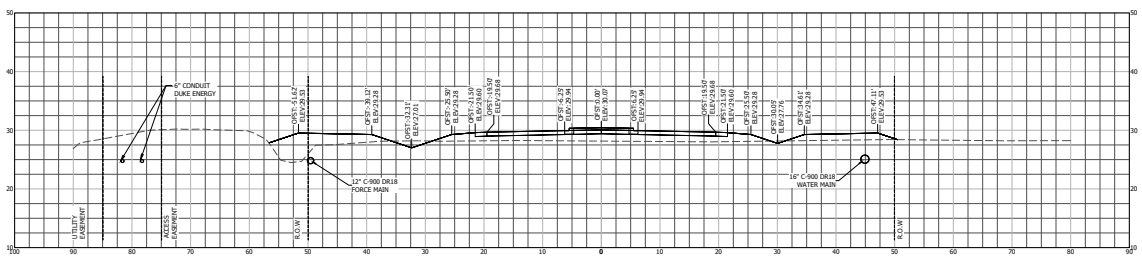
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BUSINESS PARK ROADWAY CROSS SECTIONS

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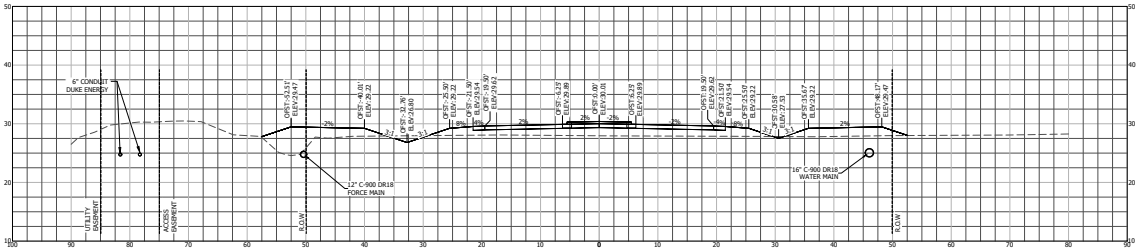
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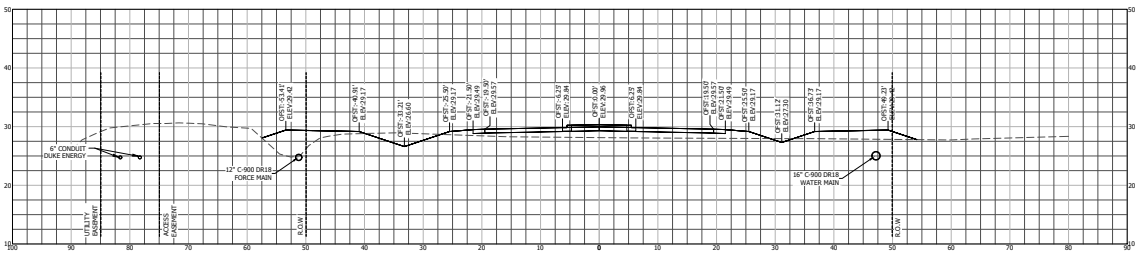
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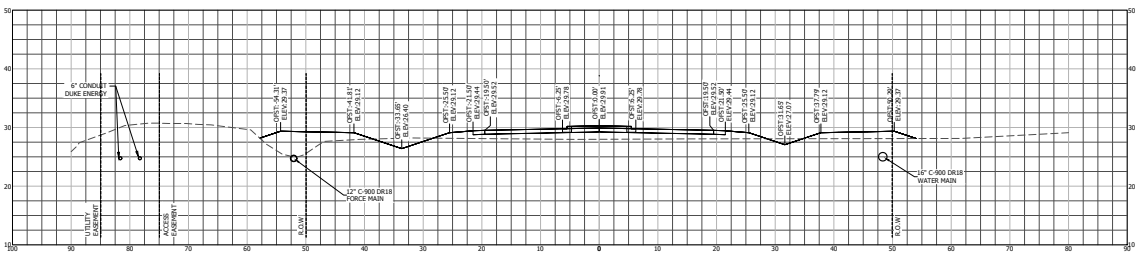
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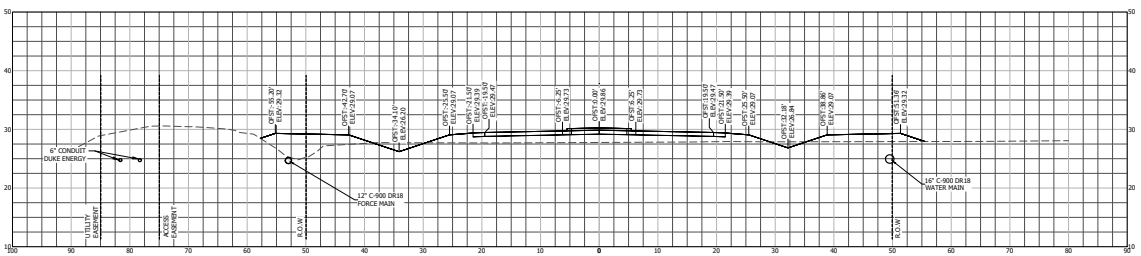
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HOLLY SHELTER BUSINESS PARK – PHASE 1

BUSINESS PARK ROADWAY CROSS SECTIONS

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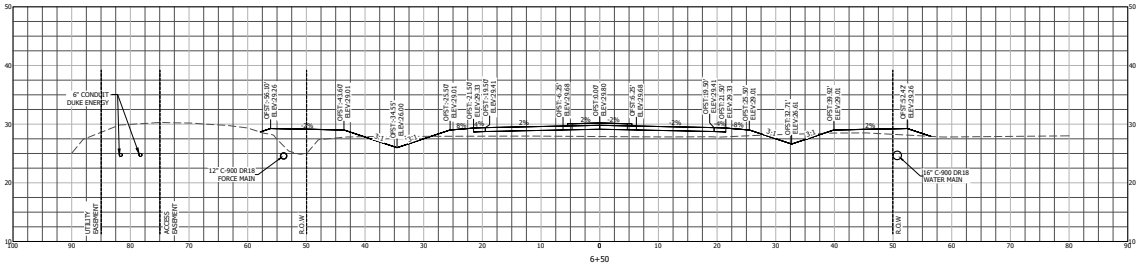
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BUSINESS PARK ROADWAY CROSS SECTIONS

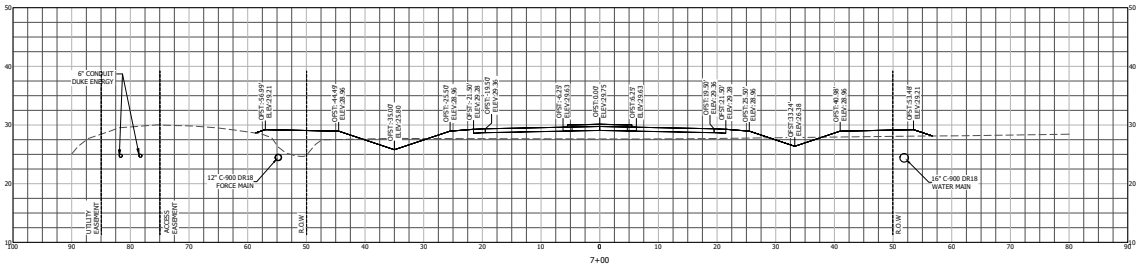
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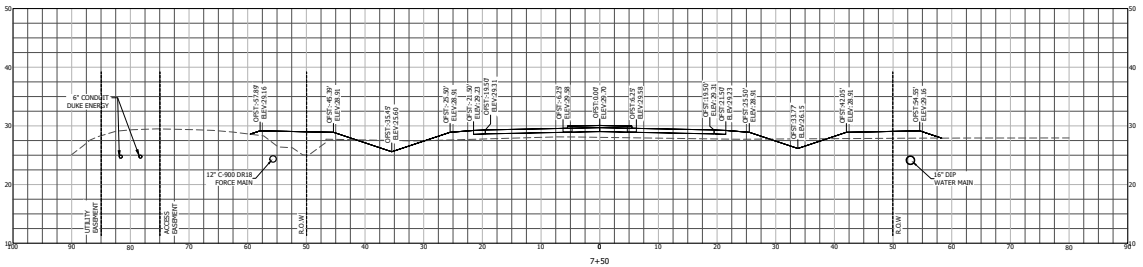
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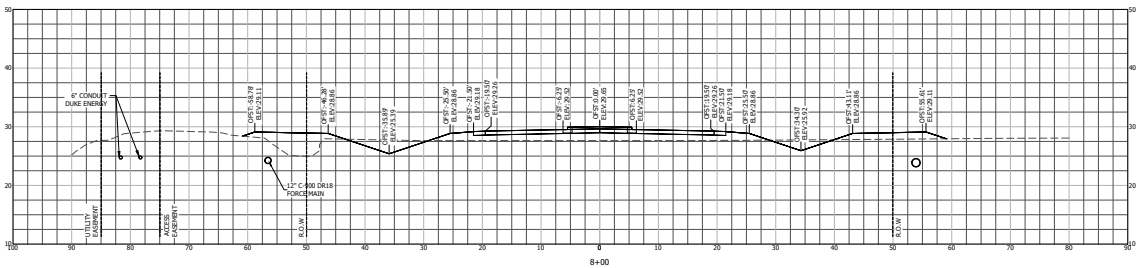
6+50



7+00



7+50



8+00

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HOLLY SHELTER BUSINESS PARK – PHASE 1

BUSINESS PARK ROADWAY CROSS SECTIONS

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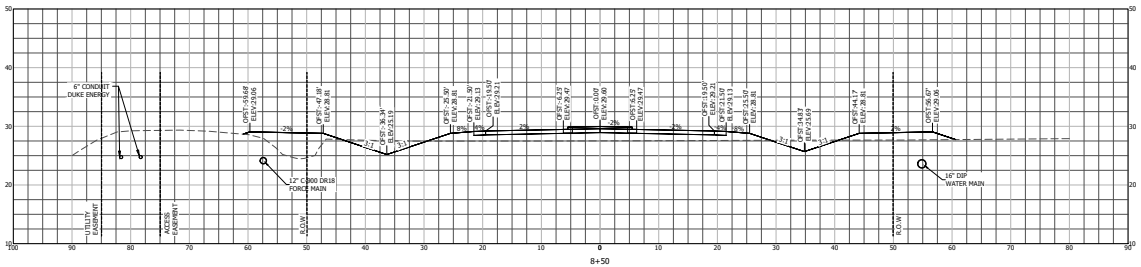
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BUSINESS PARK ROADWAY CROSS SECTIONS

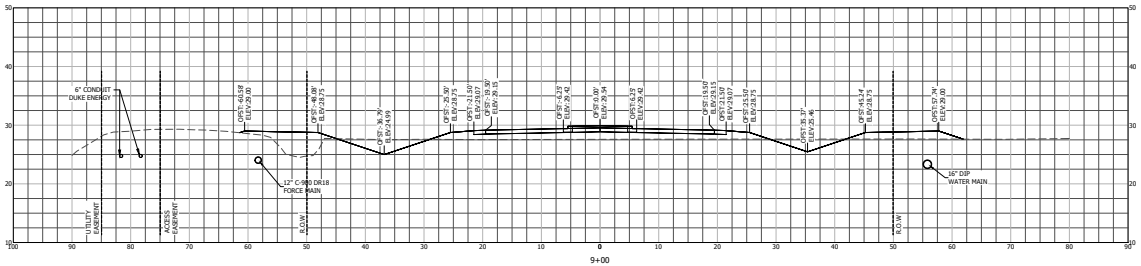
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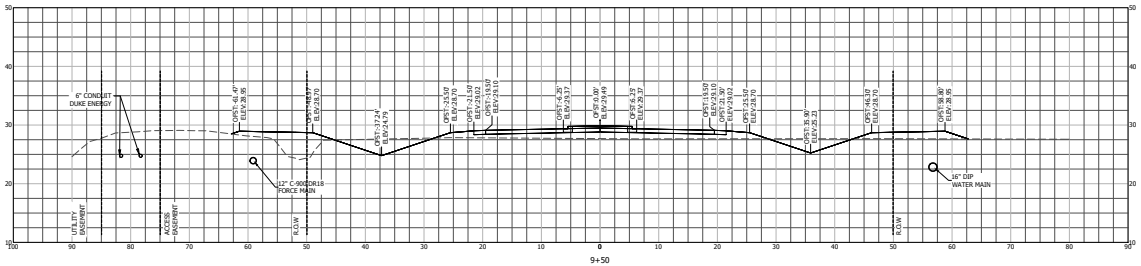
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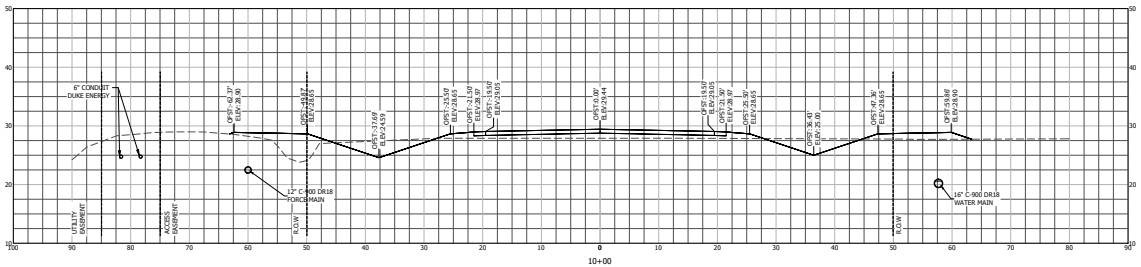
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9+00



9+50



10+00

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HOLLY SHELTER BUSINESS PARK – PHASE I

BUSINESS PARK ROADWAY CROSS SECTIONS

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PROJECT NO.: 3514-A

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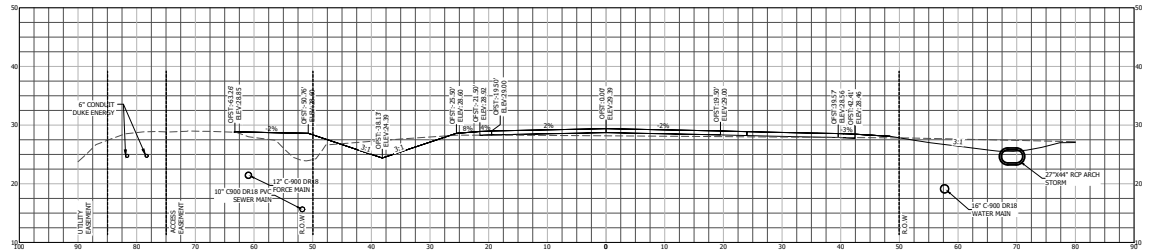
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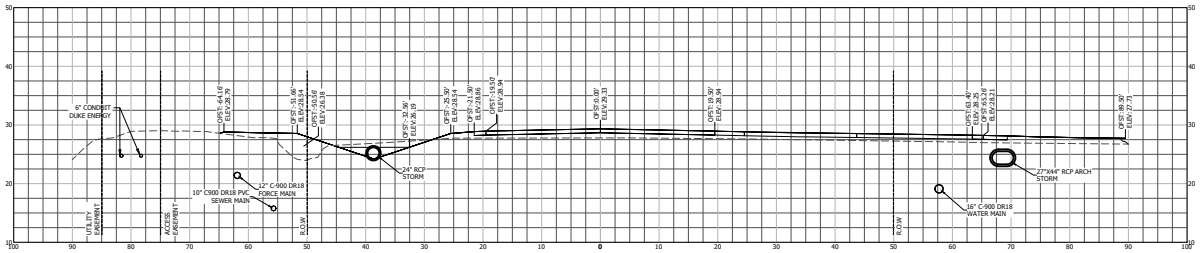
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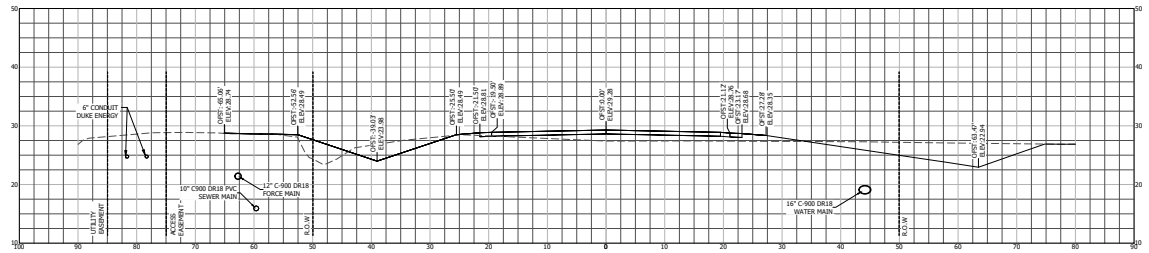
NOTE:
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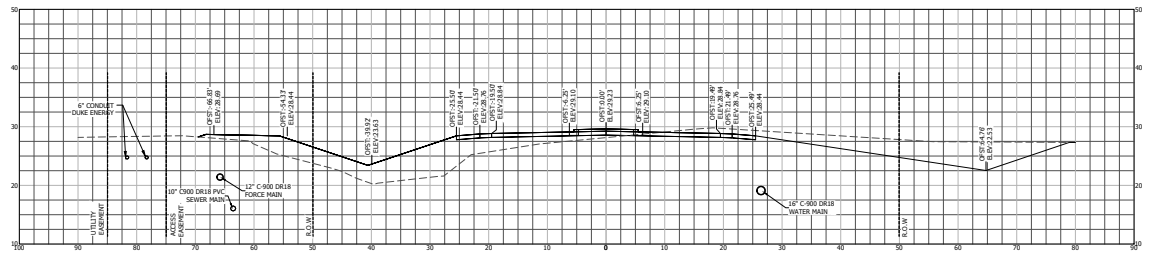
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SCALE: 1"=10' HORZ.









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NEW HANOVER COUNTY NORTH CAROLINA

NEW HANOVER COUNTY

HOLLY SHELTER BUSINESS PARK – PHASE I

BUSINESS PARK ROADWAY CROSS SECTIONS

FINAL DRAWING
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ISSUED FOR:

90% PROGRESS

DATE: 08/2025

DESIGNED BY: AMW

DRAWN BY: MMS

CHECKED BY: LVL

PROJECT NO.: 3514-A

EN-14

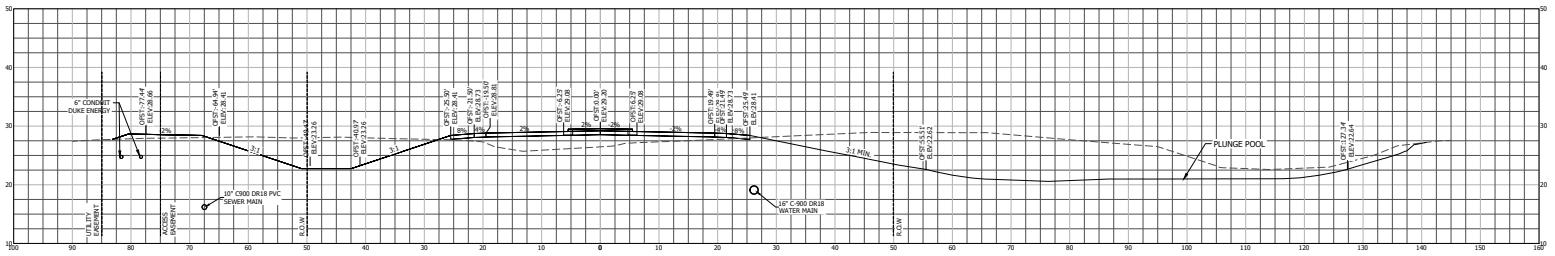
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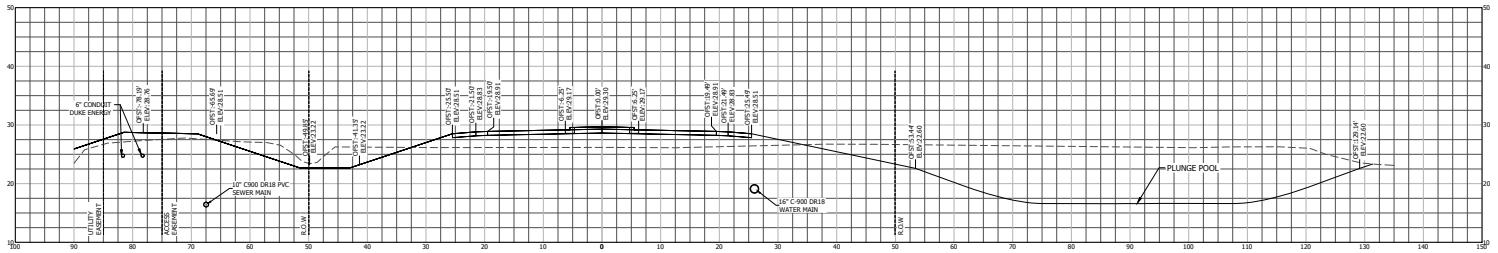
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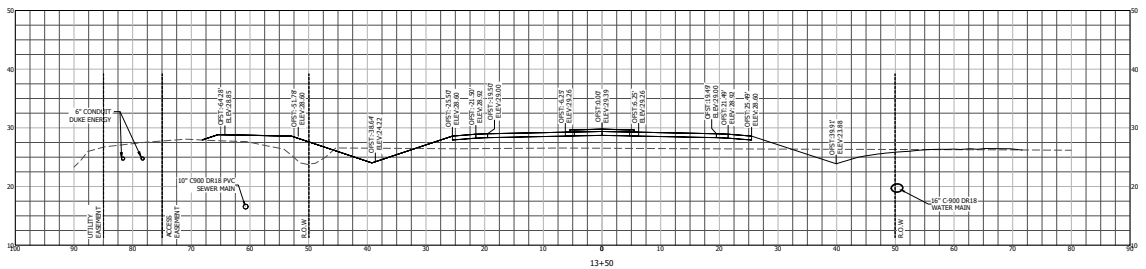
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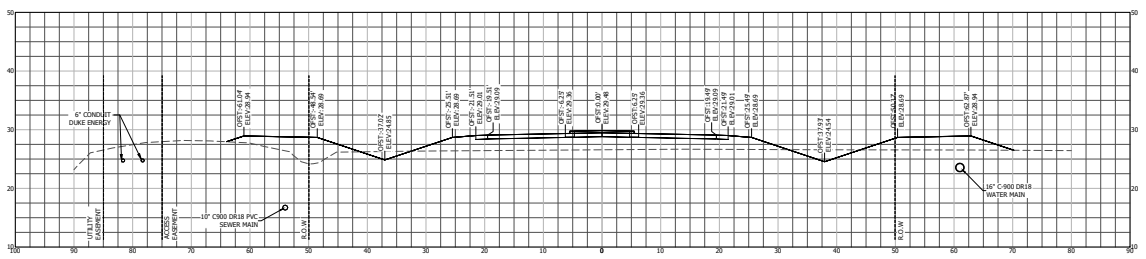
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SCALE: 1"=10' HORZ.









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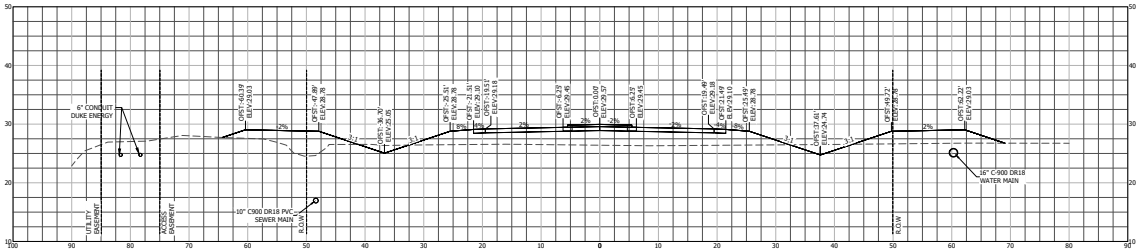
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BUSINESS PARK ROADWAY CROSS SECTIONS

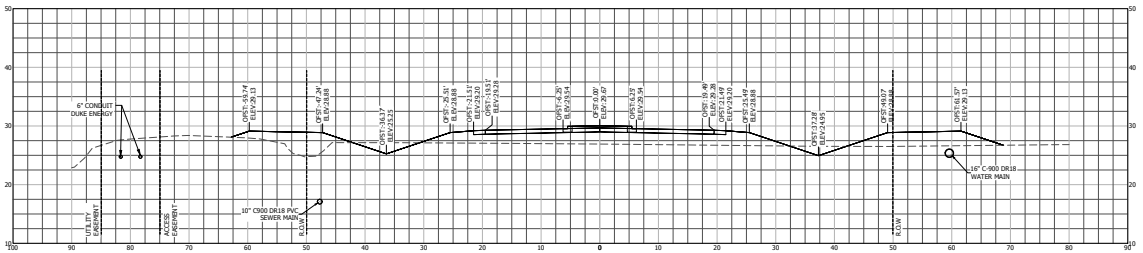
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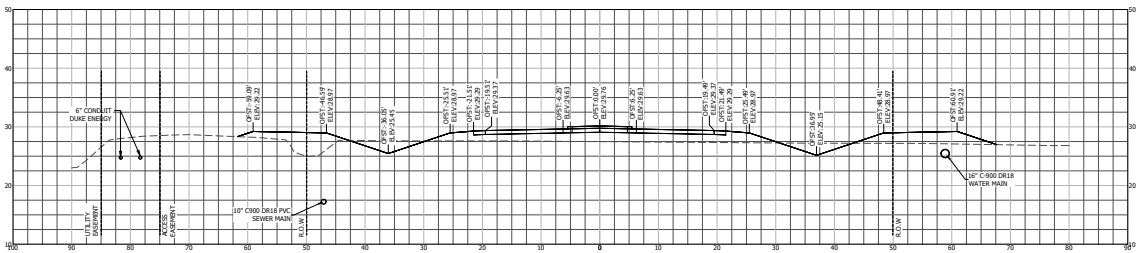
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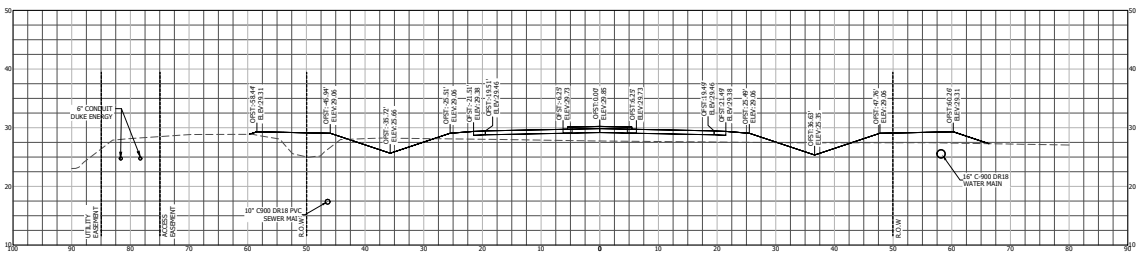
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15+00



15+50



16+00

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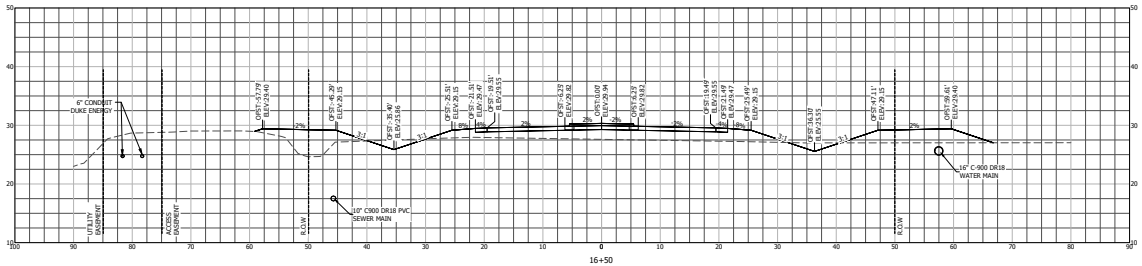
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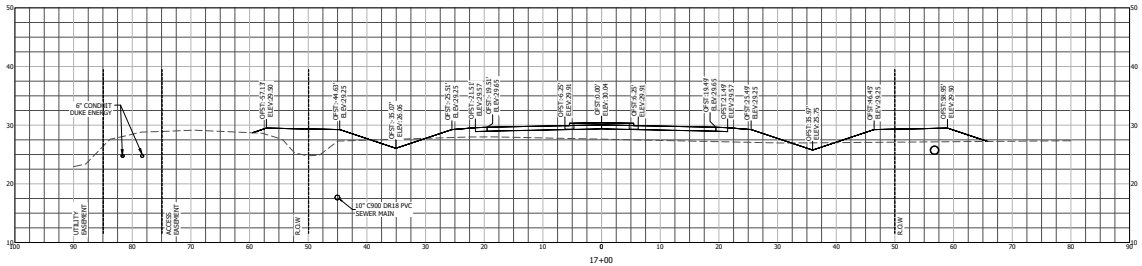
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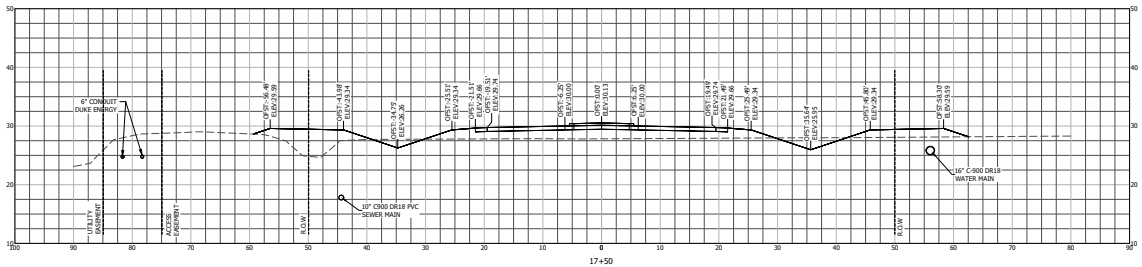
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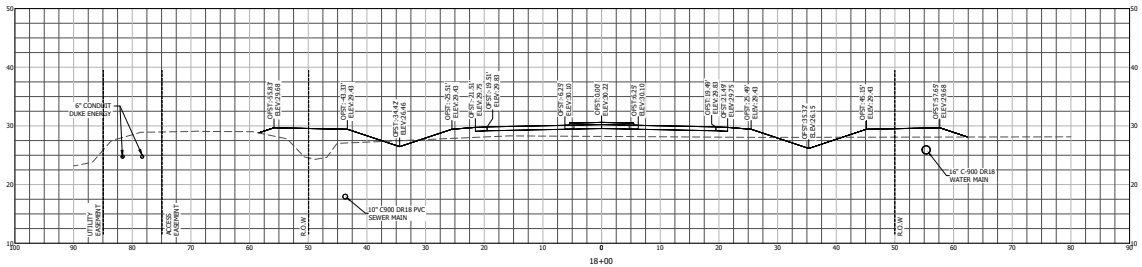
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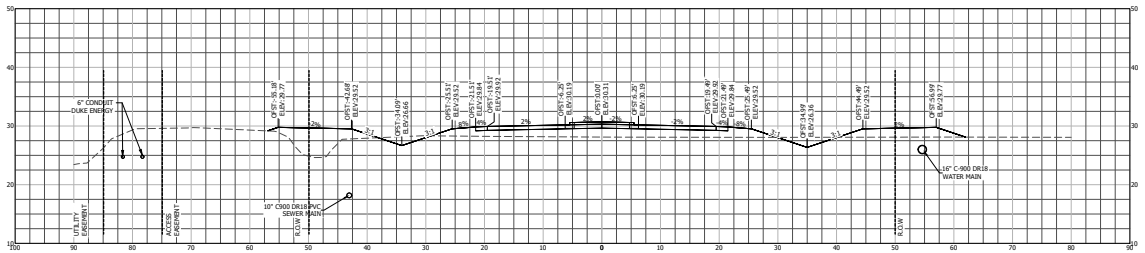
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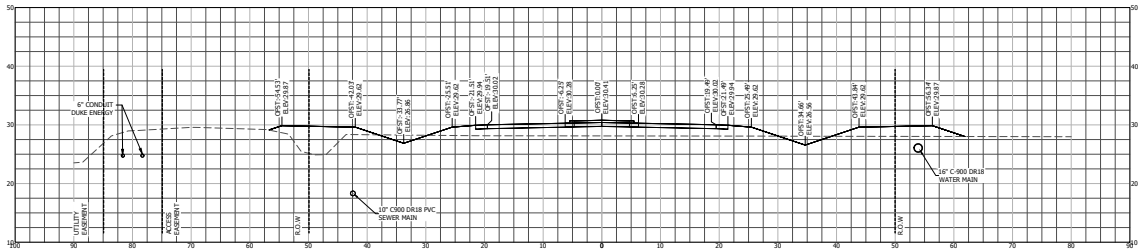
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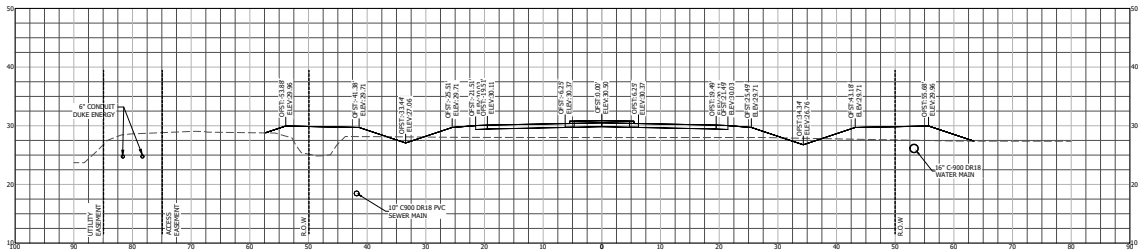
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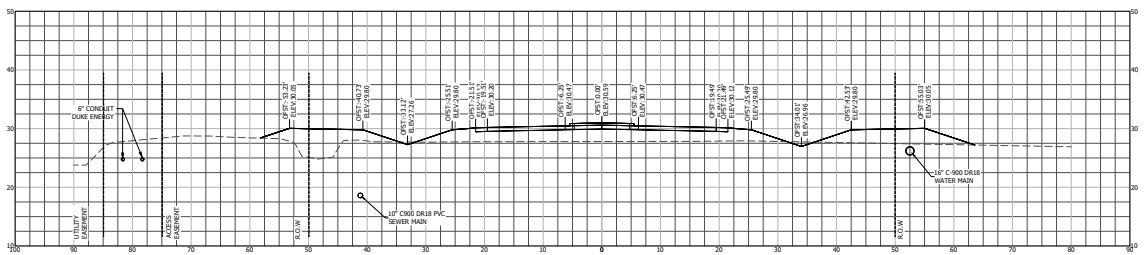
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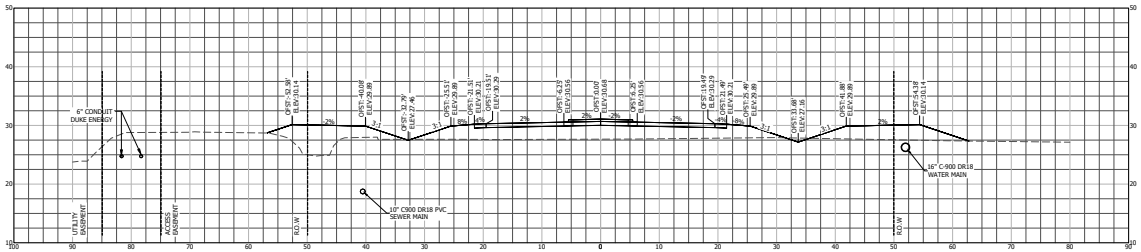
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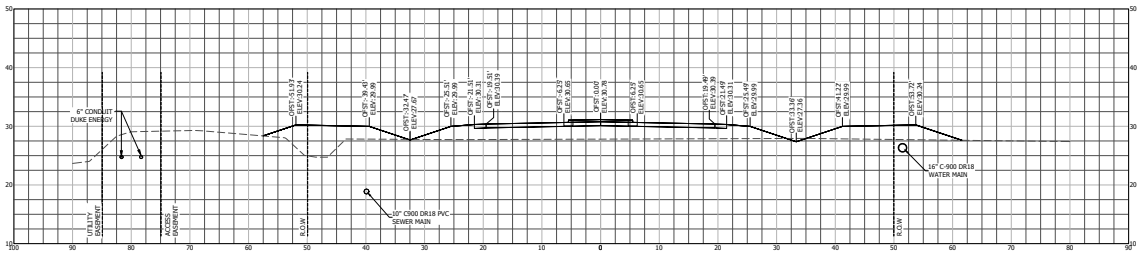
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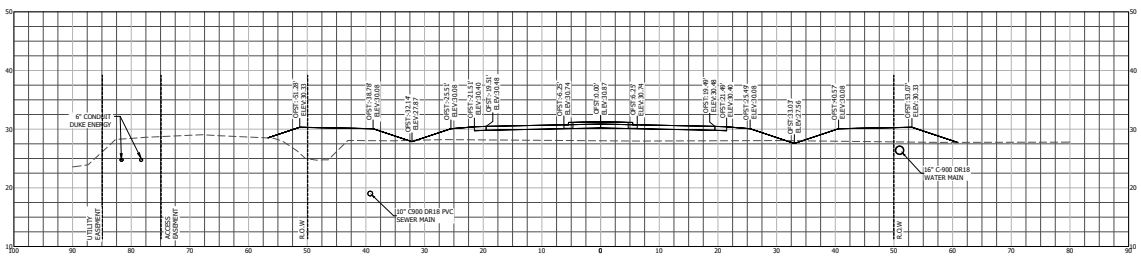
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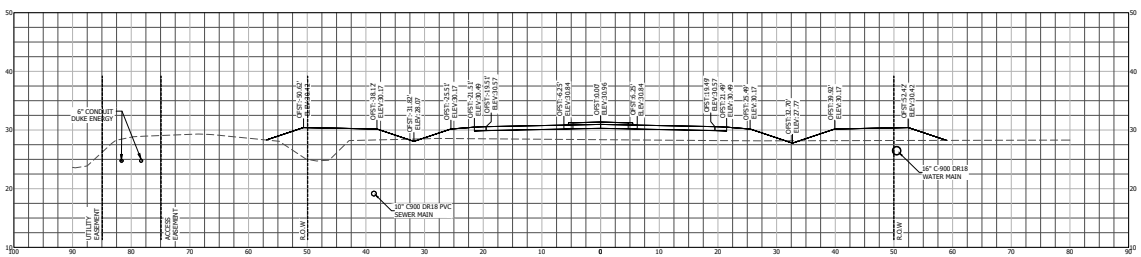
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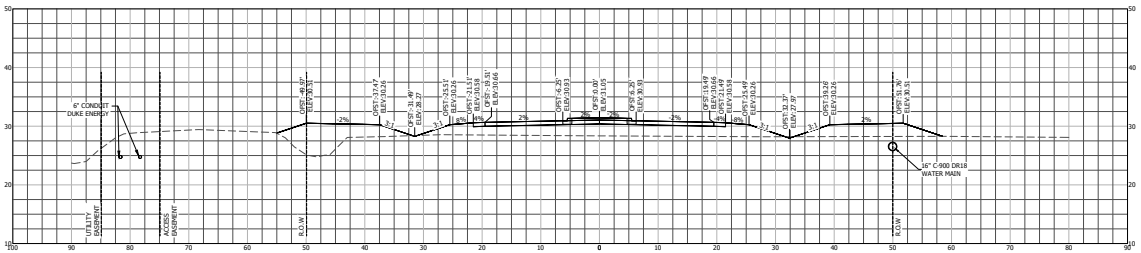
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BUSINESS PARK ROADWAY CROSS SECTIONS

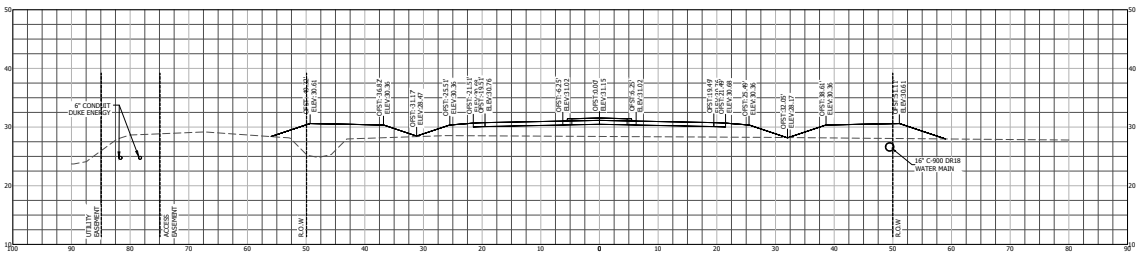
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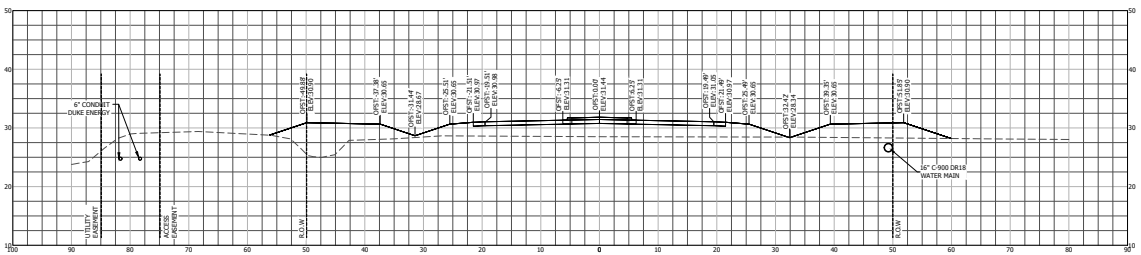
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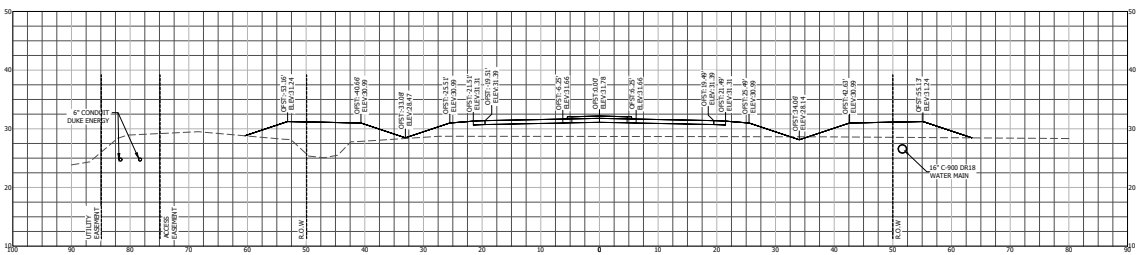
22+50



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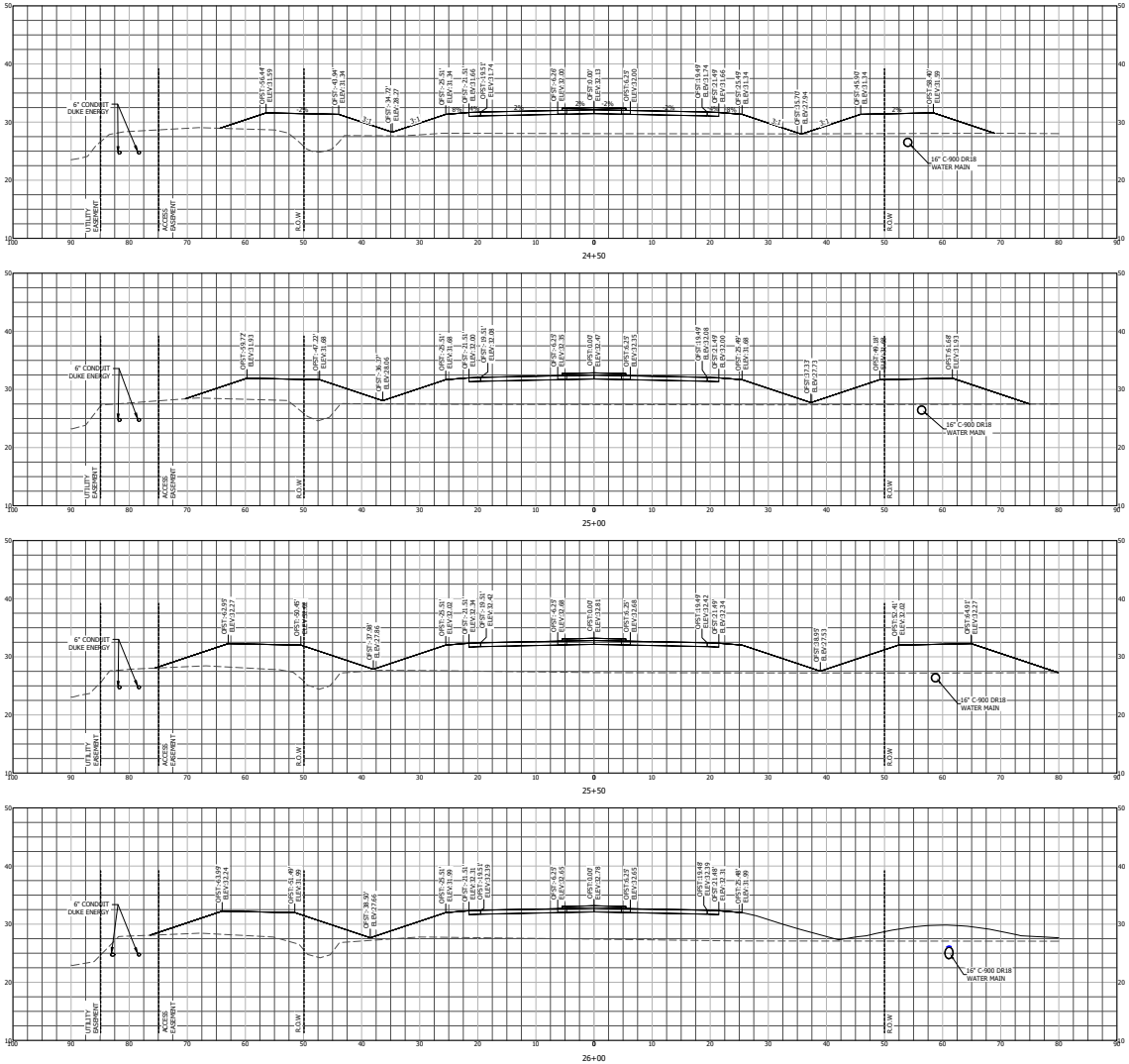
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BUSINESS PARK ROADWAY CROSS SECTIONS

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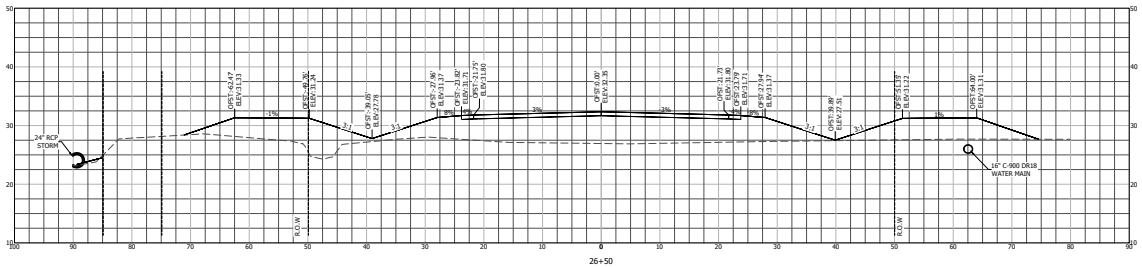
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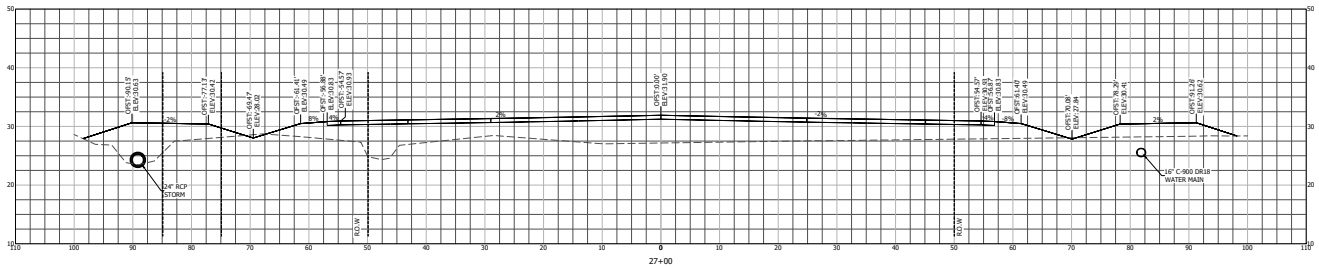
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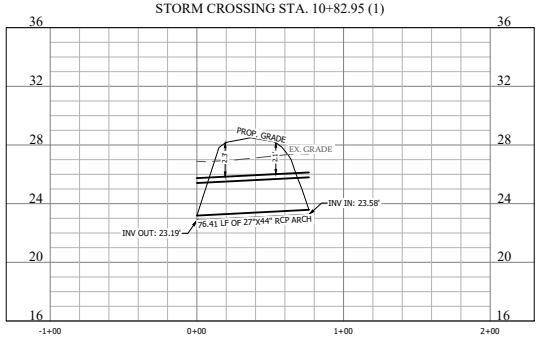
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BUSINESS PARK ROAD STORM CROSSING PROFILES

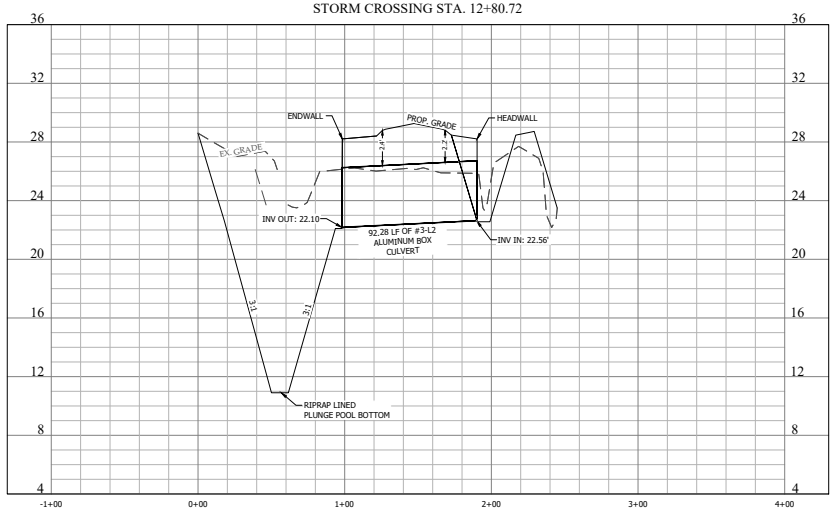
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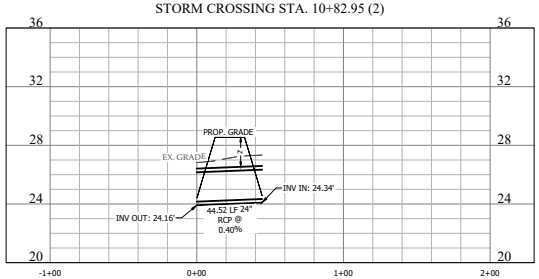
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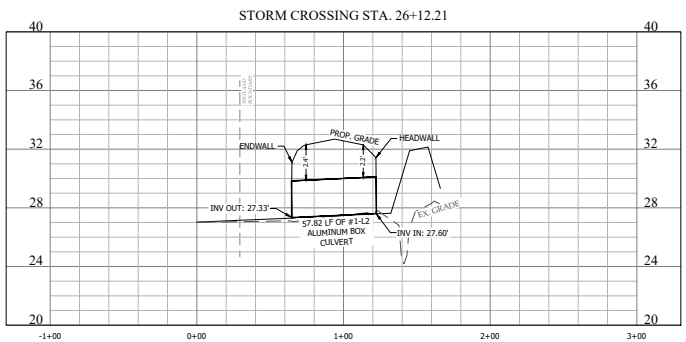
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STORM CROSSING STA. 10+82.95 (2)



STORM CROSSING STA. 26+12.21



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CHANGE ORDER NO 1

Owner: New Hanover County — Owner's Project No.: Owner's Project ID
Engineer: The Wooten Company — Engineer's Project No.: 3514-A
Contractor: Contractor's Legal Name — Contractor's Project No.: Cont. Proj. ID
Project: Holly Shelter Road Business Park – Roadway Infrastructure Improvements – Phase I
Contract Name: Contract Name
Date Issued: — Effective Date of Change Order:

The Contract is modified as follows upon execution of this Change Order:

Description:

1.

Attachments:

1.

Change in Contract Price	Change in Contract Times [State Contract Times as either a specific date or a number of days]
Original Contract Price: $ Contract Price	Original Contract Times: Substantial Completion: Days to Sub. Comp. Ready for final payment: Days to Completion
Select from previously approved Change Orders No. 1 to No. : ____ $_____	Select from previously approved Change Orders No.1 to No. ____ : Substantial Completion: _____ Ready for final payment: _____
Contract Price prior to this Change Order: $ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for final payment: _____
Select this Change Order: $_____	Select this Change Order: Substantial Completion:_____ Ready for final payment: ____
Contract Price incorporating this Change Order: $ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for final payment: _____

Recommended by Engineer (if required)

By:_____
Title: _____
Date:

Accepted by Contractor

_____

Authorized by Owner

By:
Title:
Date:

Approved by Funding Agency (if applicable)

END OF SECTION

2018 EJCDC® C-941, Change Order EJCDC® C-941, Change Order, Rev.1.

SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. Work described in this Project Manual includes the provision of labor, materials, equipment, and services required to complete the Holly Shelter Business Park – Roadway Infrastructure Improvements – Phase I for the County of New Hanover, North Carolina.

1.02 CONTRACTS

A. Project construction will be let under one Contract with construction including, but not limited to, the following major work items:
   1. Utilities and Roadway Infrastructure Improvements
      a. +/-2750 LF new onsite median divided roadway.
      b. +/-800 LF new offsite right turn lane.
      c. Aluminum Box Culvert storm drainage crossings.
      d. 3054 LF 16” water main.
      e. +/-1400 LF 10” gravity sewer main and associated manholes.
      f. 1313 LF 12” force main.
      g. Construction of new pump station.
      h. Associated earth work, erosion control, stormwater measures, and other miscellaneous items.

1.03 WORK SEQUENCE

A. Construction Progress:

   Construction progress schedule, as required in section, Submittal Procedures, shall indicate the anticipated items and times that will be required for construction for the 12 month project duration.

1.04 OWNER OCCUPANCY

A. Owner will not occupy site during entire period of construction.

1.05 CONTRACTOR USE OF SITE

A. Contractor shall have access to the project construction limits which is property controlled by New Hanover County. Any areas outside of the construction limits would require approval by the New Hanover County.

B. Owner shall provide a staging area at the site for the Contractor material and equipment storage.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 22 00

UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Delineation of measurement and payment criteria applicable to Work performed under Contract by the unit price payment method.

1.02 FIELD MEASUREMENT

A. Take measurements and compute quantities for submittal of the monthly pay request unless specified otherwise in the measurement paragraphs as indicated in this Section.

1.03 CHANGE IN QUANTITIES

A. Increase in the quantity of a bid item above what is indicated in the Bid Form shall only be made by a Change Order as required by the Contract Documents.

B. A final adjusting Change Order shall be made for adjustment of the actual quantities installed prior to submittal of the final pay request.

1.04 GENERAL

A. Items with a "(X)" in the title of the following bid items represent the size or depth as indicated on the Bid Form.

B. Method of measurement for the individual Bid Items shall be as specified below.

C. Payment for each item shall be in accordance with the Contract Unit Price times the number of units installed in accordance with the Contract Documents.

D. Work for each bid item shall include, but not be limited to, the work listed below and the labor, materials, equipment, and services required and reasonably implied by the Contract Documents for a complete installation.

1.05 MOBILIZATION

A. Measurement shall not be made for this item.

B. Work shall include administrative cost including, but not limited to, mobilization, bonds, insurance, project signage, shop drawing submittal, scheduling, coordination with owner, engineer, NCDOT, CFPUA, and other permitted agencies, as-built documentation, and other miscellaneous temporary facilities and controls. General office administration for the Project construction shall be included in the individual unit price items.

C. Bid Price for Mobilization shall not exceed 5 percent of the total bid. Half of the mobilization may be requested on the first pay request and the remainder on the second. Any amount bid over 3% shall be paid on last pay estimate.

1.06 UTILITY PIPING (BID ITEMS LISTED BY THE LINER FOOT (LF))

A. Measurement: Measure horizontally or from station to station as shown or indicated on the Drawings for the various types and sizes of pipes installed.
   1. (X)-inch (PVC) Sewer Force Main: No deduction will be made for space occupied by valves or fittings.
   2. (X)-inch (PVC) Sanitary Sewer, (X)-(X) ft: Measure pipe from center to center of manholes. No deduction will be made for space occupied by manholes. Measure depth of pipe vertically from pipe invert to original grade as shown on the Drawings.
   3. (X)-inch PVC Water Main: No deduction will be made for space occupied by valves or fittings
   4. (X)-inch Storm Sewer: Measure pipe from end to end. Depth of pipe will not affect measurement. No deduction will be made for space occupied by structures, if any.

B. Work shall include, but not be limited to (unless specifically noted otherwise on the Bid Form and this specification Section), the following:
   1. Temporary removal and restoration or temporary support of, but not limited to, existing mailboxes, signs, fences, shrubs, plants (under 6 feet in height), guard rails, power and telephone poles.
   2. Excavating, shoring and bracing where required, dewatering as required, installing, backfilling (including Class I material as specified for the pipe bedding, haunching, and initial backfill).
   3. Installation of warning / identification tape over utilities.
   4. Installation of tracer wire on non-metallic utilities.
   5. Temporary support and protection of existing underground facilities.
   6. Pipe, concrete blocking and encasement, connection to existing piping, and all required pipeline restraints.
   7. Flushing and testing.
   8. Disinfect of mains
   9. Adjust valve boxes to finish grade surface elevation.
   10. Repair to damaged new and existing utilities.
   11. Grade disturbed areas to original surface profile prior to seeding.
   12. Removal and reinstallation of existing water meters, water service connections, hydrants, and hydrant legs as needed for infrastructure construction.
   13. Replacement and repair of gravel, concrete, asphalt, driveways.
   14. Replacement of driveway culvert pipes.
   15. Installation of Anti-Seep Collars where noted.

C. Payment: The first Application for Payment will be approved based on the utilities installed during the agreed upon payment period without testing. Subsequent Application for Payments shall not be approved by the Engineer unless utilities installed during the previous payment period have passed the specified tests and clean up and seeding is complete.

1.07 BID ITEMS LISTED BY THE UNIT “EACH (EA)

A. Measurement: By the number installed.

B. Water Work Items:

   1. (x)-inch Gate Valve and Box: Valve, valve box, concrete setting pad, concrete top collar, and valve markers as shown in contract.

   2. Fire Hydrant Assembly: Fire hydrant, hydrant tee, hydrant elbow, standpipe

extension(s), concrete base, blocking, bridle rods and rod collars, the 6 inch gate valve (including valve box, concrete setting pad and concrete top collar) and 6 inch pipe from the water main to hydrant.

3. Air Release Valve in Manhole: air release valve, pipe tap, and manhole (including stone base, frame and cover).

4. Connect to existing water main (X)-inch: Work shall include all fittings, excavation, coordination, backfilling and compaction, removal of existing pipeline fittings, sharing, and locating existing main required for complete connection to existing water main as indicated on the drawings.

C. Sanitary Sewer work items:
   1. Combination Air Release Valve and Manhole: Air release valve, pipe tap, and manhole (including stone base, frame and cover).
   2. (x) inch Plug Valve and Box: Valve, valve box, valve marker, concrete setting pad, and concrete top collar.
   3. Connection to Existing Force Main: Work includes but is not necessarily limited to, coordination with the Owner, fittings, valves, excavation, backfill, compaction, locating and tying to existing force main, providing transition and restraint system, all as needed to make connection as shown on Drawings

1.08 (X)' DIA. MANHOLE, DEPTH (X) – (X) FT

A. Measurement: By the number of various sizes and at the depth installed. Measure depths from manhole cover to lowest pipe invert.

B. Work: Excavating, backfilling, stone subbase, concrete sections as required for the depth, tap adjusting rings, steps, pipe boots and ring and cover.

1.09 CLASS "X" RIP RAP

A. Measurement shall be by the ton of class "X" rip rap actually installed.

B. Measurement: Measure by the ton underlaid with filter fabric at the required depth as shown on the drawings. Engineer shall approve location and amount of stone to be used prior to placement. Payment shall not be made for stone that is not verified by the Engineer at the time of delivery.

1.10 INCIDENTAL STONE #57

A. Measurement should be by the ton of #57 stone actually installed.

B. Measurement: Measure by the ton of installed rock. Engineer shall approve the location and general amount of incidental stone to be used prior to placement. Payment shall not be made for stone that is not verified by the Engineer at the time of delivery.

1.11 UNDERCUT (REMOVAL AND REPLACEMENT) - ROADWAY

A. Measurement: Measure undercut in the field in the presence of the Engineer. Undercut must be approved by the Engineer as the Work progresses. Maintain daily log sheets of measured quantities. Log sheets must be signed by Engineer and submitted with payment request. Payment shall not be made for quantities that have not been field verified by the Engineer. Measurement shall be by the "Cubic Yard" (CY).

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

1.12 GEOTEXTILE UNDERLINER

A. Measure by the square yard of installed liner.

B. Work shall include installed fabric as indicated on the drawings.

1.13 “X” CABC STONE FOR ROADWAY

A. Measurement: Measure by the ton. Engineer shall approve location and amount of stone to be used prior to placement. Payment shall not be made for stone that is not verified by the Engineer at the time of delivery.

B. Work: Stone, hauling, placement, and compacting.

C. Stone payment shall be for stone base as indicated on the drawings.

1.14 MILLING OF ASPHALT PAVEMENT (“X” DEPTH x “X” WIDTH)

A. Measurement shall be by the square yard (SY) of milled asphalt at the specified depth.

B. Work shall include pavement preparation, labor, materials and equipment to perform milling operation.

1.15 REMOVAL OF ASPHALT PAVING

A. Measurement shall be by the square yard (SY) of asphalt removal.

B. Work shall include labor, materials and equipment to perform saw cutting removal, hauling and offsite legal disposal.

1.16 ASPHALT PAVING

A. Asphalt paving shall cover the following three paving layers:
   1. 4.0-inch I-19.0C Int. Course
   2. 3.0-inch S-9.5C bit. conc. Surface Course
   3. 4.0-inch B25.0C bit. conc. Surface, Course (<6’ width of pavement only)

B. Measure by the ton installed.

C. Work shall include fine grading of sub-grade; hauling, condition stone base; primer, and hauling, placing, and compaction and testing of asphalt.

1.17 PAVEMENT STRIPING

A. Measure by the linear foot from the start of striping to the end for all thickness and color as indicated on the drawings.

B. Traffic Lane striping. For broken lines it shall be determined by the nominal length of a line multiplied by the number of lines in place.

C. Work shall include pavement preparation, layout, and application of striping material.

1.18 DIRECTION ARROWS

A. Directional Arrows shall be paid per each as indicated on the drawings.

B. Work shall include pavement preparation, layout, and application of pavement markings.

1.19 STOP BARS

A. Stop Bars shall be paid for by the liner foot of installed bar.

B. Work shall include pavement preparation, application, labor and materials.

1.20 SIGNAGE

A. Measured by each sign installed.

B. Work shall include installation as shown on the drawings.

1.21 (X) INCH CONCRETE CURB & GUTTER

A. Measure by the linear foot as taken along the face of the curb and gutter installed.

B. Work shall include excavation, forming, concrete placement and finishing, construction and expansion joints, and backfill.

1.22 TRAFFIC CONTROL

A. Measurement shall not be made for this item.

B. Payment for traffic control shall be in accordance with the Contract Lump Sum price for the installation of necessary control measures. Payment shall be for the labor, material, equipment and accessories required for temporary traffic control devices, manpower, and equipment for the project.

1.23 CLEARING AND GRUBBING

A. Measurement shall not be made for this item.

B. Payment for the clearing and grubbing shall be in accordance with the Contract lump sum price. Bid Form has the quantity, payment by the acre. Payment shall be for the labor, material, equipment, and accessories required for the clearing and grubbing as indicated in the Contract Documents.

1.24 EARTHWORK

A. Measurement shall not be made for this item.

B. Payment for the earthwork shall be in accordance with the Contract lump sum price for the earthwork as required by the Contract Documents. Payment shall be for the labor, material, equipment, and accessories required for a complete installation including, but not limited to, the following:

1. Topsoil stripping, stockpiling and spreading after the completion of the grading and for offsite import if onsite supply is inadequate.
2. Backfilling of area stripped of topsoil and filling from existing grades to new subgrade elevation. Providing offsite borrow material for backfilling and filling.
3. Protection of existing service lines and utility structures.
4. Maintenance and Stability of site grading.
5. Disposal of waste and surplus material.

1.25 UNDERCUT UNSTABLE PIPE FOUNDATION (REMOVAL AND REPLACEMENT)

A. Measurement: Measure along the centerline of the trench times the undercut depth below the pipe bedding as approved by Engineer times the pipe OD plus two feet. Measure unstable soils at manholes on the maximum basis of 1 foot greater diameter than the outside diameter of the manhole and a depth as approved by the Engineer. Measurement shall be based on the actual quantities removed but not exceeding the maximum specified trench dimensions. Take measurements in the presence of the Engineer. Maintain daily log sheets of measured quantities. Log sheets must be signed by Engineer and submitted with payment request. Payment shall not be made for quantities that have not been field verified by the Engineer.

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

1.26 EROSION CONTROL

A. Measurement shall not be made for this item.

B. Payment for the erosion control shall be in accordance with the Contract lump sum price for the installation of erosion control measures as required by the Contract Documents. Payment shall be for the labor, material, equipment, and accessories required for a complete installation including, but not limited to, the cost of installing, maintaining, and removal of the individual erosion control devices. Erosion control devices shall include, but not be limited to, the following:
   1. Silt fence.
   2. Temporary and permanent swales.
   3. Rock Check Dam
   4. Stone Construction Entrance as per Drawings
   5. Erosion Control Matting
   6. Reporting Requirements

1.27 SEEDING AND MULCHING

A. Measurements shall not be made for this item.

B. Payment for clean-up and seeding shall be in accordance with the Contract lump sum price. Payment shall be for the labor, material, equipment, and accessories required for the seeding as indicated in the Contract Documents.

1.28 DUAL L2 ALUMINUM BOX CULVERT WITH HEADWALL WINGWALLS (“X”-FT - “X”-IN)

A. Measurements shall not be made for this item.

B. Work shall consist of all labor, equipment, material and accessories for complete installation of new aluminum box culvert system crossing layout, excavation, stone bedding, backfill, compaction pipe assembly and installation, tie-backs, headwall and wingwall installation, inspection and final NBIS inspection report for NCDOT acceptance at proper completion.

1.29 ARCH RCP (“X”-IN x “X”-IN)

A. Measurements shall be made by the Liner Foot for this item.

B. Work shall consist of all labor, equipment, material and accessories for complete installation of the new Arch RCP system Including layout, excavation, foundation bedding, backfill, and acceptance.

1.30 RCP (“X”-IN)

A. Measurements shall be made by the Liner Foot for this item.

B. Work shall consist of all labor, equipment, material and accessories for complete installation of the new class III RCP system Including layout, excavation, foundation bedding, backfill, and acceptance.

1.31 HOLLY SHELTER PUMP STATION

A. Measurements shall not be made for this item.

B. Work shall consist of all labor, equipment, materials, and accessories for installation of the Holly Shelter Pump Station, including, but not limited to, piping (gravity and force main within the pump station fence), grinder and grinder manhole, wetwell, pumps, floats, stilling well, valves, pressure gauges, valve vault, air release valve and manhole, flow meter and vault, drain system for each vault, hatches, temporary bypass connection, fittings, pre-fabricated control building, control panel, various controls and electrical equipment noted on the drawings, miscellaneous concrete pads (control building, generator, odor control, and transformer), light poles, electrical controls, power wiring,

conduits, water service (meter, backflow preventor, yard hydrant, and piping), site work (driveway, gravel, and fencing), electrical service, excavation, backfilling, compacting, start up (water for start up), testing, telemetry/SCADA, fencing and gate, and all other pump station related work as indicated on the drawings for a complete and operational pump station.

C. Price includes remobilization for re-testing and start-up when downstream facilities are ready to accept flow

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Construction progress schedule.

G. Contractor's daily reports.

H. Progress photographs.

I. Coordination drawings.

J. Submittals for review, information, and project closeout.

K. Number of copies of submittals.

L. Requests for Interpretation (RFI) procedures.

M. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 31 19 – Project Meetings.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Engineer:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Engineer are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Engineer's consultants will be permitted to use the service at no extra charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, Bluebeam, Procore, etc., unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: TBD

C. Project Closeout: Engineer will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. Engineer will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. CFPUA
   3. Engineer.
   4. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Submission of initial Submittal schedule.

6. Designation of personnel representing the parties to Contract, Owner and Engineer.
7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
8. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING (IF REQUIRED)

A. Attendance Required:
1. Contractor.
2. Owner.
3. CFPUA.
4. Engineer.
5. Contractor's superintendent.
6. Major subcontractors.

B. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

C. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
1. Contractor.
2. Owner.
3. CFPUA.
4. Engineer.
5. Contractor's superintendent.
6. Major subcontractors.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of RFIs log and status of responses.
   7. Review of off-site fabrication and delivery schedules.
   8. Maintenance of progress schedule.
   9. Corrective measures to regain projected schedules.
   10. Planned progress during succeeding work period.
   11. Coordination of projected progress.
   12. Maintenance of quality and work standards.
   13. Effect of proposed changes on progress schedule and coordination.
   14. Other business relating to work.

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

3.05 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the duration of the project.

3.06 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.

C. Photography Type: Digital; electronic files.

D. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Engineer.

E. In addition to periodic, recurring views, take photographs of each of the following events:

F. Views:
   1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
   2. Consult with Engineer for instructions on views required.
   3. Provide factual presentation.
   4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

G. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
   1. Delivery Medium: Via email.
   2. File Naming: Include project identification, date and time of view, and view identification.
   3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

4. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

3.07 REQUESTS FOR INTERPRETATION (RFI)

A. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
   2. Prepare using software provided by the Electronic Document Submittal Service.
   3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

C. Review Time: Engineer will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

3.08 SUBMITTAL SCHEDULE

A. Submit to Engineer for review a schedule for submittals in tabular format.
   1. Submit at the same time as the preliminary schedule.
   2. Coordinate with Contractor's construction schedule and schedule of values.
   3. Format schedule to allow tracking of status of submittals throughout duration of construction.

3.09 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Design data.
   3. Shop drawings.
   4. Samples for selection.
   5. Samples for verification.

B. Submit to Engineer for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below.

3.10 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Certificates.
   2. Test reports.
   3. Inspection reports.
   4. Manufacturer's instructions.
   5. Manufacturer's field reports.
   6. Other types indicated.

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

3.11 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout.
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.12 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Engineer.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.13 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   5. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Send submittals in electronic format via email to Engineer.
   6. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 10 business days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Engineer's consultants, Owner, or another affected party, allow an additional 7 days.
   7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.

8. Provide space for Contractor and Engineer review stamps.
9. When revised for resubmission, identify all changes made since previous submission.
10. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

B. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

3.14 SUBMITTAL REVIEW

A. Submittals for Review: Engineer will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Engineer will acknowledge receipt, but will take no other action.

C. Engineer's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 GENERAL

1.01 MEETINGS

A. Pre-construction conference shall be held prior to the beginning of the Work.

B. Construction progress meetings shall be held monthly.

C. Project close-out conference shall be held during the final phases of the Work.

D. Engineer may schedule additional meetings.

E. Meetings scheduled by the Engineer shall be held at the office of the New Hanover County Engineer, or onsite as needed, unless otherwise specified.

F. Contractor's project superintendent shall attend meetings.

G. Notify suppliers and subcontractors to attend meetings as appropriate or as required by Engineer.

H. Contractor shall schedule pre-installation conferences as required in the individual specification sections.

I. Notify Engineer of project meetings scheduled by the Contractor.

J. Engineer will schedule and administer meetings throughout the progress of the Work, except for meetings held by the Contractor for normal coordination of the Work.

K. Meeting agenda shall include, but not be limited to, the following: Project Administration, Submittals, Construction Schedules and Methods, Safety and Health Regulations, Project Coordination, Payment Application, Change Orders, and Site Inspections.

L. Engineer will prepare agenda with copies to participants, preside at meetings, prepare minutes and distribute to participants for meetings scheduled by the Engineer.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

(ROADWAY)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes, but is not limited to, requirements for the following:
   1. Submittal procedures.
   2. Construction progress schedule.
   3. Project record documents.

1.02 SUBMITTAL PROCEDURES

A. Submittals shall be uploaded to the Project ShareFile and after review shall be downloaded. Contractor will be provided access permission upon Notice to Proceed.

B. Submittals shall be numbered as required by the Wooten submittal numbering convention that will be provided at the Notice to Proceed.

C. Cover letter for each submittal package shall list the following:
   1. Contractors name:
   2. Owners name: New Hanover County
   3. Project name: Holly Shelter Business Park – Roadway Infrastructure Improvements – Phase I
   4. Wooten Job No.: 3514-A

D. Individual submittals shall each be listed by the following information:
   1. Submittal reference no.
   2. Specification section number.
   3. Drawing and detail number when appropriate.
   4. Equipment.
   5. Type submittal.
   6. Supplier.
   7. Manufacturer.

E. Contractor shall provide a submittal log listing the submittals required and the expected dates for submittal.

F. Apply Contractor's stamp to each submittal, signed or initialed and dated, certifying that Contractor has reviewed submittal for conformance with requirements of Contract Documents, and has coordinated submittal with related work.

G. Schedule submittals to expedite Project and deliver to coordinate submission of related items. Allow a minimum of fifteen (15) working days for Engineer's review.

H. Identify variations from Contract Documents and Product limitations as they relate to the satisfactory performance of the Project.

I. Provide space for Contractor and Engineer review stamps.

J. Revise and resubmit submittals as required; identify changes made since previous submittal.

K. Distribute reviewed submittals to concerned parties. Instruct parties to promptly report inability to comply with provisions.

L. Work requiring submittal review by Engineer shall not be started until review has been obtained.

M. Engineer's review of submittals shall not relieve Contractor of responsibility for complete compliance with Contract Documents.

1.03 ADMINISTRATIVE SUBMITTALS

A. Construction Progress Schedule
   1. Submit initial progress schedule 15 days after date of Owner-Contractor Agreement.
   2. Progress schedule shall be, as a minimum, a horizontal bar chart with a separate line for each major section of Work. Identify the first workday of each week.
   3. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.
   4. Indicate the expected monthly pay requests.
   5. Submit revised schedule with each Application for Payment as required for updating, identifying changes since previous version. Indicate estimated percentage of completion for each item of Work at each submission.
   6. Indicate submittal dates required for critical shop drawings, product data, samples, and product delivery dates including those furnished by Owner and items listed under Allowances.

B. Project Record Documents
   1. Maintain on site, one set of the following record documents; record actual revisions to the Work:
      a. Contract Drawings.
      b. Project Manual.
      c. Addenda.
      d. Change Orders and other Modifications to the Contract.
      e. Reviewed submittals.
   2. Store Record Documents are separate from documents used for construction.
   3. Record information concurrent with construction progress.
   4. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
      a. Manufacturer's name and product model and number.
      b. Product substitutions or alternates utilized.
      c. Changes made by Addenda and Modifications.
   5. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
      a. Measure elevations of structures in relation to survey benchmark.
      b. Measure and reference horizontal and vertical locations of underground utilities and appurtenances to existing permanent surface improvements that are indicated on the Drawings.
      c. Field changes from construction Drawings.
      d. Details not on original Contract Drawings.
   6. Submit documents to Engineer with final Application for Payment.

1.04 TECHNICAL SUBMITTALS

A. General
   1. Submit the following as required by the individual sections of the technical specifications.

B. Certificates of Compliance
   1. Certificates shall certify that the Products delivered to the project are in conformance with the specifications.
   2. Certificates may be recent or previous test results on Product but must be acceptable to Engineer.
   3. Certification shall not relieve the Contractor of responsibility for complying with requirements of the specifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 45 00

QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality assurance and control of installation.

B. Inspection and testing laboratory services.

C. References.

D. Field samples.

E. Manufacturers' field services and reports.

1.02 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Manufacturer shall have the minimum number of years of proven successful experience required in each section in the design, manufacture, and servicing of Products specified.

B. In lieu of the required experience, manufacturer may provide a cash deposit or bond equal to the cost of the Product, but pro-rated to the number of years of actual experience.

C. Products from a manufacturer who does not meet the experience requirements must meet technical requirements.

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

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

F. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

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

H. Perform work by persons qualified to produce workmanship of specified quality.

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

1.03 INSPECTION AND TESTING LABORATORY SERVICES

A. Owner shall provide the services of an independent firm to perform inspection and testing specified in the individual specification sections that are not listed above.

B. Testing laboratory shall be authorized to operate in the state in which Project is located.

C. Testing laboratory shall have a full-time registered Engineer on staff to review services.

D. Testing equipment shall be calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards (NBS) standards or accepted values of natural physical constants.

E. Prior to start of Work, submit testing laboratory name, address, and telephone number, names of full-time registered engineer, field inspector, and responsible project manager. Laboratory subject to the approval of the Engineer.

F. The same independent firm shall perform retesting. Contractor shall pay for retesting required by the failure of the initial test to meet the requirements of the specifications.

1.04 LABORATORY RESPONSIBILITIES

A. Testing Laboratory shall have the following responsibilities for the Project:
1. Attend pre-construction conferences and progress meetings as required by the Engineer.
2. Collect and test samples of mixes.
3. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
4. Perform inspection, sampling, and testing in accordance with Contract Documents and specified standards.
5. Ascertain compliance of soil compaction and material mixes with requirements of Contract Documents.
6. Promptly notify Engineer and Contractor of observed irregularities or nonconformance of Work or Products.
7. Perform additional inspections and tests required by Engineer when specified tests have failed.

1.05 LIMITS ON TESTING LABORATORY AUTHORITY

A. The authority of the Testing Laboratory is limited as follows:
1. May not alter requirements of Contract Documents.
2. May not approve or accept any portion of the Work.
3. May not assume duties of Contractor.
4. Has no authority to stop the Work.

1.06 LABORATORY REPORTS

A. After each inspection and test, the independent testing firm shall submit report(s) as specified in Section, Submittal Procedures.

1.07 CONTRACTOR RESPONSIBILITIES

A. Unless specified otherwise, deliver to laboratory at designated location, adequate samples of materials proposed to be used that require testing. The proposed mix designs shall be included with delivery.

B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturer's facilities as specified.

C. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site and at source of products to be tested, to facilitate tests and inspections, storage, and curing of test samples.

D. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

1.08 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. Require suppliers and manufacturers to provide a qualified technician for required services as outlined by the individual equipment and material specification sections.

B. Submit qualifications of technician to Engineer 30 days in advance of required work. Technician subject to approval of Engineer.

C. Technicians shall report observations, site decisions, and instructions given to Contractor, installers, and Owner's staff that are supplemental or contrary to manufacturers' written instructions directly to the Engineer.

D. Submit test and start-up report as specified in Section, Submittal Procedures.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, water, and sanitary facilities.

B. Work on public right-of-way.

C. Traffic control.

D. Temporary Controls: Barriers, enclosures and fencing, water control, dust control, erosion and sediment control, and protection of the work.

E. Construction Facilities: Access roads, parking, progress cleaning, project signage, and field offices.

1.02 TEMPORARY UTILITIES (IF NEEDED)

A. Electricity
   1. Provide and pay for required power service for construction from Utility source.

B. Lighting
   1. Provide and maintain lighting for construction operations as required by Contractor.
   2. Provide and maintain lighting to exterior staging and storage areas after dark for security purposes as required by Contractor.

C. Water
   1. Contractor shall provide hauling as required for Contractor's use from existing site hydrants as designated by CFPUA.
   2. Contractor shall coordinate with the CFPUA for use of water for construction purposes.

D. Sanitary Facilities
   1. Provide and maintain required facilities and enclosures as necessary to comply with the laws and ordinances of the authority having jurisdiction and the State of North Carolina.
   2. General Contractor shall provide the above sanitary facilities for all contractors, sub-contractors, Owner and Engineer at the Project Site.

1.03 WORK ON PUBLIC RIGHTS-OF-WAY

A. Work on this Project involves some work along rights-of-way under jurisdiction of the following N.C. Department of Transportation (NC DOT) offices and Owner:
   1. Work in: New Hanover County
   2. Division 3, District 3
   3. Benjamin Hughes, P.E., District Engineer
      Phone 910.398.9100

B. Work shall comply with requirements of the Encroachment Agreement(s) and Driveway Permit as attached to Project Supplementary Conditions.

C. Post Bonds as required by Encroachment Agreement.

D. Prior to start of Work notify the Office of the N.C. Department of Transportation as indicated in the encroachment agreement and driveway permit. Also notify the Owner.

E. Work shall conform to the requirements and be subject to the approval of the above agency(ies).

F. Contractor shall be responsible to the Owner for the cost of all DOT inspection that is billed to the Owner by the N.C. DOT as indicated in the Special Provisions of the Encroachment Agreement. Such cost shall be deducted from the Contractor's pay request.

G. Submit letter to the above District Engineer(s) when work is complete as required by the Encroachment Agreement.

H. Submit letter of approval for completed Work from the above agency(ies) with Final Payment Request.

I. Clean rights-of-way as work progresses and daily.

J. Power broom existing pavement as work progresses.

K. Work shall be in accordance with the latest edition of the N.C. Division of Highways, "Policies and Procedures for Accommodating Utilities on Highway Right-of -Way."

L. Consult with the above agency(ies) in establishing public thoroughfares to be used for haul routes and site access.

M. Confine construction traffic to designated haul routes.

N. Provide traffic control along haul routes to regulate traffic and to minimize interference with public.

1.04 TRAFFIC CONTROL

A. On public and private road rights-of-way provide traffic control devices when construction encroaches within the right-of-way. Devices shall include, but not be limited to, cones, drums, flares, warning signs, temporary pavement marking, warning lights, and flagman.

B. Traffic control devices shall provide the following:
   1. Protection of motorists, pedestrians and workers from accident hazards.
   2. Advance public information of proposed work sites.
   3. Establishment of an orderly and safe flow of traffic and to minimize traffic congestion.
   4. Provision of access for emergency vehicles.

C. Traffic control devices shall be used in accordance with the latest edition of the NC DOT "Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)."

D. Provide personnel trained in traffic control.

1.05 TEMPORARY CONTROLS

A. General
   1. Temporary controls shall be the responsibility of each Contractor for their respective work unless noted otherwise.

B. Barriers
   1. Provide barriers to prevent unauthorized entry to construction areas for the safety of the public, the protection of the work, and to protect existing facilities and adjacent properties from damage from construction operations.
   2. Provide barricades required by agency in 1.4.A for public rights-of-way and for public access to existing buildings.
   3. Provide protection for plant life designated to remain. Replace damaged plant life.
   4. Protect vehicular traffic, stored materials, site, and structures from damage.

C. Water Control
   1. Grade site to drain. Provide, operate, and maintain pumping equipment to maintain excavations free of water.
   2. Protect site from running water.

D. Dust Control
   1. Execute Work by methods designed to minimize raising dust from construction operations.
   2. Provide positive means to prevent airborne dust from dispersing into atmosphere.

E. Erosion and Sediment Control
   1. Provide Erosion and Sediment Control as indicated on the Drawings and specified in Section, Erosion Control.

F. Protection of Installed Work
   1. Protect installed Work and provide special protection where specified in individual specification Sections.
   2. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.
   3. Prohibit traffic from landscaped areas.

1.06 CONSTRUCTION FACILITIES

A. General
   1. Construction facilities shall be the responsibility of each Contractor for their respective work unless noted otherwise.

B. Access Roads
   1. Contractor shall construct and maintain temporary drives as necessary to access public thoroughfares and existing drives to serve the construction area.
   2. Provide means of removing mud from vehicle wheels before entering streets.

C. Parking
   1. When site space is not adequate, arrange for temporary off site surface parking areas to accommodate construction personnel.
   2. Do not allow vehicle parking in existing right-of-way or to block existing drives.
   3. Do not allow vehicle parking on private property without prior approval.

D. Progress Cleaning
   1. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
   2. Remove waste materials, debris, and rubbish from site periodically and dispose off site.

1.07 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary above grade or buried utilities, equipment, facilities, and materials, prior to Final Inspection.

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

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

D. Product options.

E. Substitutions.

1.02 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying, and erection of the Work. Products may also include existing materials or components specified in the Contract Documents for reuse.

1.03 TRANSPORTATION AND HANDLING

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

B. Ship fabricated assemblies in largest sections permitted by carrier regulations and properly marked for ease of field erection.

C. Promptly inspect shipments to assure that Products comply with specified requirements, quantities are correct, and Products are undamaged.

D. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.04 STORAGE AND PROTECTION

A. Keep on site storage of material to a minimum.

B. Store and protect Products in accordance with manufacturer's instructions in unopened original packages, with seals and labels intact and legible. Store sensitive Products in weather-tight, climate-controlled enclosures.

C. For exterior storage of fabricated Products, place on sloped supports, above ground.

D. Provide off site storage and protection when site does not permit on site storage.

E. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

F. Store loose granular Products on solid flat surfaces in a well drained area. Prevent mixing with foreign matter.

G. Arrange storage of Products to permit access for inspection. Periodically inspect to assure Products are maintained under specified conditions.

1.05 DAMAGED PRODUCTS

A. Remove damaged Products from Project site.

1.06 PRODUCT OPTIONS

A. Products Specified by Reference Standards: Product meeting standard and specific requirements of these specifications.

B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming Three Manufacturers with an "or equal" Provision for Substitutions: Submit a request for substitution for manufacturer not named during the shop drawing submittal.

1.07 SUBSTITUTIONS

A. Engineer will consider requests for Substitutions only within 30 days after date of Owner-Contractor Agreement.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. Request constitutes a representation that Contractor:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Shall provide same warranty for Substitution as for specified product.
   3. Shall coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Shall reimburse Owner for review or redesign services associated with reapproval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure:
   1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
   2. Submit shop drawings, product data, and certified test results attesting to proposed product equivalence.
   3. Engineer will notify Contractor, in writing, of decision to accept or reject request.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not used

END OF SECTION

Roadway Specifications

SECTION 03 30 00

CAST-IN-PLACE CONCRETE
(ROADWAY)

PART 1 GENERAL

1.01 SCOPE

A. Provide labor, materials, and equipment required for placement of cast-in-place concrete.

B. Work included under this section includes, but is not limited to, the following:
   1. Concrete materials
   2. Concrete
   3. Reinforcement
   4. Form work
   5. Grout
   6. Mixing, placing and curing
   7. Concrete finishing

1.02 REFERENCED STANDARDS

A. The latest revision, at the time of bidding, of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
   1. American Concrete Institute (ACI)
      a. 301
      b. 318
   2. American Society of Testing Materials (ASTM)
      a. A307 Carbon Steel Externally Threaded Standard Fasteners.
      b. C39 Test for Compressive Strength of Cylindrical Concrete Test Specimens.
      c. C94 Ready Mixed Concrete
      d. C143 Test for Slump of Portland Cement Concrete.
      e. C171 Sheet Materials for Curing Concrete.
      f. C192 Making and Curing Concrete Test Specimen.
      g. C231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
      h. C309 Liquid Membrane-Forming Compounds for Curing.
      i. C920 Elastomeric Joint Sealants.
      j. D1751 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   3. N. C.. Department of Transportation - Standard Specifications for Roads and Structures (NC DOT). 2024 Version
   4. Concrete Reinforcing Steel Institute (CRSI)

1.03 QUALITY ASSURANCE

A. Concrete work shall conform to the requirements of ACI 318, ACI 301 and CRSI “Manual of Standard Practice” as a minimum.

B. Methods and materials of work shall conform to the requirements of the standards and codes and recommended practices as referred to within this section.

1.04 SUBMITTALS

A. Submit the following in accordance with Section, Submittal Procedures:
   1. Test Reports:
      a. Laboratory Mix Design: Mix design shall be in accordance with ACI 318, Section 5.3 (Field Experience and / or Trial Mixtures). Design mixes shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce specified concrete.
      b. Concrete Tests: Reports for 7-day and 28-day concrete compressive strengths.
   2. Catalog Data: Manufacturer standard drawings or catalog cuts for the following. Clearly indicate equipment to be furnished for the Project including options to be provided for the following.
      a. Water stops.
      b. Forming accessories
      c. Admixtures
      d. Patching compounds
      e. Joint systems
      f. Curing compounds
      g. Dry-shake finish materials.
   3. Shop Drawings: Project specific shop drawings for the following:
      a. Reinforcing Steel: Shop drawings shall comply with ACI SP-66 “ACI Detailing Manual”. Shop drawings shall be drawn to a scale of 1/4" = 1' - 0" or larger. Where necessary for clear delineation, complicated wall steel shall be shown on inside and outside elevations. Bars shall be clearly shown, accurately located, and dimension on the plans, elevations, and sections.
   4. Delivery Tickets: Submit copy of delivery tickets to the Engineer for each batch of ready mixed concrete in accordance with ASTM C-94. Indicate total water content.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Reinforcement Steel: Store reinforcement in a manner that will avoid excessive rusting or coating by grease, oil, dirt, and other objectionable materials. Store in separate piles so as to avoid confusion or loss of identification after bundles are broken.

B. Protect cement from contamination or damage during handling. Do not use cement which has been damaged, is partially set, lumpy or caked. If the damaged cement is in bags, the entire contents of the bag shall be rejected. Do not use cement salvaged from used bags or reclaimed from cleaning bags.

PART 2 MATERIALS

2.01 CEMENT

A. Portland cement shall comply with ASTM C-150, Type I unless otherwise specified.
   1. Different brands of cement, different types of cement, or the same brand of cement from different mills shall not be mixed, nor shall they be used alternately, except when authorized by the Engineer.

2. Measure cement by the bag as packaged by the manufacturer, or by weight; one bag of cement shall be considered to contain 94 pounds net. A barrel is equivalent to 4 bags or 376 pounds net.
3. When bulk cement is used, the weighing and handling shall be inspected by the Engineer prior to use.
4. Pozzolans or fly ash conforming to ASTM C618 may be blended with the cement. The maximum pozzolan or fly ash content shall not exceed 25 percent by weight of the total cement material.

B. A concrete mix design utilizing expansive or shrinkage compensating concrete may be proposed for use in large concrete structures.

2.02 ADMIXTURES

A. Air-entraining admixtures shall conform to ASTM C-260. Testing in accordance with ASTM C-233 will be waived provided the admixture has been tested and accepted by the Bureau of Public Roads, U.S. Department of Transportation, or provided a statement is submitted by the manufacturer that the admixture to be furnished for the project has been tested and conforms to ASTM C-260.

B. Water-reducing admixture shall conform to ASTM C-494, Type A or Type D and shall be chloride free.

C. Non-corrosive accelerator admixture shall conform to ASTM C-494, Type C or E, and have long term test data proving its non-corrosive effect on metal deck and reinforcing steel. Admixture shall be "Accelguard" by the Euclid Chemical Company, "Darex Set Accelerator" by W. R. Grace and Company, or equal.

D. Shrinkage reducing admixture shall be “eclipse shrinkage reducing admixture” by Grace Construction Products or equal.

2.03 AGGREGATES

A. Fine aggregate for use in classes of concrete (except lightweight concrete) and Portland cement mortars, except mortars for masonry work, shall conform with ASTM C33 and as specified in accordance with NCDOT Section 1014, "Aggregate for Portland Cement Concrete", Para. 1014-1, "Fine Aggregate", and graded as specified in Table 1005-2 of Section 1005. Fine aggregate for lightweight concrete shall be as specified above or lightweight sand as necessary to meet the required density and compressive strength.

B. Coarse aggregate for normal concrete, except as specified otherwise herein, shall be in accordance with ASTM C33 and graded as specified in NCDOT Table 1005-1 of Section 1005. Coarse aggregate for lightweight concrete shall be as specified in ASTM C-330 as required to meet the density and compressive strength requirements.

2.04 HIGH EARLY STRENGTH CONCRETE

A. High early cement (Type III), the non-corrosive accelerator added to the normal cement (Type I) or high strength concrete shall be used only where specified or in an emergency when approved by Engineer. In such cases, the requirements for proportioning and mixing shall be as specified herein.

2.05 REINFORCEMENT

A. Metal reinforcement shall be Grade 60 and conform to ASTM A615. Bars shall be deformed except 1/4 inch round bars which may be plain. Bars shall be formed to

the dimensions indicated and approved on the shop drawings. Fabrication and details on reinforcement shall conform to the requirements of the ACI 318, Chapter 7, "Details of Reinforcement". Heating for bending shall be employed only when approved by Engineer.

B. Welded wire fabric shall conform to ASTM A185 or A497. Where the size and weight of welded wire fabric is not indicated or specified, it shall be 6 x 6 inch mesh of 0.192 inch nominal-diameter wire and shall weigh approximately 42 pounds per 100 square feet.

C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.
   1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.06 FORMS

A. Forms except as otherwise specified shall be of plywood, steel or other approved material. Plywood shall be concrete form plywood, not less than 5/8 inch thick. Surfaces of steel forms shall be free from irregularities, dents, and sags.

2.07 MISCELLANEOUS PRODUCTS

A. Bonding and patching compounds: Compounds for bonding, patching, and structural repairs, shall be “Euco Weld” by Euclid Chemical Company, "Colma Dur Mortar", "Sikadur Hi-Mod" by Sika Chemical Corporation, or equal.

B. Non-shrink Grout: Factory premixed non-shrink, non-metallic grout with minimum compressive strength of 5,000 PSI at 24 hours and 9,000 PSI at 28 days. Grout shall be "Euco N-S" by The Euclid Chemical Company, "Masterflow 713" by Master Builders, Sonogrout by Sonneborn Company, or equal.

C. Waterstops: Vinyl meeting U.S. Corps of Engineers' Specification CFD-C572-71, 6 inch minimum width and 3/8 inch thickness, of the rib-center bulb or dumbbell type.

D. Expansion Joint Filler: Bituminous impregnated, preformed type conforming to ASTM D 1751.

E. Concrete curing paper: Conform to ASTM C 171, Type 1, Waterproof Paper, shall be used. Polyethylene or similar plastic sheets shall not be used for concrete curing. Sisalkraft "Orange Label," Ludlow Papers, Inc., "Scuf-Champ," "Glas-Kraft" Grade A, or equal.

F. Joint sealer: Shall conform to ASTM C 920, Type M, Grade P, Class 25, Use T. Joint sealer for water containment structures shall be Polysulfide Type. Provide concrete primer as recommended by sealant manufacturer and compatible with the substrate.

G. Anchor bolts: Shall conform to ASTM A 307, Section 1c,Grade A.

H. Plain washers for anchor bolts: Shall conform to "Plain Washers," ANSI B18.22.l-1965 (R1975), Type A. Furnish one washer with each anchor bolt, unless otherwise noted on the Drawings.

I. Membrane forming curing compound: Liquid membrane forming curing compounds shall be wax free resin-type capable of retaining 95 percent of the moisture for the specified curing period and shall conform to ASTM C309, Type l-D, and shall contain a red fugitive dye. Curing compound applied to surfaces to be left permanently exposed to view shall not cause permanent discoloration or otherwise adversely affect the appearance of surface.

J. Curing compound: Shall be "Super Floor Coat" or "Super Pliocure" by Euclid Chemical Company, "Masterseal" by Master Builders, Kure-N-Seal by Sonneborn, or equal. Compound shall conform to Federal Specification TT-C-800A, 30% solids content minimum.

K. Abrasive aggregate for non-slip finish: Crushed ceramically bonded aluminum oxide grits as abrasive aggregate for non-slip finish. Material shall be factory-graded, packaged, rust-proof and non-glazing, and unaffected by freezing moisture and cleaning materials and equal to "Frictex" by Sonneborn Building Products, Inc., "Korundum" by Concrete Service Materials Company, "Non-Slip" by Euclid Chemical Company.

L. Liquid chemical floor hardener: Colorless, aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 pounds of fluosilicate per gallon. Material shall be "Hornolith" by A. C. Horn Co., "Saniseal 50" by Master Builders Co., or "Lapidolith" by Sonnebom Building Products, Inc or equal.

M. Stone under slab: Clean NC DOT size No.67 coarse aggregate.

N. Vapor barrier under slabs: "Moistop," by the Fortifiber Corporation or equal.

O. Structural steel shapes and plates to be embedded in or anchored to the concrete shall conform to ASTM A 36-93.

PART 3 EXECUTION

3.01 GENERAL

A. Provide a minimum of 4 inches of stone under concrete slabs on grade unless noted otherwise on Drawings.

B. Provide a vapor barrier under interior concrete slabs on grade unless noted otherwise on drawings.

C. Provide a two coat treatment of a liquid chemical floor hardener to interior concrete floor surfaces to be left permanently exposed to view.

D. Provide a "dry shake" application of abrasive aggregate for non-slip finish on exterior concrete platforms, steps and landings, and interior and exterior concrete ramps. shall receive a Ceramically bonded aluminum oxide grits as abrasive aggregate for non-slip finish.

E. Provide joint sealing compound at locations indicated on the Drawings and at joints in interior and exterior floor slabs to be left permanently exposed to view. Color of joint sealing compound for exposed joints shall match concrete color.

F. Install waterstops in accordance with manufacturer's instruction and securely anchor to reinforcing bars or forms to prevent displacement during placing of concrete.

G. Provide joint sealer locations indicated on the Drawings and between points of contact between slabs and vertical surfaces. Provide joint filler between horizontal concrete surfaces at expansion and isolation joints, unless otherwise noted on the Drawings.

3.02 CONCRETE MIX

A. General: Provide normal weight, air-entrained concrete except where specified or indicated on the Drawings to be lightweight concrete. Interior slabs, subject to abrasion, shall have a maximum air content of 3 percent. Concrete shall contain the specified water-reducing admixture. Thin slabs (less than 8 inches thick) placed below 50 degrees F shall contain a non-corrosive accelerator. Each mix shall be proportioned as specified by weight and use the aggregate and cement proposed for the project. Mix designs shall be in accordance with ACI specifications.

B. Design of Concrete: Provide concrete mix designs and engage an independent testing laboratory, approved by the Engineer, to prepare the mix designs for the classes of concrete specified in the "Properties and Location of Concrete" table which follows. Materials and proportioning shall be in accordance with the ACI Specifications, unless otherwise specified.
   1. Submit mix designs, test data, laboratory strength tests and certificates of analysis for cement and aggregates prior to the placement of concrete.
   2. Proportion concrete mixes to be placed by pumping for the type of equipment to be used so as to have a continuous flow of concrete through the pumping system.

Properties and Location of Concrete:

Concrete Class (Location)	Min 28-day Compressive Strength (6"x 12" Cylinders)	Maximum Allowable Course Aggregate Size & Type	Slump	Total Air Content By Volume	*Max W/C Ratio
Liquid Retaining Structures	4,500 psi	1-1/2" Stone	2" – 4"	4-1/2% +/- 1-1/2%	0.35
Exterior Slabs	3,500 psi	3/4" Stone	2" - 5"	6% +/- 2%	0.40
Interior Slabs	3,500 psi	3/4" Stone	2" - 5"	N/R	0.40
Footings- Building	3,000 psi	1-1/2" Stone	2" - 4"	Not Reqd	0.58
All Other Concrete	3,000 psi	3/4" Stone	2" - 4"	5% +/- 1-1/2%	0.46

* Including free surface moisture on aggregates and liquid admixtures. W/C ratio is maximum permissible ratio for concrete when strength data from field experience or trial mixtures are not available. Higher ratios may be acceptable provided documentation is submitted in accordance with ACI Specifications. The maximum permissible W/C ratio for liquid retaining structures shall be 0.45.

   3. If expansive or shrinkage compensating concrete or shrinkage reducing admixtures are proposed for use in concrete for liquid retaining structures, increased spacing of construction joints may be proposed. Submit request for modification along with recommendation from material supplier for review along with mix design.

3.03 MEASUREMENT OF MATERIALS, MIXING AND EQUIPMENT

A. Concrete shall be machine mixed except in emergencies mixing may be by hand as directed. Except when ready-mixed concrete is used, provide an approved type of batch mixer at the site equipped with an accurate water measuring and control device and capable of producing a homogeneous concrete mixture of uniform color. Apparatus provided for weighing aggregate and cement shall be designed

especially for this purpose. Weigh fine and coarse aggregate and cement separately. Cement in standard packages need not be weighed, but bulk cement or fractional packages shall be weighed. Accuracy of measuring devices shall be such that successive quantities can be measured to within one percent of required amount. Measuring devices shall be subject to verification. Do not exceed rated capacity of mixer. Time of mixing after cement and aggregates are in the mixer drum shall not be less than one minute for one cubic yard or less and increased 15 seconds for each additional cubic yard or fraction thereof in capacity. The total required water shall be in the drum before one-fourth of the mixing time has elapsed. Mixer drum shall rotate at a peripheral speed of about 200 feet per minute throughout the mixing period. Discharge entire contents of mixer drum before recharging. Provide necessary equipment and establish accurate procedures subject to Engineer's approval for determining the quantity of free moisture in the aggregates. Moisture determination shall be made at intervals as directed by Engineer. The retempering of concrete which has partially hardened, i.e., mixing with or without additional cement, aggregate, or water, will not be permitted.

3.04 READY-MIXED CONCRETE

A. Ready-mixed concrete plant shall be properly equipped for the accurate proportioning and proper mixing and delivery of the concrete, including the proper water measurements and controls, as specified above. Plant shall have sufficient capacity and transportation equipment to deliver the concrete at the required rate. Plant shall be subject to inspection and approval of the Engineer.

B. Mix and handle ready-mixed concrete in accordance with ASTM C-94.

3.05 CONVEYING

A. Convey concrete from mixer to its final position as rapidly as practicable by approved methods which will not cause segregation or loss of ingredients. Deposit concrete as nearly as practicable in its final position to avoid rehandling. Free vertical drop of concrete shall not exceed 3 feet. Chuting will be permitted only where the concrete is deposited into a hopper before it is placed in the forms. Clean conveying equipment before each run. Deposit concrete as soon as practicable after the forms have been coated and the reinforcement placed. Place concrete before the initial set and not later than 30 minutes after mixing or agitating. Concrete which has segregated in conveying shall not be used.

3.06 PLACING

A. Place concrete in accordance with ACI 301, Chapter 8.

B. Accomplish compaction by use of a mechanical vibrator having a frequency of not less than 8000 cps. Vibration shall not be used to flow concrete horizontally more than 2 feet.

3.07 PLACEMENT IN EXTREME WEATHER

A. Placing Concrete in Cold Weather: Do not place concrete when the atmospheric temperature is below 40 degrees F, or when the concrete is likely to be subjected to freezing temperatures within 24 hours after placement. Heat concrete as necessary to maintain a concrete temperature of between 60 and 80 degrees F when placed. Remove frozen material from aggregates before placing in the mixer.

B. Placing Concrete in Hot Weather: When the outdoor ambient temperature is over 90 degrees F or as directed by the Engineer, provide methods so the temperature of

the concrete as placed shall not exceed 90 degrees F. Shade concrete after placing and start curing as soon as the surface of the fresh concrete is sufficiently hard to permit it without damage. Unless specified otherwise, the control of hot weather concreting and the methods employed to control the temperature of the material both during placing and curing operation shall be in accordance with ACI 305R, Hot Weather Concreting.

3.08 CURING AND PROTECTION

A. General: Protect concrete, including areas to be given a special finish, from damage by the sun, rain, flowing water, frost, and mechanical injury. Do not allow concrete to dry out for a minimum of seven days from the time it is placed. Provide water curing by keeping the surface of the concrete continuously wet by covering with water, with an approved water saturated covering, or by spraying. Water used for curing shall be fresh water. Where water curing is not used, provide curing by sealing the water in the concrete so that it cannot evaporate. This may be done by leaving the forms in place, covering with a waterproof curing paper laid with airtight joints, use of a curing compound, or by other approved means.

B. Do not use liquid membrane-forming curing compounds where terrazzo, hard tile or cementitious floor finish materials are to be installed. See finish schedule.

C. Apply curing compound immediately after final finishing.

D. Keep wood forms sufficiently damp to prevent drying out of the concrete.

E. Portions of the time during which either moisture or warmth is lacking shall not be counted effective for curing. When concrete is placed in cold weather, make provisions for maintaining the temperature of the air in contact with the concrete at not less than 50 degrees F for a period of not less than 7 days after placing, or at not less than 70 degrees F for a period of not less than 3 days after placing. Heating of the concrete in place shall be affected by salamanders or steam coils under canvas covers or by other approved means. Temperature within enclosures shall not exceed 100 degrees F, and apply adequate moisture during the heating period to prevent concrete from drying out. Rate of cooling after the protection period shall be approximately 1 degree F per hour for the first 23 hours and 2 degrees F per hour thereafter.

3.09 REMOVAL OF FORMS AND PROTECTION

A. General: Remove forms in a manner which will not damage the concrete. Do not remove forms for the following minimum times:

	Days after Placing
Side forms on beams, girders, columns, and walls (lifts 15 ft and under)	24 hours provided patching and finishing may be completed in 8 hours and the work immediately recovered with approved curing media.
Columns and walls (lifts over 15 ft)	5
Supporting forms for arches, beams, girders, and slabs	14

B. Provide sufficient shoring members to support dead load plus construction loads on beams, girders, slabs, and arches until concrete has reached the full specified strength.

C. Special Requirements for High-Early Strength Concrete: The curing periods, minimum periods during which supporting forms and shores shall be left in place, and minimum periods for maintaining curing temperatures shall be not less than one-quarter of those specified for concrete using Type 1 cement, but in no case less than 24 hours.

3.10 CONSTRUCTION JOINTS

A. General: Provide construction joints where indicated on the Drawings or as otherwise approved.

B. Prepare construction joint surfaces for placement of concrete by cleaning with compressed air and water. Remove stains and foreign material from the surface and coat with a bonding compound. Place new concrete after bonding compound has dried.

C. Where new concrete is to be bonded to existing concrete, clean existing surface and roughened thoroughly, remove loose particles, dampen surface, and apply bonding compound. Place new concrete after bonding compound has dried.

D. Where construction joints are indicated on the Drawings for slabs on grade, control joint indicated on the Drawings may be used instead. This provision does not apply when the construction joint occurs directly under CMU walls.
   1. Control Joints: Saw cut slab after concrete has hardened sufficiently to prevent dislodging of aggregate and while the temperature of the fresh concrete is still rising. Complete cutting of slabs within twenty four hours of concrete placement. Flush out joints immediately after cutting with air or water under pressure to remove sawing residue.
   2. Keep joints clean and protected from debris, grease, and oil. No earlier than thirty days after concrete placement, fill joints with a flexible epoxy joint filler and compatible back up material intended for this purpose. Prepare joint and apply filler in accordance with manufacturer's recommendations.

3.11 FINISHING CONCRETE

A. General: As soon as forms are removed, patch defective areas and fill tie holes with cement mortar of the same composition as that used in the concrete. Cut out defective areas to solid concrete but to a depth of not less than 1 inch. Edges of the cut shall be perpendicular to the surface of the concrete. Area to be patched and at least 6 inches adjacent thereto shall be dampened and apply bonding compound. Place patching mortar after bonding compound has dried. Mix mortar approximately one-half hour before placing and remix occasionally during this period with trowel without the addition of water. Compact mix into place and screed slightly higher than the surrounding surface. Finish patches on exposed surfaces to match the adjoining surfaces after they have set for a period of an hour or more. Cure patches as specified for concrete. Wet tie holes with water and fill solid with mortar. Fill holes extending through the concrete by means of a plunger type gun or other suitable device from the exposed face. Wipe excess mortar off the exposed face with a cloth. Protect finish surfaces from stains and abrasions.

B. Surface Finishes: Exposed concrete surfaces, except floors, bottom slabs, and walking surfaces, shall receive the following finish.
   1. As soon as the pointing and patching has set sufficiently to permit it, thoroughly wet surface with a brush and rub with a No. 16 carborundum stone or other equally good abrasive, bringing the surface to a paste. Continue rubbing

sufficiently to remove form marks and projections, producing a smooth dense surface without pits or irregularities.

2. Carefully spread or brush material, which in the above process has been ground to a paste, uniformly over the entire surface and allowed to reset. After the rubbing is complete, thoroughly drench and keep surface wet for a period of 7 days, unless otherwise directed. Obtain final finish by a thorough rubbing with a No. 30 carborundum stone or other equally good abrasive. Continue rubbing until entire surface is a smooth texture and uniform in color.
3. Adjoining or adjacent work which has been disfigured by the above specified work shall be thoroughly cleaned by approved methods so that the complete unit presents the same appearance.
4. In lieu of the procedure described in items 1, 2, and 3 above, grind all fins smooth and use a cementious type concrete coating, color as selected by the Owner. Apply cementious type concrete coating in strict accordance with the manufacturer's recommendation. Acceptable manufacturers shall be Thoroseal, Euclid Company, Old North Manufacturing Company or equal.

C. Floor and Roof Slab Finishes:
1. Finished floor and roof slab surfaces shall be true plane surfaces, with a tolerance of 1/8 inch in 10 feet unless otherwise indicated. Pitch surfaces to drains. Dusting of finish surfaces with dry materials will not be permitted.
2. Monolithic Finish: Floor and roof slabs shall be placed, consolidated, struck off and leveled to the required elevation. When the concrete has stiffened sufficiently to bear a man's weight without deep imprint, float surface, at least twice, to a uniform sandy texture. Steel trowel surface to a smooth, even, impervious finish, free from trowel marks.
3. Surface of slabs, except roof slabs, shall be given a second steel-troweling to a burnished finish.

D. Sidewalk, platform, and wearing surfaces not otherwise specified shall receive a broom finish. Slab shall receive a float finish, as indicated above, and then lightly brush surface with a hair broom to leave a slightly rough, non-slip surface. Brooming shall be done in one direction and leave a uniform neat pattern.

E. Concrete bottom slabs in channels, clarifiers, wet wells, and chlorine contact chamber shall receive a steel troweled finish. Surface shall be smooth, true to established planes and conforming to lines and slopes as indicated on the Drawings. Care shall be taken to produce a surface of maximum smoothness, and care shall be taken to protect surface from damage during later work.

3.12 FORMS

A. General: Form concrete unless specified or directed otherwise. Set forms true to line and grade within the allowable tolerances specified for finishes and shall be mortar-tight. Arrange bolts and rods used for internal ties so that when forms are removed, metal will have the minimum specified cover.

B. Where water-tightness is required, do not use bolts or rods which are withdrawn when the forms are removed. Do not use wire ties where the concrete surface will be exposed to weathering and where discoloration will be objectionable. Provide form work with adequate clean-out openings to permit inspection and easy cleaning after reinforcement has been placed. In columns, walls, and similar members of small dimensions, the height of forms for each vertical lift shall not exceed 6 feet unless suitable openings are provided at not more than 6 foot vertical intervals to permit proper placing of the concrete. Where forms for continuous surfaces are

placed in successive units, fit forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar. Install panel forms to provide tight joints between panels. Install forms so they can be removed without damaging the concrete. Chamfer exposed joints, edges, and external corners. Forms for heavy girders and similar members shall be constructed with a camber, as directed. When placing concrete in excavations, forms shall be not less than 3 inches outside the concrete lines indicated.

C. Coating: Before placing the concrete, coat contact surfaces of forms with a non-staining mineral oil or two coats of nitrocellulose lacquer, except for unexposed surfaces when the temperature is above 40 degrees F sheathing may be wetted thoroughly with clean water. Remove excess oil by wiping with cloths. Clean contact surfaces of forms for reuse.

3.13 REINFORCING STEEL

A. General: Provide reinforcement bars, stirrups, hanger bars, wire fabric, and other reinforcing materials as indicated on the Drawings or required by the specifications together with necessary wire ties, chairs, spacers, supports, and other devices to properly install and secure the reinforcing. Reinforcement shall be free from foreign substances. Reinforcement which has bands not shown on the project drawings or on approved shop drawings or which is reduced in section by rusting shall not be used.

B. Fabricate bar mats from bars conforming to specifications for reinforcement bars and intersections shall be fastened securely by approved mechanical ties.

C. Placing: Place reinforcement accurately and thoroughly secure. Support with concrete or metal chairs, spacers, or metal hangers. Metal chairs, clips, or supports, the ends of which will be exposed on the concrete surface, will be permitted only where the surface will not be exposed to weathering and where discoloration will not be objectionable; elsewhere concrete or other approved non-corrodible material or other approved means shall be used for support.

D. Splicing: Where splices in addition to those shown on the project Drawings are necessary, lap bars as scheduled below.

BAR SIZE	LAP, INCHES	BAR SIZE	LAP, INCHES
#3	16 (18)	#7	33 (42)
#4	19 (24)	#8	39 (51)
#5	23 (30)	#9	69 (90)
#6	28 (36)	#10	88 (114)

Figures in parentheses are for top bars (horizontal reinforcement placed such that more than twelve inches of fresh concrete is cast in the member below the reinforcement). Other figures are for all other bars.

Stagger splices in alternate bars. Splices shall be in accordance with ACI 318 and ACI 301.

E. Protection of Reinforcement: Reinforcement of footings and other principal structural members in which the concrete is deposited on the ground shall have not less than 3 inches of concrete between the reinforcement and the ground contact surface. If concrete surfaces after removal of the forms are to be exposed to the weather or water or be in contact with the ground, the reinforcement shall be protected with not

less than 2 inches of concrete for bars greater than 5/8-inch in diameter and 1-1/2 inches for bars 5/8-inch or less in diameter. Measure protective cover from the outside edge of the steel.

F. Concrete protective covering for reinforcement of surfaces not exposed directly to the ground, water, or weather shall be not less than 3/4 inch for slabs and walls and not less than 1-1/2 inch for beams, girders, and columns.

G. Do not use heat to field bend bars.

H. When required and approved in writing by the Engineer, welding of reinforcing shall conform to "Recommended Practice for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction (ANS D12.1)". No tack welding will be permitted.

3.14 SETTING MISCELLANEOUS MATERIALS

A. Pipe sleeves, wall castings, anchors and bolts, including those for machine and equipment bases, angle frames or edgings, hangers and inserts, pipe supports, conduits and other materials in connection with concrete construction, shall, where practicable, be placed and secure in position when the concrete is placed. Anchor bolts for machines and equipment shall be set according to templates, shall be carefully plumbed, checked for location and elevation with an instrument, and be held in position rigidly to prevent displacement while concrete is being placed.

3.15 TESTING

A. Field Poured Specimens:
   1. Provide one set of specimens for compressive strength tests for each 100 cubic yards, or fraction thereof, of each class of concrete, placed each day. Not less than four specimens shall be made for each test. Specimens shall be made and cured in accordance with ASTM C31. When in the opinion of the Engineer there is a possibility of the air temperature falling below 40 degrees F, additional specimens shall be taken and cured in the field under conditions similar to those of the concrete in the structure. Test specimens in accordance with ASTM C39.
      a. The standard age of specimens at test shall be 28 days. Of the four specimens made for each test, two shall be tested at 28 days for acceptance and one shall be tested at 7 days for information. The fourth specimen shall be a reserve.
      b. The strength level of the concrete will be considered satisfactory so long as the averages of all sets of three consecutive strength test results (average of two cylinders tested at 28 days) equals or exceeds the specified strength f'c and no individual strength test result falls below the specified strength f'c by more than 500 psi. When the test results do not conform to these requirements, the Engineer shall have the right to require changes in the mix design and conditions of temperature and moisture necessary to secure the required strength.
      c. Tests shall be performed by an independent laboratory as specified in Section, Quality Control.
      d. Test reports shall be submitted in accordance with Section, Quality Control.

B. Drilled Cores:
   1. Where there is a question as to the quality of the concrete in the structure, the Engineer may require additional testing in accordance with ASTM C42 for that portion of the structure where the questionable concrete has been found. If the

results of these additional tests meet the requirements of the specifications, the Owner shall pay for the costs of the tests. If the results of the additional tests fail to meet the requirements of the specifications, the Contractor shall pay for the tests. Concrete failing to meet the specifications shall be removed and replaced at no additional cost to the Owner.

C. Air Entrainment shall be as specified. Test air content in accordance with AASHTO T152, T121, or T156. Test shall be at the frequency required by the Engineer.

D. Test slump plus or minus 1 inch as determined by AASHTO T119. Make test from each delivery before placing concrete. Slump tests shall be made in the presence of the Engineer's representative. Concrete not meeting the slump standards specified shall be modified, if possible, to meet the standards or shall be rejected by the Engineer's representative and removed from the project.

E. Water-bearing structures shall be watertight against water pressure which may come upon them prior to backfill. Repair imperfections. On completion of water-bearing structures, fill with water to the high water line and allow to remain filled for forty-eight (48) hours before testing for water-tightness. Repair leaks to make structures water-tight.

END OF SECTION

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work shall include, but not be limited, to the following:
   1. Access roads.
   2. Clearing and grubbing.
   3. Removal of surface debris.
   4. Demolition and removal of existing paving and structures.
   5. Temporary and permanent ground cover.

1.02 RELATED SECTIONS

A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
   1. Section 31 25 00 Erosion Control
   2. Section 33 92 00 Lawns and Grasses.

1.03 WARRANTY AND FINES

A. Contractor is liable for damages to public and private property and fines as may be placed on the Project by the governing agencies due to failure to provide adequate erosion control devices.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PROTECTION

A. Take reasonable care during construction to avoid damage to vegetation outside of the construction limits. Temporarily tie back ornamental shrubbery and tree branches, where appropriate, to minimize damage. Trees that receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Treat tree trunks damaged by equipment with a tree dressing.

B. Locate and protect property corners and survey control stakes prior to start of clearing operations.

C. Provide temporary gates and fences as necessary to prevent unauthorized vehicular access to the site.

D. Mark clearing limits.

E. Refer to paragraph 4.04 of the General Conditions and 4.04.A.2 of the Supplementary Conditions concerning the protection of Underground Facilities.

3.02 INSTALL EROSION CONTROL DEVICES

A. Clear areas required to install erosion control devices, which shall be in place and operational prior to other land disturbing activity. Install erosion control devices in accordance with Section, Erosion Control.

3.03 BORROW AND DISPOSAL AREAS

A. Obtain and pay for erosion control permit for borrow and disposal areas as required by Contractor.

B. Install and maintain erosion control devices in accordance with Contractor's approved plan.

3.04 CLEARING AND GRUBBING

A. Clear total width of permanent easement. Clear within temporary construction easement only as necessary for construction.

B. Grub within the permanent easement only as necessary for the installation of the work. Do not grub within the temporary construction easement.

C. Clear and grub area within the proposed fence line of the pump stations.

D. When the depth of embankment exceeds 6 feet, cut sound stumps off at the existing ground level and do not grub. Remove decayed stumps to a depth of approximately 2 feet below the existing grade.

E. Fill holes and depressions and bring cleared and grubbed area to a uniform contour to match existing grade. Provide positive drainage.

F. Remove and properly dispose of cleared and grubbed material from the site. Make reasonable effort to channel timber resulting from clearing operations into a beneficial use.

G. Burning shall not be permitted at the site.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide labor, equipment, and material to perform site preparation and earthwork as specified herein and indicated on the Drawings. Work shall include, but is not limited to, the following:
   1. Survey staking as required for construction.
   2. Topsoil stripping and stockpiling, and offsite import if needed.
   3. Dewatering.
   4. Protection of existing facilities.
   5. Site grading.
   6. Excavation, trenching, and backfilling for structures and foundation including stone base as indicated on the Drawings.
   7. Borrow material including, but not limited to, material, excavating, hauling, placing, and compacting.
   8. Maintenance and stability of site.
   9. Disposal of waste and surplus material.

B. Examine the site to determine the extent of excavating, grading, and related items necessary to complete the work.

1.02 RELATED SECTIONS

A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
   1. Section 31 11 00 Clearing and Grubbing
   2. Section 31 25 00 Erosion and Sedimentation Control

1.03 MEASUREMENT AND PAYMENT PROCEDURES

1.04 REFERENCE STANDARDS

1.05 DEFINITIONS

A. Backfill: A specified material used in refilling a cut, trench, or other excavation, placed at a specified degree of compaction.

B. Compaction: Process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of compaction" shall be expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D698 (Standard Proctor).

C. Excavation: The removal of soil or rock to obtain a specified depth or elevation.

D. Fill: Specified material placed at a specified degree of compaction to obtain an indicated grade or elevation.

E. Hard Material: Solid, homogeneous material which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment with ripper teeth. Material having a standard penetration resistance as determined by ASTM D1586 60 and 150 blows per foot is defined as "hard material."

F. Lift: Layer of soil placed on top of a previously prepared or placed soil.

G. Rock: Solid, homogeneous material which cannot be removed without the systematic drilling and blasting exceeding one (1) cubic yard in volume. Material having a standard penetration resistance as determined by ASTM D1586 greater than 150 blows per foot is defined as "rock." Removal of "hard material" will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

H. Soil classification shall be in accordance with ASTM D2487.
   1. Satisfactory materials: Soils classified as GW, GP, GC, GM, SP, SC, SM, SW, ML, and CL.
   2. Unsuitable materials: Soils considered as unsatisfactory shall be materials that do not comply with the requirements of satisfactory above and include, but shall not be limited to, the following:
      a. Soil containing organic matter, debris, stones larger than 6 inches, or frozen material. Stones greater than 4 inches will not be permitted in the top 12 inches.
      b. Soils classified as Pt, CH, MH, OH, and OL.
   3. Cohesionless: Classified as GW, GP, SW, and SP. Soils classified as GM and SM shall be classified as cohesionless only when the fines have a plasticity index of less than 10.
   4. Cohesive: Classified as GC, SC, ML, CL, MH, and CH. Soils classified as GM and SM shall be classified as cohesive only when the fines have a plasticity index greater than 10.

I. Subgrade: Lowest elevation upon which fill or other work will be placed in the absence of unsuitable material.

J. Topsoil: Natural, friable soil, representative of productive soils in the vicinity of the site. Topsoil shall be free from roots, stones larger than 1 inch, objectionable weed seeds, toxic substances, and materials that hinder grading, planting, and maintenance operations.

1.06 SUBMITTALS

A. Submit the following in accordance with Section, Submittal Procedures:
   1. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following.
      a. Structural fabric.
      b. Perforated Pipe
   2. Manufacturer's Installation Procedures.
      a. Structural fabric
      b. Perforated Pipe
   3. Permits
      a. Erosion control permits for borrow and disposal site(s).

PART 2 PRODUCTS

2.01 MATERIAL

A. 6” Perforated Pipe: See NCDOT Section 815 for material requirements including the stone and fabric to create a drench drain.

B. Stone Base: A clean crushed stone, crushed gravel, or uncrushed gravel conforming to ASTM C33 coarse aggregate grading size ABC

C. Structural Fabric: Provide structural fabric specifically designed and manufactured to stabilize soft soils under an aggregate base for roads and parking areas. Fabric shall provide a permeable layer, planar flow, and tensile reinforcement for retaining the soil matrix. Fabric shall be inert to commonly encountered chemicals, hydrocarbons, resistant to mildew, rot, and ultraviolet light exposure, and meet or exceed the following test standards:

Mechanical Properties	**Test Method**	**Unit**	**Minimum Average Roll Value**	
			MD	**CD**
Grab Tensile Strength	ASTM D4632	lbs (N)	200 (890)	200 (890)
Grab Tensile Elongation	ASTM D4632	%	15	15
Trapezoid Tear Strength	ASTM D4533	lbs (N)	75 (334)	75 (334)
CBR Puncture Strength	ASTM D6241	lbs (N)	700 (3115)	
			Maximum Opening Size	
Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve (mm)	40 (0.425)	
			Minimum Roll Value	
Flow Rate	ASTM D4491	gal/min/ft^2 (l/min/m^2)	4 (163)	

PART 3 EXECUTION

3.01 GENERAL

A. Provide erosion control measures as specified in Section, Erosion Control and clearing and grubbing as specified in Section, Clearing and Grubbing.

B. Protect existing structures and features to remain.

C. Dispose of excavated material in such a manner that it will not obstruct the water flow, endanger existing improvements or Work in progress, impair the use or appearance of the existing facilities, or be detrimental to the completed Work.

D. Weather Limitations: Proceed with fill and backfill operations based on the following weather conditions:
   1. Temperature must be above freezing.
   2. In windy, hot, or arid conditions with a high rate of evaporation add moisture to the material to maintain the optimum moisture content.
   3. Do not proceed in rain or on saturated subgrade.

E. Repair or undercut and backfill soils that become damaged by construction activity or unsuitable due to being left exposed to the weather at no additional cost.

F. Do not place material on surfaces that are muddy, frozen, or contain frost.

G. Excavation carried below the elevation indicated on the Drawings shall be backfilled and compacted in accordance with these specifications.

H. Remove and properly dispose of unsatisfactory and excess material from the site.

3.02 CONSTRUCTION STAKING

A. Provide construction staking as indicated in paragraph 4.03 of the General Conditions. Engineer will only provide key reference points and benchmarks.

3.03 PROTECTION OF UNDERGROUND FACILITIES

A. Refer to paragraph 5.05 of the General Conditions and 5.05.A.2 of the Supplementary Conditions concerning the protection of Underground Facilities.

B. Approximate locations of existing underground facilities at the site are indicated on the Drawings based on information available to the Engineer. Engineer and Owner do not take responsibility for the accuracy of the information.

3.04 WATER CONTROL

A. Inspect the site prior to mobilizing to determine the appropriate equipment for site grading and foundation work.

B. Perform work to prevent surface water from accumulating in excavations, and unfinished fill areas. Perform grading and excavation so the work area and affected operations shall be continually and effectively drained.

C. Install a dewatering system prior to excavating beneath the ground water table. Maintain the water table approximately 2 feet below the bottom of the excavation.

D. Maintain dewatering until backfilling has proceeded above the natural ground water level and the structural weight is sufficient to prevent "floating" of the structure. Provide a job superintendent experienced in dewatering work.

E. Water from dewatering operations must be disposed of in accordance with the North Carolina Sedimentation Pollution Control Act.

3.05 USE OF EXPLOSIVES

A. Explosives are not permitted.

3.06 TOPSOIL

A. Strip topsoil from areas to be disturbed to a depth of 8 inches and stockpile separate from other excavated material. Locate topsoil so that the material can be used readily for the finished grading. Protect and maintain topsoil until needed. Place topsoil after completion of work in accordance with Section, Lawns and Grasses. Note, if onsite topsoil stripping is not adequate for final grading, contractor shall provide offsite import at no additional cost to the owner.

3.07 SITE GRADING

A. Proofroll exposed soils following topsoil stripping with a loaded tandem axle dump truck to identify unsuitable subgrade areas as determined by the Engineer. Unsuitable areas will be repaired in place or undercut to firm soils as directed by the Engineer. Payment for in place repair or undercutting and backfilling of unsuitable areas shall be as indicated in the Measurement and Payment paragraph.

B. Perform undercutting of unsuitable soils with a backhoe top loading dump truck or similar equipment approved for the use by the Engineer. Backfill undercut areas immediately.

C. In undercut areas where the exposed soils may be wet and compaction of the initial fill may be difficult, a bridge lift of about 18 to 24 inches may be allowed at the direction of the Engineer.

D. In-Place repair shall consist of discing and recompaction of existing soils to a depth of approximately 12 inches.

E. At the direction of the Engineer provide a structural fabric for stabilization of unsuitable soil areas. Install fabric in accordance with the manufacturer's recommendation and the following minimum requirements.
   1. Provide a fabric overlap of 24 inches.
   2. Back dump and spread fill over fabric at the fill specified thickness.
   3. Compact fill with vibratory roller prior to allowing additional construction traffic.
   4. In addition, French Drains may be needed to permanently driver subsurface water to drainage features.

F. Site grading shall be unclassified except as specifically indicated otherwise. Perform grading within the limits of the Project. Finished surface shall conform to the grades and cross sections indicated on the Drawings and be uniformly sloped for a positive drainage away from structures.

G. Excavate rock encountered in cut sections to a depth of 6 inches below finished subgrade and backfill with satisfactory material.

H. Scarify the existing subgrade surface to a minimum depth of 6 inches and recompact if subgrade density is less than the degree of compaction for the proposed fill material. Plow or bench existing ground surfaces steeper than one vertical to four horizontal in such a manner that the fill material will bond with or be keyed to the existing surface. Use compaction equipment suitable for the soil being compacted. Moisten or aerate material as necessary to obtain the optimum moisture content within plus or minus one percent to obtain specified compaction.

I. Soils used for fill and backfill shall be satisfactory soils classified SP, SP-SM, SP-SC or SM in accordance with ASTM D2487. Dry or wet soil as necessary to maintain optimum moisture. In addition, soil shall contain less than 5% organics, be free of debris or other deleterious materials; have a maximum particle size of 2" inches or less.

J. Place backfill and fill material in accordance with the following:
   1. Maximum uniform loose lifts: 8 inches
   2. Optimum moisture content: +/- 3 percent
   3. Percent compaction at optimum moisture content:
      a. From ex. grade to within one (1) foot of struc. subgrade: 95
      b. Final foot to subgrade under pavements: 100
      c. Grass areas: 90

K. Approved compacted subgrade that is disturbed by construction or adverse weather shall be scarified and re-compacted as specified previously. Re-compaction over utilities shall be by hand tamping.

3.08 FILL AND BACKFILL

A. Place and compact fill and backfill material adjacent to structures in a manner that prevents wedging and eccentric loading on or against structures. Do not use equipment adjacent to structures that may overload structure. Backfill against structure only after concrete has attained the specified 28-day compressive strength.

B. Stone Base: Structures shall have a compacted crushed stone subgrade to the depth of 12 inches.

3.09 EXCAVATION FOR STRUCTURES

A. Provide shoring or side slopes of excavations as necessary to protect workmen, and existing and new structures. Use, install, and remove shoring in accordance with State and Federal OSHA regulations.

B. Furnish, erect, and maintain required guardrails at exposed boundaries of excavation.

C. Perform excavation for utilities in accordance with Section, Trenching for Utilities. Install utilities to a minimum distance of five (5) feet beyond the face of the structure.

D. Make excavation to the dimensions and elevations for the structures as indicated on the Drawings. Extend excavation a sufficient distance from walls and footings to allow for placing and removal of forms.

E. Remove unsatisfactory material below required grade and replace with select backfill material as directed by Engineer.

F. Excavation carried below the depths indicated, without specific directions, shall be backfilled and compacted as specified herein to the proper grade. In excavations for footings the concrete shall be extended to the bottom of the over excavation. Work caused by over excavation shall be at the Contractor's expense.

G. Excavations for Embankments and Under Pavements and Concrete Footings - and Slabs: The entire area of the original ground under embankments and under pavements and concrete footings and slabs shall be excavated to remove all vegetable matter, sod, muck, rubbish, and other unsuitable materials to a depth of 12 inches. In the event that it is required to remove unsuitable material to a greater depth than specified, an adjustment in the contract price may be made in accordance with applicable.

H. Excavations for Embankments, Pavements and Structures: Unsuitable materials shall be excavated to a depth of 12 inches below the existing ground elevations for embankments and the proposed subgrade elevation for pavement, footings and concrete slab areas. In the event that it is required to remove unsuitable material to a greater depth than specified, an adjustment in the contract price may be made in accordance with applicable provisions of the General Conditions of the contract unit prices from the Bid Schedule.

I. Excavation Below Structures in Which Rock is Encountered: The rock shall be removed to a 12" depth below the structure bottom. The entire area excavated shall be brought to subgrade elevation with a suitable fill material compacted to 95% of the maximum density in accordance with ASTM D-2167.

3.10 ROCK EXCAVATION

A. Notify Engineer immediately in the event that rock is encountered when the Contract requires payment by the unit price.

3.11 BORROW MATERIAL

A. Provide borrow material required for fill and backfill to bring the site to the elevations indicated on the Drawings. Borrow material shall be subject to the approval of the Engineer. Notify Engineer as to the site selected for inspection and approval prior to transporting borrow material to the site.

B. Obtain erosion control permit as necessary for borrow pit grading operations.

C. Provide soil analysis for each type of material from proposed borrow pit(s) for Engineer's approval prior to placing borrow material. Contractor shall do necessary work to bring the borrow material to within plus or minus 1-1/2 percent of the optimum moisture content. A minimum of one sample per structure shall be obtained for analysis.

3.12 MAINTENANCE AND STABILITY

A. Maintain fills and embankments to the grade and cross section indicated on the Drawings until the final completion and acceptance of the Project. Repair areas that are damaged.

3.13 DISPOSAL OF SURPLUS MATERIAL

A. Dispose of surplus material not required or unsuitable for filling, backfilling, or grading in an approved offsite spoil area in accordance with local ordinances.

B. Obtain erosion control permit as necessary for offsite disposal site(s).

3.14 SOIL TESTING

A. Owner will provide the services of a testing firm to perform the required soils testing.

B. Testing firm shall have the following qualifications:
   1. Authorized to operate in the state in which Project is located.
   2. Have a full-time registered Engineer on staff to review services.
   3. Testing equipment shall be calibrated at reasonable intervals with devices of accuracy traceable to either National Bureau of Standards (NBS) Standards or accepted values of natural physical constants.
   4. Prior to start of Work, submit testing laboratory name, address, and telephone number, names of full-time registered engineer, field inspector, and responsible project manager. Laboratory subject to the approval of the Engineer.
   5. The same independent firm shall perform retesting.

C. Testing Laboratory shall have the following responsibilities for the Project:
   1. Attend pre-construction conferences and progress meetings as required by the Engineer.
   2. Test samples of mixes submitted by Contractor.
   3. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
   4. Perform specified inspection, sampling, and testing of Soil and Materials in accordance with Contract Documents and specified standards.

5. Ascertain compliance of soil compaction and material mixes with requirements of Contract Documents.
6. Promptly notify Engineer and Contractor of observed irregularities or nonconformance of Work or Products.
7. Perform additional inspections and tests required by Engineer when specified tests have failed.
8. Submit test reports and soil specialist daily logs to the Engineer.

D. Authority of the Testing Laboratory is limited as follows:
1. May not alter requirements of Contract Documents.
2. May not approve or accept any portion of the Work.
3. May not assume duties of Contractor.
4. Has no authority to stop the Work.

E. The testing laboratory soil specialist, as a minimum, shall be at the project site for the following:
1. Monitor proofrolling of existing soils to determine requirements for undercutting unsuitable soils
2. Monitor grading for the separation and wasting of unacceptable soils.
3. Providing tests in accordance with the following schedule:
   a. Optimum moisture and laboratory maximum density: Provide one (1) test per type of material to determine optimum moisture and maximum density values in accordance with ASTM D698.
   b. Moisture content: Provide two (2) tests per day per type of material in accordance with ASTM D2216.
4. Provide in-place field density in accordance with ASTM D1556 or other approved test and the following schedule:
   a. Provide a minimum of one (1) in-place bearing capacity test for every 1,200 sq ft of subgrade area under structures prior to the start of foundation work.
   b. While filling activities are in progress for structures and paved areas. Provide a minimum of one (1) in-place density test for every 1,200 sq ft of lift with a minimum of one (1) test for every lift.
   c. Provide a minimum of one (1) in-place bearing capacity test for every 100 feet of foundation trench.
5. Monitor for settlement due to construction activities during excavation work adjacent to existing building.

F. Submit test reports and soil specialist daily logs in accordance with Section, Quality Control.

G. Verify soil-bearing capacity where proof rolling is not possible. Arrange and pay for a minimum of one (1), three foot deep penetrometer test and subsequent bearing capacity evaluation per 500 sf of structure footprint by the soil testing firm.

H. Contractor responsibilities for soil testing shall include, but not be limited to, the following:
1. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring inspection and testing services as indicated above.
2. Cooperate with laboratory personnel, and provide access to the Work.
3. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site, to facilitate tests and inspections, storage, and curing of test samples.

4. Based on test results, make corrections, adjustments, and modifications of methods, materials, and moisture content for proper placing and compaction of fill and backfill material.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work shall include, but not be limited to, the following:
   1. Erosion control at project site.
   2. Erosion control at borrows and disposal areas as required by Contractor. Cost shall include erosion control permits as necessary for borrow and disposal areas.
   3. Removal of surface debris.
   4. Temporary and permanent ground cover.
   5. Maintain and remove erosion control devices.
   6. Self Inspection and Monitoring

1.02 RELATED SECTIONS

A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
   1. Section 31 25 00, Erosion Control
   2. Section 32 92 00, Lawns and Grasses

1.03 REFERENCED STANDARDS

A. “Erosion and Sediment Control Planning and Design Manual,” issued by the N. C. Sedimentation Control Commission.

1.04 QUALITY ASSURANCE

A. Conform to rules and regulations of the Erosion Control Laws of the State of North Carolina, specifically the Sedimentation Pollution Control Act of 1973 (G.S. 113A) as amended, and the local jurisdiction where the project is located.

B. Post a copy of the approved erosion control permit, furnished by Owner, at the site prior to starting work. Maintain a copy of the approved erosion control plan at the site.

C. Provide permanent ground cover as soon as possible, and no later than 15 working days after completion of work in a specific area.

1.05 WARRANTY

A. Contractor is liable for damages to public and private property and fines as may be placed on the Project by the governing agencies due to failure to provide adequate erosion control devices.

1.06 SUBMITTALS

A. Submit the following in accordance with Section, Submittal Procedures:
   1. Self Inspection Reports

PART 2 PRODUCTS

2.01 MATERIALS

A. Matting / Erosion Control Fabric (ECF): See Construction Plan Details.

B. Wire Staples: 16 gauge steel wire, with minimum of 3” top and 4” long legs.

C. Gravel for Stone Filters: #57 crushed stone.

D. Filter Fabric: 7-1/2 oz. burlap fabric or other silt filtering fabric.

E. Riprap:
   1. Class A: Stone shall conform to NCDOT standards and shall range in size from 2 to 6-inches with the stone gradation being equally distributed within the required size range.
   2. Class B: Stone shall conform to NCDOT standards and shall range in size from 5 to 16-inches with the stone gradation being equally distributed within the required size range.
   3. Type 1: Stone shall conform to NCDOT standards and shall range in size from 5 to 17-inches with the stone gradation being equally distributed within the required size range.

F. Rock Check Dims: See Construction Plan Details

G. Temporary Silt Fence: See Construction Plan Details

PART 3 EXECUTION

2.02 INSTALL EROSION CONTROL DEVICES

A. Install erosion control devices, which shall be in place and operational prior to other land disturbing activity.

B. After installing erosion control devices as indicated on the Drawings, verify that reasonable measures have been taken to prevent the sedimentation of nearby watercourses, existing and new facilities, and adjacent property.

C. Should Contractor believe that additional measures are necessary to adequately prevent erosion, immediately notify Engineer. If rain is predicted before the Engineer can be notified, take measures as necessary to prevent siltation of nearby water courses and work will be paid for as provided in the General Conditions.

D. After installing erosion control devices, request an inspection by the local agency having jurisdiction and the Engineer.

E. Incorporate permanent erosion control work into the project at the earliest practicable time. Coordinate temporary erosion control measures with permanent erosion control measures and other work on the project to assure effective and continuous erosion control throughout the construction and post construction period.

F. Maintain erosion control devices during construction until the disturbed areas are stabilized and the agency having jurisdiction and the Engineer have approved the removal of the erosion control devices.

2.03 BORROW AND DISPOSAL AREAS:

A. Obtain and pay for erosion control permit for borrow and disposal areas as required by Contractor.

B. Install and maintain erosion control devices in accordance with Contractor's approved plan.

2.04 MAINTENANCE

A. Inspect erosion control devices after each rainfall. Make required repairs immediately. Remove sediment deposits when deposits reach approximately one-half of the capacity of the erosion control device.

B. Respread accumulated sediments on the project site in a manner that will not adversely affect erosion control facilities and permanent ground cover.

C. Silt Fence: Should the filter fabric decompose or become ineffective before approval of its removal by the Engineer, replace fabric immediately at no additional cost to the Owner.

D. Temporary Construction Entrance: Maintain entrance in a condition that will prevent tracking or flow of mud onto public rights-of-way. This may require periodic top dressing with 2 inches of stone, as conditions require, at no additional cost to the Owner.

2.05 SEEDING

A. Disturbed areas not covered by new construction shall be seeded.

B. Provide temporary and permanent seeding in accordance with Section, Lawns and Grasses.

2.06 STABILIZATION AND CLEAN-UP

A. Remove erosion control devices upon the approval of the permanent stabilization of this site by the agency having jurisdiction of the area and the Engineer. Dress sediment deposits remaining in place after the erosion control devices are removed to conform to the existing grade, prepared and seeded. Include cost of removal and cleanup in the cost of the installation of the device.

2.07 SELF INSPECTION AND MONITORING

A. Provide self-inspection and reporting as required by the Sedimentation Pollution Control Act for the duration of the project. These inspections will performed to ensure that the approved sedimentation and erosion control measures on the Drawings are installed, maintained, and working adequately.
   1. The inspections need to be conducted after each phase of the project, and continue until permanent ground cover is established.
   2. The self-inspection forms and information regarding this program are available at the following website: Form Rev 07012020
      a. https://www.deq.nc.gov/energy-mineral-and-land-resources/land-quality/combined-construction-stormwater-monitoring-form/demlr-monitoring-form-rev-07012020/download
   3. Documentation of inspections shall be recorded on a single copy of the approved erosion and sedimentation control drawings. These Drawings and inspection reports shall be made available at the project site.

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

END OF SECTION

SECTION 32 12 12

PAVEMENT AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE

A. Provide pavement, and curb and gutter sections as indicated on the Drawings and specified herein. Construction shall conform with the lines, grades, thickness, and typical cross-section indicated on the Drawings.

1.02 RELATED SECTIONS

A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
   1. Section 31 20 00 Earth Moving

1.03 REFERENCED STANDARDS

A. The latest revision, at the time of bidding, of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
   1. N.C. Department of Transportation - Specifications for Roads and Structures (NCDOT).
   2. NCDOT's Hot Mix Asphalt Quality Management System (HMA/QMS) Manual, latest edition.

B. Paragraphs in the NCDOT standard regarding measurement and payment do not apply to this Project.

1.04 SUBMITTALS

A. Submit the following in accordance with Section, Submittal Procedures:
   1. Certificates of Compliance: Certificates shall attest that supplied products conform to the referenced standard and this specification, that all tests set forth in each applicable referenced publication have been performed, and that all test requirements have been met. Submit for each of the following materials:
      a. Asphalt Concrete
      b. Aggregate Base Course
      c. Pavement Marking Material

1.05 PROTECTION OF EXISTING PAVEMENT AND CURB AND GUTTER

A. Existing pavement and curb and gutter to remain at the site are in good condition. Contractor, Owner, and Engineer shall inspect the entire site prior to the start of construction and mark existing damaged areas and note areas on Contractor's plan set to be used for the Record Drawings.

B. Protect existing pavement and curb and gutter during construction.

C. Remove areas of existing curb and gutter damaged during construction. Removal shall include to the nearest existing joint. Replace damaged areas with new curb and gutter to match the existing section.

D. Remove areas of existing pavement damaged during construction. New pavement patch shall consist of re-stabilizing the subgrade, and providing 8 inches of ABC, 3.5

inches I-19.0C Asphalt and 2.5 inches of SF9.5A asphalt to match existing pavement surface for final road build.

E. Repair damage to existing pavement and curb and gutter.

PART 2 PRODUCTS

2.01 MATERIALS AND MIXES

A. Asphalt Concrete Intermediate Course - Type I-19.0 C: Conforming to materials and compositions required in NCDOT Section 610, Asphalt Concrete Plant Mix Pavements.

B. Tack Coat: Conforming to materials and compositions required in NCDOT Section 605, Asphalt Tack Coat.

C. Asphalt Concrete Surface Course - Type S9.5B: Conforming to materials and composition required in NCDOT Section 610, Asphalt Concrete Plant Mix Pavements.

D. Concrete for Curb and Gutter, and Sidewalks: Conforming to materials and composition required in NCDOT Section 846, Concrete Curb, Curb and Gutter, Concrete Gutter, Shoulder Berm Gutter, Concrete Expressway Gutter, Concrete Valley Gutter and Concrete Flumes, and Section 848, Concrete Sidewalks and Driveways and Wheelchair Ramps.

E. Base Course: Aggregate base course shall comply with requirements of NCDOT Section 520, Aggregate Base Course.

F. Pavement Markings and Symbols: Conforming to materials and composition required in NCDOT Sections 1087 and 1205, Pavement Marking General Requirements.

PART 3 EXECUTION

3.01 PREPARATION OF SUBGRADE

A. Refer to applicable portions of Section, Earthwork.

B. Compaction shall be to at least 95 percent maximum density Standard Proctor Method.

C. Remove unsuitable material to a depth of one foot and replace with an approved material. Loosen exceptionally hard spots and re-compact. Finish subgrade to provide uniform bearing surface.

D. Maintain subgrade in satisfactory condition and properly drain until surface courses are placed.

E. Preparation, shaping, and compaction shall be in accordance with NCDOT Section 500, Fine Grading Subgrade, Shoulders, and Ditches.

3.02 MILLING ASPHALT PAVEMENT

A. Milling of existing asphalt pavement shall be in accordance with applicable paragraphs of NC DOT Section 612.

B. Milled asphalt shall be properly disposed by the Contractor.

C. Minimize heavy construction equipment traffic within areas of reduced pavement sections .

3.03 AGGREGATE BASE COURSE

A. This applies to both the aggregate base course as indicated on the Drawings for paved and unpaved roads.

B. The stone base shall be constructed in accordance with the applicable paragraphs of NCDOT Section 520.

C. Compacted base shall be of the thickness indicated on the Drawings.

3.04 ASPHALT CONCRETE INTERMEDIATE COURSE

A. Spreading, compaction, and finishing shall comply with the requirements of NCDOT Section 610, Asphalt Concrete Plant Mix Pavements.

B. Compacted thickness shall be no less than the thickness indicated on the Drawings.

3.05 ASPHALT CONCRETE SURFACE COURSE

A. Spreading, compaction, and finishing shall comply with the requirements of NCDOT Section 610 Asphalt Concrete Plant Mix Pavements.

B. Compacted thickness shall be as indicated on the drawings.

3.06 TACK COAT

A. Application rates, method of application and curing shall be in accordance with the requirements of NCDOT Section 605.

3.07 CONCRETE CURB & GUTTER

A. Provide concrete curb and gutter where indicated on the Drawings. Curb and Gutter shall conform to the section indicated on the Drawings.

B. Construct Curb and Gutter in accordance with NCDOT Section 846.

3.08 CONCRETE SIDEWALKS (IF APPLICABLE)

A. Provide concrete sidewalks where indicated on the Drawings. Construction shall be in conformity with the materials, lines, grades, thickness, and typical section as indicated on the Drawings.

B. Construct sidewalks in accordance with NCDOT, Section 848, and the following specifications.

C. Space contraction joints equal to the width.

D. Place a 1/2 inch wide expansion joint at all intersections and wherever walks about structures and other walks.

E. Place additional expansion joints at each fifth contraction joint.

F. Walks shall receive a light broom finish.

3.09 PAVEMENT MARKINGS AND SYMBOLS

A. Stripe roads maintained by the NCDOT or the local municipality in accordance with the agency requirements.

B. Provide painted pavement symbols as indicated on the Drawings.

3.10 SUBSURFACE DRAINIAGE (6” PERFERATED PIPE FRENCH DRAIN)

A. Install if requested by onsite geotechnical representative or engineer.

B. The subsurface drainage underdrain shall be in accordance with the requirements of NCDOT Section 815, Subsurface Drainage.

END OF SECTION

SECTION 32 92 00

LAWNS AND GRASSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work shall include, but not be limited to, the following:
   1. Surface preparation of subsoil.
   2. Placing topsoil (stored onsite and/or offsite source) if required.
   3. Addition of lime and fertilizer.
   4. Seeding.
   5. Maintenance to produce a permanent stand of grass.

1.02 PAYMENT PROCEDURES

A. Base bid for the work on the specified quantities of lime, fertilizer, and seed. After the specified soil tests have been made, Engineer may vary specified quantities. Should the actual quantities applied in the field vary appreciably from those specified, an adjustment in the contract price may be made.

1.03 REFERENCES

A. N.C. Department of Agriculture - NCDA

B. U.S. Department of Agriculture - USDA

1.04 PERFORMANCE REQUIREMENT

A. Grassed area shall be considered established when it presents a green appearance from eye level 50 feet away and the grass is vigorous and growing well in each square foot of seeded area. It is not required that the seeded area be thick and heavy as an old established lawn.

B. Should the permanent seed not germinate and produce a strand of grass, reseed affected areas until a permanent stand is established.

1.05 SUBMITTALS

A. Not less than 6 weeks prior to seeding, obtain representative soil samples from areas to be seeded and deliver the properly packaged samples with an information sheet for each sample properly filled out to the Soils Division of the NC Department of Agriculture or a private laboratory. Based on the test results, submit to the Engineer a recommendation as to the quantity and type of lime, fertilizer and seed for the area covered by the test.

1.06 QUALITY ASSURANCE

A. Quality of fertilizer, lime, and seed, and operations in connection with the furnishing of this material, shall comply with the requirements of the N.C. Fertilizer, Lime and Seed Law; and with the requirements of the rules and, regulations adopted by the NC Department of Agriculture in accordance with the provisions of the said law.

B. Seed containers shall bear an official "Certified Seed" label as inspected by the N.C. Crop Improvement Association.

C. Packages for soil conditioners and fertilizer shall bear manufacturer's guaranteed analysis.

D. Do not apply lime, fertilizer or seed in strong wind, when the soil is extremely wet, or otherwise unworkable. No rolling shall be done if precipitation after seeding would make the operation detrimental to the seed bed.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Deliver grass seed mixture in sealed containers showing percentage of seed mix, year of production, net production, net weight, date of packaging, and location of packaging.

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

1.08 MAINTENANCE SERVICE

A. Maintain seeded areas until grass is well established and exhibits a vigorous growing condition for a minimum of two cuttings. Mow grass at regular intervals to a maximum height of 3 inches. Hand clip where necessary.

B. Control growth of weeds. Apply herbicides in accordance with manufacturer’s instructions.

C. Water areas seeded between May 1 and July 15 at such intervals as to maintain the seeded area in a moist condition until the grass is established and accepted by the Engineer. Provide equipment to transport and distribute the water to the seeded areas. Areas seeded between September 1 and November 1 need not be irrigated beyond the initial watering specified above except that the Contractor may apply water at his own discretion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds, and roots; pH value of minimum 5.4 and maximum of 7.0.

B. Lime: Ground Dolomitic agricultural limestone, not less than 85 percent total carbonates, ground so that 50 percent passes 100 mesh sieve and 90 percent passes 30 mesh sieves. Coarser material will be acceptable, provided the specified rates of application are increased proportionately on the basis of quantities passing No. 100 mesh sieve.

C. Fertilizer: Mixed, commercial, fertilizer containing 10-10-10 percentages of available nitrogen, phosphoric acid, and potash respectively, plus superphosphate with 20 percent P2O5 content. Fertilizer shall be dry, in granular (pellet) form, shall be delivered to the site in the manufacturer's original bag or container which shall be plainly marked as to formula.

D. Seed: Fresh seed guaranteed 95 percent pure with a minimum germination rate of 85 percent within one year of tests. Provide the following seed mixtures with lime and fertilizer in disturbed areas including NCDOT Rights-of-Way:

Temporary Seeding

Planting Dates	Grass Type	Pounds/Acre
Fall	Rye(Grain)	120
Late Winter and Early Spring	Rye(grain)	120
	*Lespedeza(kobe/korean)	50
Summer	German Millet	40
	**Small Stemmed Sundagrass	50

*Omit annual Lespedeza when duration of temporary cover is not to extend beyond July.

**In Piedmont and Mountains this maybe substituted.

Soil Amendments: Follow recommendations of soil tester or apply 2,000 lbs/acre ground limestone (4,000 lbs/acre in clay soils) Ground Agricultural Limestone, 1,000 lb/acre 10-10-10 fertilizer, 4,000 lbs/acre straw, and 400 gallons/acre asphalt emulsion tack.

Permanent Seeding

Planting Dates	Grass Type	Pounds/Acre
Aug. 15 – Nov. 1	Tall Fescue	300
Nov. 1 – Mar. 1	Tall Fescue	300
&	Abruzzi Rye	25
Mar. 1 – April 15	Tall Fescue	300
April 15 – June 30	Hulled Common Bermuda Grass	25
July 1 – Aug. 15	Tall Fescue	120
&	Browntop Millet	35
&	Sorghum-Sundan Hybrids	30
Lime		4,000
Fertilizer	10-10-10	1,000
Mulch	Straw	4,000

E. Matting / Erosion Control Fabric (ECF): Matting and ECF shall be heavy jute mesh over mulch held in place by staples. Commercially available ECFs may be used upon approval of the engineer. Approval of fabrics will require manufacturer's design data regarding velocity, ditch slopes, method of installation, decay cycle, repair techniques, and grass growth enhancement characteristics.

F. Wire Staples: 16 gauge steel wire, with minimum of 3" top and 4" long legs.

G. Mulch: Threshed straw of oats, wheat, or rye; free from seed of obnoxious weeds; or clean salt hay. Straw which is fresh and excessively brittle or straw which is in such an advanced stage of decomposition as to smother or retard growth of grass will not be acceptable.

H. Water: Water shall be free from substances harmful to growth of grass.

I. Provide the following seed mixtures with lime and fertilizer in disturbed Wetland Areas:

1. Surface water control measures to be installed according to plan.
2. Areas to be seeded shall be ripped and spread with available topsoil 6" deep. Total seedbed prepared depth shall be 6" to 8" deep.
3. Loose rocks, roots and other obstructions shall be removed from the surface so that they will not interfere with establishment and maintenance of vegetation. Surface for final seedbed preparation, at finish grades shown, shall be reasonably smooth.
4. Provide agricultural lime at rate required to bring soil acidity to slightly acid - ph 6, according to soil test report.
5. Lime and fertilizer shall be applied uniformly and mixed with the soil during seedbed preparation.
6. Apply 0-20-10 commercial fertilizer at the rate of 20 lbs./1000 sf. for warm season mix (see schedule).
7. Apply 10-20-10 commercial fertilizer at the rate of 20 lbs./1000 sf. for cool season mix (see schedule).
8. Apply 10-10-10 commercial fertilizer at the rate of 20 lbs./1000 sf. for temporary cover crops. In addition, provide 15 lbs./1000 sf. of superphosphate.
9. The following is for the warm season mix:
   a. All warm grass seed shall be debearded or conditioned by brushing to create a product nearly the same as debearding. This does not apply to Switchgrass.
   b. Disc two times to break-up crop residue and dirt clods prior to seeding.
   c. Pack soil to create a firm seedbed with a cultipacker or roller.
   d. If a rain shower should fall after the seedbed is prepared but before planting, break up any crust formation.
   e. Seeding shall be installed to a depth of 1/4" utilizing a rangeland drill or conventional grass drills. It is extremely important that seed not be planted deeper than ½" deep. Do not disc or harrow after seeding. This will put the seed too deep. A Brillion seeder will be acceptable.
10. Seed in accordance with the following schedule and application rates:

Dates	Types	Rates
April – July 15	Warm Season Mix	
	Switchgrass, Cave-in-rock, Alamo	8 bulk #/acre or 1 oz./1000 sf.
	Smartweed	2 bulk #/acre or 1 oz./1000 sf.
	Japanese Millet or Sorghum Sudan Grass Hybrids (mow prior to maturity)	20 lb./acre or ½ lbs./1000 sf.
July 16 – Sept. 1	Temporary crop of Japanese Millet or Sorghum Sudan Grass Hybrids (to be followed by permanent mixture)	20 lb./acre or ½ lbs./1000 sf.

Sept. 2 – Nov. 1	Cool Season Mix	
	Reed Canary Grass	12 bulk #/acre or 6 oz./1000 sf.
	Smartweed	2 bulk #/acre or 1 oz./1000 sf.
Nov.1-March 31	Temporary crop of wheat (to be followed by permanent mixture)	40 lbs./acre

11. Contractor shall be required to provide a permanent mixture according to the schedule.
12. Temporary crops must be incorporated prior to seeding of permanent mixtures.
13. Cover crops or temporary crops must be mowed at proper time to prevent seed heads from maturing. Wheat may be harvested.
14. Grass mix and temporary covers shall be mulched with straw applied at the rate of 75lbs. to 100 lbs./1000 sf. Use clean wheat straw.
15. Wetlands crossings shall be covered with “Terra Jute” erosion control netting or equal installed per manufacturer directions.”

PART 3 EXECUTION

3.01 PREPARATION OF SUBSOIL

A. Complete operations in the area to be seeded and prepare subsoil to eliminate uneven areas and low spots. Bring surface to the approximate design contours.

B. Scarify subsoil to a depth of 3 inches. Remove weeds, roots, stones and foreign materials 1-1/2 inches in diameter and larger.

3.02 PLACING TOPSOIL

A. Place topsoil during dry weather and on dry unfrozen subsoil. Utilize available stack pile onsite or provide offsite source if needed.

B. Spread topsoil to a minimum depth of 4 inches. Remove vegetable matter and foreign non-organic material from topsoil while spreading. Grade surface to provide positive drainage and prevent water ponding. Lightly compact topsoil with at least one pass of a cultipacker or similar equipment

C. Maintain the finished surfaces by protecting, and replacing topsoil and subsoil as necessary until the area is accepted under the contract.

3.03 APPLICATION OF LIME

A. Liming shall be done immediately after grading has reached the fine grading stage, even though actual seeding may not be done until several months later.

B. Spread lime evenly by means of a mechanical distributor.

C. When lime is distributed by commercial liming dealers, sales slips showing the tonnage delivered shall be filed with the Engineer and shall show the full tonnage required for the acres treated.

D. Incorporate lime in the top 2 to 3 inches of soil by harrowing, disking, or other approved means.

3.04 APPLICATION OF FERTILIZER

A. Spread fertilizer not more than 2 weeks in advance of seeding.

B. To verify application rate, determine acreage to be fertilized and provide Engineer with total weight of fertilizer applied to the area.

C. Provide mechanical spreader for even distribution and spread half of the rate in one direction, and the other half at right angles to the first. Mix thoroughly into upper 2 to 3 inches of soil by disking, harrowing or other approved methods.

3.05 SEEDING

A. Accomplish seeding by means of an approved power-drawn seed drill, combination corrugated roller-seeder, approved hand operated mechanical seeder, or other approved methods to provide even distribution of seed.

B. Do not seed when ground is excessively wet or excessively dry. After seeding, roll area with a roller, not less than 18 inches in diameter and weighing not more than 210 pounds per foot of width. Upon completion of rolling, water area with a fine spray.

C. Immediately following seeding apply mulch or matting. Do not seed areas in excess of that which can be mulched on same day.

D. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil depth

3.06 MULCHING AND MATTING

A. Apply mulch or matting as required to retain soil and grass, but no less then the following:
   1. Slopes from 0 to 20 percent by spreading a light cover of mulch over seeded area at the rate of not less than 85 lbs. per 1000 sq. ft.
   2. Slopes greater than 20 percent mulch with matting. Pin matting to the ground with wire staples at 5 foot intervals, immediately after seeding.
   3. Use tack to prevent disruption of mulch.

B. For tack use an asphalt tie-down of emulsified asphalt grade AE-3 or cut-back asphalt grade RC-2 or other approved equal. The application rate shall be 0.10 gal/sy (11 gal / 1000 sq ft). An approved jute mesh or net may be used in lieu of tacking straw mulch.

C. Other types of mulch and anchoring methods may be used upon approval by the Engineer.

3.07 PROTECTION

A. Protect seeded areas from damage by barricades, signs, and other appropriate means. Maintain and protect slopes from weather damage.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work under this section includes, but is not limited to, piping and appurtenances for a complete storm drainage system.

1.02 RELATED SECTIONS

A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
   1. N/A

1.03 REFERENCES

A. Publications are referred to in the text by basic designation only.
   1. American Society for Testing and Materials (ASTM)
      a. A126 (latest)
      b. B746 (latest)
      c. C76 Reinforced Concrete Culverts, Storm Drain and Sewer Pipe (latest)
      d. C443 Flexible Watertight Joints for Circular Concrete Pipe and Precast Manhole Sections (latest)
      e. C478 Precast Reinforced Concrete Manhole Sections (latest)
      f. C507 Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe (latest)
      g. C858 Underground Precast Concrete Utility Structures (latest)
      h. C890 Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures (latest)
      i. C913 Precast Concrete Water and Wastewater Structures (latest)
      j. C923 Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals (latest)
      k. C990 Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants (latest)
      l. D1248 Polyethylene Plastics Molding and Extrusion Materials (latest)
   2. American Association of State Highway and Transportation Officials (AASHTO)
      a. M206 Standard Specification for Reinforced Concrete Arch Culvert Storm Drainage Sewer Pipe.
      b. M219 – Aluminum Alloy Standards (latest)
      c. M 170 Standard Specifications for Reinforced Concrete Culverts, Storm Drain, and Sewer Pipe (latest)
   3. UNI-BELL Plastic Pipe Association (UNI)
      a. B-6 Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe (latest)
   4. NCDOT Standard Specifications for Roadway and Structure and Standard Details.

1.04 SUBMITTALS

A. Submit the following in accordance with Section, Submittal Procedures:
   1. Affidavit of Compliance: Affidavit shall attest that supplied products conform to the referenced standard and this specification and that all tests set forth in each

applicable referenced publication have been performed and that all test requirements have been met. Submit for each of the following materials:

a. Pipe
   1) Reinforced Concrete Pipe with pipe joint detail (Round)
   2) Reinforced Concrete Pipe with pipe joint detail (Arch)
b. Pre-cast concrete boxes

2. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following. Clearly indicate equipment to be furnished for the Project including options to be provided.
   a. Pipe
      1) Reinforced Concrete Pipe with pipe joint detail (Round and Arch)
   b. Pre-cast Concrete Boxes and the following appurtenances: N/A
3. Reports: (If Applicable)
   a. Field test report for each section of pipe for the following:
      1) Low-pressure air test for storm drain piping.
4. NCDOT Approved Markings
   a. All concrete pipe, boxes, structures, grate, frame/hood, manhole ring and covers, etc. shall bear an NCDOT Approved stamp, tag, or sticker per NCDOT requirements for all products used.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide a suitable pipe hook or rope sling when handling the pipe with a crane. Lifting of the pipe shall be done in a vertical plane. Under no conditions shall the sling be allowed to pass through the pipe unless adequate measures are taken to prevent damage to both tongue and groove ends.

B. Deliver pipe in the field as near as practicable to the place where it is to be installed. Distribute pipe along the side of the trench opposite to the spoil bank. Where necessary to move the pipe longitudinally along the trench, it shall be done in such a manner as not to injure the pipe.

1.06 CALCULATIONS AND DRAWINGS

A. Provide calculations and drawings for cast-in-place or pre-cast headwalls and wingwalls (concrete or corrugated aluminum) sealed by a North Carolina Professional Engineer.

1.07 CERTIFICATIONS

A. If required by NCDOT at closeout, Contractor shall provide a post construction certification of installed culvert crossing signal and sealed by a North Carolina Professional Engineer. This PE must have an NBIS certification. This is for all bridges, reinforced box culverts and all pipes 48” and greater.

PART 2 PRODUCTS

2.01 REINFORCED CONCRETE PIPE

A. Round Pipe shall conform to the following requirements:
   1. Size shall be as indicated on the Drawings.
   2. Suitable for pressures as specified ASTM C76

B. Reinforced Concrete Pipe shall conform to ASTM C76, AASHTO M170, and to the following requirements:
   1. Pipe lengths shall be not less than 8 feet.
   2. Pipe shall be Class III minimum per ASTM C76. If less than 1’ of cover use class IV pipe.
   3. Pipe shall be designed for a Type 2 laying condition at the depth of cover

indicated on the Drawings.

4. Joints shall be flexible preformed butyl rubber-based sealant material conforming to Federal Specification SS-S-210A, Type Butyl Rubber, unless otherwise shown on the drawings.

2.02 CORRUGATED ALUMINUM BOX CULVERTS AND HEADWALLS

A. This item shall govern the furnishing and installation of an Aluminum Box Culvert and Headwalls for culverts and storm sewers for the types, sizes, and designations as shown on the plans and further specified in these specifications.

B. Material:

1. The Aluminum Box Culvert shall be fabricated from an Aluminum alloy coil, conforming to the current AASHTO M-219 and ASTM B 746 material specification. The materials shall also meet or exceed the latest AASHTO Section 12 requirements.

2. The Aluminum Box Culvert is to be fully welded inside and out to headwalls using two root welds and two finish welds on either side of the wall. All finish welds are to be ground to a smooth finish.

3. Headwall and Box Culvert are to be reinforced per AASHTO specifications or structural engineer’s requirements.

4. All fabrication of the product shall occur within the United States.

5. Supplier must provide all necessary hardwire, including: wale beams, caps, galvanized steel tieback rods with dead man anchor (DMA) plates, anchors, lugs, inserts, adjustable turnbuckles and all other materials relating to the culvert and headwall system necessary to complete the assembly.

6. Aluminum Box Culvert shall be NCDOT approved product.

7. Aluminum Box Culvert shall manufactured by Contech Construction Products or approve equivalent.

2.03 CASTINGS (WHERE APPLICABLE)

A. General
1. Made of gray iron, ASTM A-48 - class 30, or ductile iron, ASTM A536, grade 65-45-12.
2. Castings shall be free from imperfections, not true to pattern. Casting tolerances shall be plus or minus 1/16 inch per foot of dimension. Top shall set neatly in frame, with edges machined for even bearing and proper fit to prevent rattling and flush with the edge of frame.
3. Castings shall be as manufactured by Neenah Foundry Co., U.S. Foundry & Manufacturing Corp., or Vulcan Foundry

B. Manhole Ring and Cover: (Where Applicable)
1. Minimum clear opening shall be 22 inches.
2. Minimum weight for frame and cover shall be 300 pounds and suitable for Heavy Duty Highway Traffic Loads of H-20.
3. Frame shall have four 1-inch anchor bolt holes equally spaced.
4. "Storm Sewer" shall be cast on the cover as appropriate. Casting shall bear the name of the manufacturer and the part number.
5. Provide cover with two 1-inch perforated holes.

C. Grate and Frame:
1. Grate and Frame shall be NCDOT Standard.

2. Grate and Frame shall be suitable for Heavy Duty Highway Traffic Loads of H-20.
3. Casting shall bear the name of the manufacturer and the part number.

2.04 PRECAST BOXES – N/A

PART 3 EXECUTION

3.01 GENERAL

A. Pipe installation shall meet the following general guidelines:
1. Lay pipe in the presence of Engineer, unless specifically approved otherwise.
2. Handle pipe and accessories in accordance with manufacturer's recommendations.
3. Carefully inspect pipe immediately prior to laying. Do not use defective pipe. Replace pipe damaged during construction.
4. Lay pipe to grade and alignment indicated on the Drawings.
5. Provide proper equipment for lowering pipe into trench.
6. Provide tight closure pipe ends when work is not in progress.
7. Keep pipe interior free of foreign materials.
8. Do not lay pipe in water or when the trench or weather conditions are unsuitable for the work.
9. Clean bell and spigots before joining. Make joints and lubricate gasket in accordance with pipe manufacturer recommendation.
10. Provide pneumatic plug at each entrance into the new storm drain system and maintain plugged until the project is complete.

B. Storm Drainage Pipe: Gravity pipe installation shall meet the following general guidelines:
1. Lay pipe upgrade from the lower end and at the grades and alignment indicated on the Drawings.
2. Lay storm drainage pipe to true lines and grades by use laser beam equipment or other acceptable means.

3.02 ALUMINUM BOX CULVERTS

A. Job Site Installation Assistance: A manufacturer’s representative, with at least two (2) years of experience in the installation of this type of structure, is required to give technical advice with assembly of the structure and headwalls, as well as to be on site during the installation and backfilling of the box culvert and headwalls through completion.

B. Installation shall be in accordance with AASHTO Standard Specifications for Highway Bridges, Section 26 and the Project Plans and Specifications.

C. Backfill Material: Recommended backfill material shall be the following:

1. Pipe Bedding and where water is encountered: #57 Stone shall be used or an approved equal (min 12” depth).

2. Other backfill up to a minimum of 24” over the top of the pipe: A-la or approved equal.

D. When transitioning from #57 Stone to a well graded material, a minimum 4 oz. geotextile is required for separation of the different backfill materials.

E. Construction Loads: Construction loads may be higher than final design loads.

Follow manufacturer's guidelines.

3.03 TESTING

A. General
   1. Clean and flush pipe system of foreign matter prior to testing.
   2. Notify Owner and Engineer a minimum of 48 hours prior to testing.
   3. Perform tests in the presence of Engineer.
   4. Length of line to be tested at one time shall be subject to approval of Engineer.
   5. Pipe sections shall not be accepted and placed into service until specified test limits have been met.
   6. Repair defects in the pipe system. Make repairs to the same standard as specified for the pipe system.
   7. Retest repaired sections until acceptance.
   8. Repair visible leaks regardless of the test results.

B. Storm Drainage
   1. Test gravity lines between manholes or junction boxes.
   2. Light Testing: Mains will be checked by Engineer for displacement after the trench has been filled to two feet above the pipe and tamped as specified, and upon completion of the project. Test will be as follows:
      a. A light will be flashed between the ends of the pipe section being tested.
      b. If the illuminated interior shows any misalignment, or other defects as designated by Engineer, defects shall be repaired.
   3. General
      a. Infiltration shall not exceed 100 gallons per inch of diameter, per mile of pipe, per 24 hours. Engineer may require flow measurement for verification of infiltration.

END OF SECTION

Water, Sewer & Pump Station Specifications per CFPUA

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END OF DOCUMENT

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

(DEVELOPMENT PROJECTS)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and Project conditions.

B. Preconstruction meeting (CFPUA Pre-Con Checklist Attached).

C. Progress meetings.

D. Preinstallation meetings.

E. Inspections.

F. Testing and Gravity Sewer Video.

G. Closeout Documentation.

H. Final Construction Completion

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various Sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate Work of various Sections having interdependent responsibilities for installing, connecting to, and placing operating equipment in service.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practical. Use spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. Coordination Meetings: In addition to other meetings specified in this Section, hold coordination meetings with personnel and Subcontractors to ensure coordination of Work.

1.3 PRECONSTRUCTION MEETING

A. A pre-construction conference is required for every development project that requires the construction of water and/or sewer facilities.

B. The pre-construction meeting must be scheduled through the CFPUA Construction Manager with at least two (2) business day notice.

C. Pre-construction meeting shall be held after receipt of all applicable permits, approval of the final construction drawings and material shop drawings, verification of contractor licensing and payment of all outstanding fees.

D. Attendance Required: Engineer, Owner or Owner's representative, Licensed Utility Contractor, major Subcontractors, and CFPUA Project/Construction Managers.

E. Minimum Agenda:
   1. Discuss the approved drawings.
   2. Discuss the general construction sequence and schedule.
   3. Review general construction inspection procedures and requirements.
   4. Discuss lines of communication.
   5. Discuss typical project pitfalls and time savers.
   6. Discuss project challenges. The contractor is encouraged to review the project ahead of the pre-con, ask for clarifications, and introduce any particular challenges that he/she anticipate in the construction of the project.
   7. Other topics per the pre-con checklist.

F. At the end of the pre-construction meeting, the developer will receive a copy of the sign in sheet, signed pre-construction checklist, stamped approved construction plans and specifications.

1.4 PROGRESS MEETINGS

A. Schedule and administer meetings through progress of the Work.

B. Plan for meetings, prepare agenda with copies for participants, and preside over meetings.

C. Attendance Required: Job Superintendent, major Subcontractors, Engineer or Owner's Representative, CFPUA Inspector and CFPUA Project/Construction Manager, as appropriate to agenda topics for each meeting.

D. Minimum Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems impeding planned progress.
   5. Review of submittal schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of Progress Schedule.
   8. Planned progress during succeeding work period.
   9. Coordination of project progress.
   10. Maintenance of quality and work standards.
   11. Effect of proposed changes on Progress Schedule and coordination.
   12. Other business relating to Work.

1.5 PREINSTALLATION MEETINGS

A. When required in individual Specification Sections, convene preinstallation meetings at Project Site before starting Work of specific Section.

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

C. Notify Engineer and CFPUA Project/Construction Manager four days in advance of meeting date.

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

E. Record minutes and distribute copies to participants within two days after meeting.

1.6 INSPECTIONS

A. Material Inspection
   1. Before any work is started on the project, the Contractor shall make submittals to the Engineering in accordance with the requirements of CFPUA Specification Section 01 33 00 - Submittals. The CFPUA Inspector shall be notified when any material is delivered to the job site.
   2. The CFPUA Inspector will verify that all materials meet CFPUA specifications, details, and/or approved submittal.
   3. The CFPUA Inspector will notify the Contractor and the CFPUA Construction Manager of any unapproved material, and that the unapproved material must be removed from the project site.

B. General Inspection
   1. Routine and unscheduled of ongoing projects will be made by CFPUA personnel during the construction phase to ensure conformance with the approved plans, CFPUA specifications and details, as well as compliance with this guidance manual.
   2. Projects approved for construction by the CFPUA automatically authorizes CFPUA inspection personnel access to the construction site at all times for the purpose of inspecting constructed facilities or observing construction operations in progress. CFPUA Inspectors will take appropriate action, as outlined herein, when improper material or unacceptable workmanship is detected on the project and will notify the CFPUA Construction Manager, Contractor, Engineer and/or Developer.
   3. CFPUA Inspectors shall make periodic checks during all phases of construction to ensure that the contractor is complying fully with project design and specifications including:
      a. CFPUA valves are not to be operated without a CFPUA Inspector or CFPUA Water Quality personnel present (Notice of Violations will be given if failure to comply).

b. Any work after normal working hours (Monday – Friday 7:00 AM – 3:30 PM) must be pre-approved and scheduled with the CFPUA Construction Manager and Inspector.
c. All shutdowns must be pre-approved and scheduled with the CFPUA Construction Manager and Inspector (they will coordinate with the proper CFPUA departments).
d. Water or sewer force main tie-ins or shutdowns will not be conducted on Friday through Monday unless pre-approved by CFPUA Operations.
e. Contractor is to give two (2) business days notification for scheduling to the assigned CFPUA Inspector for each of the following:
    1) Operating any CFPUA valve (includes tapping valves).
    2) When beginning construction and if the contractor pulls off the site.
    3) Laying out of any connection in existing manholes.
    4) Cutting in any new manholes on existing lines.
    5) Coring any manholes.
    6) Connecting onto existing sewer force mains.
    7) Connecting onto existing water lines.
    8) Any bores and threading carrier pipes.
    9) All camera work, testing, chlorination, and water sampling.
    10) All testing.

1.7 TESTING AND GRAVITY SEWER VIDEO

All structures, pressure piping and gravity sewer piping shall be tested by the contractor as specified in the CFPUA Specifications in accordance with applicable regulations and as directed by the CFPUA Inspector. All testing must be conducted in the presence of the CFPUA Inspector. The Contractor is to give two (2) business days notification for scheduling, to the assigned CFPUA Inspector for all testing.

1.8 CLOSEOUT DOCUMENTATION

A. The purpose of the as-built record drawings is to verify that the water and sewer system serving the project were installed per CFPUA Technical Specifications, in accordance with the approved construction permit, and recorded to show the actual locations of the water and sewer assets to be conveyed to CFPUA for ownership, operation and maintenance.

B. Paper As-built Drawings

Two (2) sets of as-built record drawings shall be provided in accordance with CFPUA Specification Section for review. The as-built checklist and an example of the plan's cover sheet are provided in the CFPUA Development Process and Procedures manual. It shall be the engineer's responsibility to assure that the most current as-built checklist is used and to check the as-builts for conformance with this checklist before submitting the as-builts.

C. Plans and Checklist

Certified, surveyed record drawings (as-built plans), sealed by a North Carolina licensed Professional Land Surveyor or Professional Engineer (engineer seal required

for profiles), shall be furnished to CFPUA by the Engineer of Record (or Developer, where applicable) prior to completion and acceptance of the infrastructure by CFPUA. The as-built plans shall conform to the as-built checklist.

D. As-built Submission

Two (2) sets of as-built record drawings shall be submitted to the CFPUA Inspector.

1. Sewer projects – Prior to the review of the camera inspection of the installed infrastructure.
2. Water projects – After the infrastructure has been installed and pressure testing, and disinfection has been completed and approved by CFPUA.

E. CFPUA Inspector's Review

The CFPUA Inspector will review the as-built drawings for compliance with the CFPUA As-built Checklist. The CFPUA Inspector will field verify the location of all water and sewer items on the as-builts. Comments will be provided to the contractor and engineer.

F. Final Sealed As-Built Drawings

Once the CFPUA Inspector approves the as-built drawing, a final copy is to be submitted on original base Mylar sheets (24" X 36"). A PDF and digital copy must be provided to CFPUA. Final Sealed as-built drawings must be submitted per the CFPUA Development Process and Procedures manual.

1.9 FINAL CONSTRUCTION COMPLETION

A. Items Required for Completion

Construction is considered complete when the following items are successfully satisfied:

1. Testing (hydro, water samples, air, vacuum, mandrel, and pump station).
2. As-Built Drawings.
3. Camera Inspection (gravity sewer).
4. Walk through acceptance inspection.

B. Once complete, the project is ready to move toward certification and conveyance.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 33 00

SUBMITTALS

(DEVELOPMENT PROJECTS)

PART 1 GENERAL

1.1 DESCRIPTION

A. Definitions.

B. Submittal procedures.

C. Use of electronic CAD files of Project Drawings.

D. Shop Drawings.

E. Certificates.

F. Manufacturer's instructions.

G. Manufacturer's field reports.

H. Contractor review.

I. Engineer review.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect/Engineer's responsive action.

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.

1.3 CONSTRUCTION PROGRESS SCHEDULE

A. At Preconstruction Meeting, submit proposed complete bar chart schedule for review.

B. Submit updated schedules at monthly progress meetings.

C. Schedule Updates:
   1. Overall percent complete, projected, and actual.
   2. Completion progress by listed activity and sub activity, to within five working days prior to submittal.
   3. Changes in Work scope and activities modified since submittal.
   4. Delays in submittals or resubmittals, deliveries, or Work.
   5. Adjusted or modified sequences of Work.

6. Other identifiable changes.
7. Revised projections of progress and completion.

D. Narrative Progress Report:
1. Submit with each monthly submission of Progress Schedule.
2. Summary of Work completed during the past period between reports.
3. Work planned during the next period.
4. Explanation of differences between summary of Work completed and Work planned in previously submitted report.
5. Current and anticipated delaying factors and estimated impact on other activities and completion milestones.
6. Corrective action taken or proposed.

1.4 SUBMITTAL PROCEDURES

A. Transmit each submittal with Engineer-accepted form.

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

C. Identify: Project, Contractor, Subcontractor and supplier, pertinent Drawing and detail number, and Specification Section number appropriate to submittal.

D. Apply Contractor's stamp, signed or initialed, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is according to requirements of the Work and Contract Documents.

E. Schedule submittals to expedite Project and deliver to Engineer at business address or submit electronic submittals via email as PDF electronic files. Coordinate submission of related items.

F. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.

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

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

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

J. Submittals not requested will not be recognized nor processed.

K. Incomplete Submittals: CFPUA will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of CFPUA.

1.5 SHOP DRAWINGS

A. Shop Drawings: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

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

C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional Engineer responsible for designing components shown on Shop Drawings.
   1. Include signed and sealed calculations to support design.
   2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
   3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. Submittals
   1. Submit number of opaque reproductions Contractor requires, plus one copy Engineer will retain, or
   2. Submit electronic submittals via email as PDF electronic files.

E. After review, produce copies and distribute.

1.6 CERTIFICATES

A. Informational Submit: Submit certification by manufacturer, installation/application Subcontractor, or Contractor to Engineer, and CFPUA in quantities specified for Product Data.

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

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

1.7 MANUFACTURER'S INSTRUCTIONS

A. Submit manufacturer's installation instructions for Engineer's and CFPUA knowledge.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Engineer and CFPUA in quantities specified for Product Data.

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

1.8 MANUFACTURER'S FIELD REPORTS

A. Submit reports for Engineer's knowledge as Contract administrator or for Owner and CFPUA’s knowledge.

B. Submit report in duplicate within 5 days of observation to Engineer and CFPUA for information.

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

1.9 CONTRACTOR REVIEW

A. Review for compliance with Contract Documents and approve submittals before transmitting 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.

C. Stamp, sign or initial, and date each submittal to certify compliance with requirements of Contract Documents.

D. Do not fabricate products or begin Work for which submittals are required until approved submittals have been received from CFPUA.

1.10 ENGINEER REVIEW

A. Informational submittals and other similar data are for Architect/Engineer's information, do not require Architect/Engineer's responsive action, and will not be reviewed or returned with comment.

B. Submittals made by Contractor that are not required by Contract Documents may be returned without action.

C. Submittal approval does not authorize changes to Contract requirements unless accompanied by Change Order or Work Change Directive.

D. Owner may withhold monies due to Contractor to cover additional costs beyond the second submittal review.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

(DEVELOPMENT PROJECTS)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Field surveying.

B. Closeout procedures.

C. Starting of systems.

D. Demonstration and instructions.

E. Project record documents.

F. Operation and maintenance data.

G. Spare parts and maintenance products.

H. Product warranties and product bonds.

I. Examination.

J. Execution.

K. Cutting and patching.

L. Protecting installed construction.

M. Final cleaning.

N. Certification, Conveyance, and Plats.

1.2 FIELD SURVEYING

A. A Licensed Land Surveyor shall be employed to provide a preconstruction survey of all utilities and appurtenances per the approved construction plans. Certifications of this work shall be provided to CFPUA prior to installation. Any conflicts noted with the survey shall be noted and changes to the construction plans shall be approved prior to installation.

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

C. Control datum for survey is established by Engineer-provided survey and indicated on Drawings.

D. Verify easements; confirm Drawing dimensions and elevations.
   1. Proposed easements shall be staked prior to installation of utilities.

E. Provide field surveying and recording services. Establish elevations, lines, and points using recognized survey practices.

F. Protect survey control points prior to starting Site Work; preserve permanent reference points during construction.

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

H. Final Record Survey: Prior to Substantial Completion, submit markup of final record in accordance with Project Record Documents in this section.

1.3 CLOSEOUT PROCEDURES

A. Prerequisites to Utility Activation: Complete following items before requesting Utility Activation, either for entire Work or for portions of Work:
   1. Complete testing, adjusting, balancing of systems and equipment, demonstrations, and instructions to CFPUA's operating and maintenance personnel as specified in compliance with this Section and CFPUA Specification Section 01 30 00 - Administrative Requirements.
   2. Submit maintenance manuals, spare parts, Project record documents, markups, gravity sewer video inspection, warranty letters and other similar final record data in compliance with this Section.
   3. Coordinate Final Walk-Through inspection by CFPUA to establish basis for request that Work is complete.
   4. Make final change-over of locks and transmit keys directly to CFPUA. Advise CFPUA's personnel of change-over in security provisions.
   5. Discontinue or change over and remove temporary facilities and services from Project Site.
   6. Perform final cleaning according to this Section.

1.4 STARTING OF SYSTEMS

A. Coordinate schedule for startup of various equipment and systems.

B. Notify Engineer seven days prior to startup of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify that tests, meter readings, and electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute startup under supervision of manufacturer's representative or Contractors' personnel according to manufacturer's instructions.

G. When specified in individual Specification Sections, require manufacturer to provide authorized representative who will be present at Site to inspect, check, and approve equipment or system installation prior to startup and will supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to CFPUA personnel.

B. Demonstrate Project equipment and instructed by authorized manufacturer's representative who is knowledgeable about the Project.

C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with CFPUA personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Reviewed Shop Drawings, product data, and Samples.
   4. Manufacturer's instruction for assembly, installation, and adjusting.

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

C. Record information concurrent with construction progress, not less than weekly. Report recording status at progress meetings.

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

E. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction as follows:

1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the Work, and change orders.
2. Include locations of concealed elements of the Work.
3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components that are parallel to utilities.
4. Dimension ends, corners, and junctions of buried utilities to permanent facility components using triangulation.
5. Identify and locate existing buried or concealed items encountered during Project.
6. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
7. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
8. Field changes of dimension and detail.
9. Details not on original Drawings.

F. Certified, surveyed record drawings ("as-built" plans), sealed by a North Carolina licensed Professional Land Surveyor and/or Professional Engineer, shall be furnished to the Cape Fear Public Utility Authority (Authority) by the Engineer of Record (or Developer where applicable) upon completion and acceptance of the infrastructure by the Authority. The "as-built" plans shall conform to the as-built checklist included herein.

G. For sewer projects, the "as-built" plans shall include accurate information regarding pipe size, pipe material, pipe length, manhole construction (size of manhole, invert, rim, alignment, location), services, and pump stations along with any relevant rights-of-way, property boundaries and easements. Plans shall also include sewer profiles showing any utility crossings and separations along with the aforementioned information.

H. For pump station projects, the "as-built" plans shall include accurate information regarding interior and exterior pipe sizes, material, length, as well as all structural dimensions of the pump station, all electrical equipment (make and model), pump information (make, model, and impeller size), and site layout information. Top plan, sectional plan, and full cross-section views are required on the "as-built" plans.

I. For force main projects, the "as-built" plans shall include accurate information regarding pipe size, pipe material, pipe length, horizontal and vertical elevations, valve locations (and turn direction), hydrant locations, fitting locations, services, and blow-off locations along with any relevant rights-of-way, property boundaries and easements.
    1. The final elevation of the force main shall be surveyed every 50', at each change in horizontal and vertical direction, and at each valve location with final grade in place.

J. For water projects, the "as-built" plans shall include accurate information regarding pipe size, pipe material, pipe length, horizontal and vertical elevations, valve locations (and turn direction), hydrant locations, fitting locations, services, and blow-off locations along with any relevant rights-of-way, property boundaries and easements.

1. The final elevation of the water main shall be surveyed every 50', at each change in horizontal and vertical direction, and at each valve location with final grade in place.

K. Submit marked-up paper copy documents to Engineer at each payment request and before Substantial Completion.

L. Digital "as-built" information shall be provided by the Engineer of Record in AutoCAD format and PDF format with seal, signature, and date by surveyor and engineer and shall include all information required on the "as-built" drawings. No other digital formats will be accepted.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit in PDF composite electronic indexed file.

B. Submit data bound in 8-1/2 x 11-inch text pages, three D side ring binders with durable plastic covers.

C. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of Project**,** and subject matter of binder when multiple binders are required.

D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

E. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

F. Contents: Prepare table of contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by Specification Section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Include the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Contact information for warranty items.
      g. Safety precautions to be taken when operating and maintaining or working near equipment.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop Drawings and product data.
      b. Certificates.
      c. Photocopies of warranties and bonds.

1.8 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specification Sections.

B. Deliver to Project Site and place in location as directed by CFPUA; obtain receipt prior to final payment.

1.9 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible Subcontractors, suppliers, and manufacturers within ten days after completion of applicable item of Work.

B. Execute and assemble transferable warranty documents and bonds from Subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include table of contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final completion.

G. Time of Submittals:
   1. For equipment or component parts of equipment put into service during construction with CFPUA's permission, submit documents within ten days after acceptance.
   2. Make other submittals prior to final completion.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing Site conditions are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Examine and verify specific conditions described in individual Specification Sections.

C. Verify that utility services are available with correct characteristics and in correct locations.

3.2 EXECUTION

A. Comply with manufacturer's installation instructions, performing each step, in sequence. Maintain one set of manufacturer's installation instructions at Project Site during installation and until completion of construction.

B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Verify that field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.

D. Conduct a preconstruction survey, staking out all proposed easements, right-of-ways, and proposed utilities. Provide a certification of each survey once completed.

E. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
   1. Secure Work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.
   2. Physically separate products in place, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.

F. Allow for expansion of materials.

G. Mounting Heights: Where not indicated, mount individual units of Work at industry recognized standard mounting heights for particular application indicated.
   1. Refer questionable mounting heights choices to Engineer for final decision.

H. Adjust operating products and equipment to ensure smooth and unhindered operation.

I. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by manufacturer.

3.3 CUTTING AND PATCHING

A. Employ skilled and experienced installers to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements affecting:
   1. Structural integrity of element.
   2. Integrity of weather-exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   4. Work of CFPUA or separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill to complete Work and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and nonconforming Work.

4. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute Work by methods to avoid damage to other Work and to provide proper surfaces to receive patching and finishing.

E. Cut masonry and concrete materials using masonry saw or core drill.

F. Restore Work with new products according to requirements of Contract Documents.

G. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction, completely seal voids.

I. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest joint or intersection; for equipment assembly, refinish entire unit.

J. Identify hazardous substances or conditions exposed during the Work to Engineer for decision or remedy.

3.4 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual Specification Sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.

C. Protect corrosion protected (coated) surfaces. When activity is necessary, obtain recommendations for protection from coating material manufacturer.

D. Prohibit traffic from landscaped areas.

3.5 FINAL CLEANING

A. Execute final cleaning prior to final Project assessment.

B. Clean Site and Facilities; sweep paved areas, rake clean landscaped surfaces.

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

3.6 Certification, Conveyance, and Plats

A. Follow the Certification, Conveyance, and requirements outlined in the Development Process and Procedures Manual.

B. Record Drawings shall be provided with accurate information including final horizontal and vertical locations of all utilities.
   1. The final survey shall be conducted with respect to the final grade. All horizontal and vertical direction changes shall be captured, and each valve location.

END OF SECTION

AS-BUILT CHECK LIST Rev. 6
CAPE FEAR PUBLIC UTILITY AUTHORITY

Date: _____

Subdivision Name: _____

Reviewed by: _____

CFPUA Project Number: _____

CFPUA Technical Specification: 01 70 00 Execution and Closeout Requirements

W	S	#	√ - COMPLETED	X - INCOMPLETE	N/A – NOT APPLICABLE
		1	Name of subdivision (if applicable), owners name, date of construction, north arrow, scale, vicinity map and as-built plan.		
		2	Drawings shall indicate water/sewer phases and their relationship to subdivision phases.		
		3	Sheet numbers and number of total sheets.		
		4	Clearly indexed cover sheet with location of plan - profile sheets on cover sheet, by sheet number.		
		5	Accurate location map and index planning map at a scale of 1 inch = 200 feet.		
		6	Total linear feet on cover sheet listed by phases:		
			Water lines:	Gravity line:	Force main:
		7	Certification notes listed by phase and location on cover sheet.		
		8	All lettering shall be at least 0.10 inches in height. The scale shall be 1” = 50’ (horizontal) and 1” = 5’ (vertical).		
		9	The contractor’s final survey shall be provided with a copy of the as-builts. The survey shall be completed in accordance with CFPUA Technical Specification 01 70 00.		
		10	Engineer has incorporated Contractor’s final survey into the as-builts. As-builts shall accurately represent final horizontal and vertical alignments with respect to final grade. Shall also include all utility separations, both horizontal and vertical, with respect to all other utilities.		
		11	The final elevation of water mains and force mains shall be surveyed every 50’ or at each change in horizontal and vertical direction, and at each valve location with final grade in place.		
		12	Final grade shall include elevation directly over the utility main as well as the elevation at the edge of pavement. Profile shall include both grade lines to distinguish the elevation drop from the edge of pavement.		
		13	All crossings shall be identified, and separations shall be verified with the Contractor's survey to confirm as-built separation. All proposed minimum separation notes from the design plans shall be removed.		
		14	All inverts into and out of manholes shall be field verified to 1/100 ft.		
		15	Show manhole top elevation & flood elevation or surface water flow levels @ each MH.		
		16	Elevations shall be tied to mean sea level. Indicate any benchmarks within project area.		
		17	All monuments shall be identified including manhole sewer monuments.		
		18	Show vertical and horizontal separations of waterlines, sewer mains, and force mains to proposed or existing utilities and structures (includes storm water piping).		
		19	For each sewer reach, show pipe diameter, length, type, slope, existing surface elevations and proposed finish grades. Show station or distance to beginning and end of change in pipe material.		
		20	Show location of air release valves, gate valves and fittings along water main and sanitary sewer force main.		
		21	Station numbers shall be included.		
		22	Plans shall show stubs for individual services. C/O shown open circle, water meters open box. Sewer Cleanouts (COs) shall be located by measuring from each manhole along the sewer main up stream to a point which lies on a line that is perpendicular to the sewer main and connects said point and C.O. - zero point shall be the immediate downstream manhole and measured from main to C/O, i.e., 127/14R. No stations shall be used. Indicate size and location of all of services.		
		23	Indicate size of services greater than 4”.		
		24	Indicate manhole service taps, service casing &/or material transition.		
		25	Water services shall be clearly drawn including the location of the tap to the meter box. An open square shall be used to identify the meter boxes.		
		26	All casing pipes shall be identified including the start and end of the casing.		

		27	Existing infrastructure where crossings are located or where connections were made shall be referenced by title and page of as-built drawing. The Authority will assist with obtaining this information, (i.e. existing manhole number, project name, CFPUA number and sheet number. Show information on plan-profile sheet and cover sheet.
		28	All proposed design language shall be removed including minimum and maximum installation requirements. Depths of pipe shall be verified with Contractor's survey and updated accordingly on the as-builts.
		29	Lot numbers, property lines and owner reference lines, street names and all easements.
		30	Engineer’s seal and Surveyor’s seal as applicable or required.
		31	Show all water supply wells within 50' & community wells within 100' of sewer main.
		32	Water & sewer layers to be bolder line type than drainage, streets, etc.
		33	All final contour lines shall be reflected on the as-built.
		34	A PDF and digital copy (format no older than AutoCAD 2005) of the Final as-built plans must be provided to the Authority. All drawings shall become the property of the Cape Fear Public Utility Authority.
		35	Permitted main line final as-built plans shall be inked on original base mylar sheets (24” X 36”), or the engineer shall provide drawings on Dupont Crovx Erasable Image (wash-off) sheets or approved equal. All drawings shall become the property of the Cape Fear Public Utility Authority.

Date Final Inspection Completed: _____

Inspectors Signature: _____

SECTION 03 05 00

CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete:
      a. Concrete mixes.
      b. Form materials.
      c. Reinforcing materials.
      d. Water stops.
      e. Grout mixes.
   2. Grouting:
      a. Portland cement grout.
      b. Rapid-curing epoxy grout.
      c. Non-shrink cementitious grout.
   3. Initial and final curing of horizontal and vertical concrete surfaces.

B. Requirements:
   1. Scope:
      a. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete, reinforcing, and related materials.
      b. The Work includes:
         1) Providing concrete consisting of Portland Cement, fine and coarse aggregates, water, and approved admixtures; combined, mixed, transported, placed, finished, and cured.
         2) Fabricating and placing reinforcing, including ties and supports.
         3) Design, erection, and removal of formwork.
         4) Building into the concrete all sleeves, frames, anchorage devices, inserts, and other items required to be embedded in concrete.
         5) Providing openings in concrete as required to accommodate Work under this and other Sections, and work under other contracts.
   2. Coordination:
      a. Review installation procedures under other Sections and coordinate installation of items to be installed in the concrete Work.
   3. Classifications of Concrete:
      a. The requirements in this section shall apply to the following types of concrete:
         1) Class A1 Concrete: Normal weight structural concrete to be used in all structures, sidewalks, and pavements, except where noted otherwise in the Contract Documents. All concrete shall be Class A1 concrete unless another class is specifically called for on Contract Documents or specified herein.
         2) Class A2 Concrete: Not Used
         3) Class A3 Concrete: Normal weight structural concrete to be used where specifically called for on Contract Drawings or where specifically

requested by Contractor and approved by Engineer. Class A3 concrete shall be similar to Class A1 except Class A3 concrete shall contain a mandatory addition of high range water reducer to aid in placement of concrete.

4) Class A4 Concrete: Not Used
5) Class A5 Concrete: Not Used
6) Class A6 Concrete: Normal weight structural concrete used where concrete is placed under pressure (pumped). Class A6 concrete shall be used only where specifically approved by Engineer.
7) Class B Concrete: Normal weight structural concrete used for duct bank encasements, catch basins, fence and guard post embedment, concrete fill, and other areas where specifically noted on Contract Drawings.
8) Class C Concrete: Not Used

1.2 REFERENCES

A. Standards referenced in this Section are:
1. ACI 224R, Control of Cracking in Concrete Structures.
2. ACI 301, Specifications for Structural Concrete for Buildings.
3. ACI 302R, Guide for Concrete Floor and Slab Construction.
4. ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
5. ACI 305R, Hot Weather Concreting.
6. ACI 306R, Cold Weather Concreting.
7. ACI 308.1, Specification for Curing Concrete.
8. ACI 309R, Guide for Consolidation of Concrete.
9. ACI 318, Building Code Requirements for Structural Concrete and Commentary.
10. ACI 347, Guide to Formwork for Concrete.
11. ACI 350-06, Code Requirements for Environmental Engineering Concrete Structures.
12. ACI/CRSI, Adhesive Anchor Installers.
13. ACI SP-66, ACI Detailing Manual.
14. ANSI/NSF Standard 61, Drinking Water Systems Components.
15. ASTM A82, Specification for Steel Wire, Plain, for Concrete Reinforcement.
16. ASTM A185, Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
17. ASTM A615, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
18. ASTM C31, Practice for Making and Curing Concrete Test Specimens in the Field.
19. ASTM C33, Specification for Concrete Aggregates.
20. ASTM C39, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
21. ASTM C94, Specification for Ready-Mixed Concrete.
22. ASTM C109 – Standard Test Method for Comprehensive Strength of Hydraulic Cement Mortars.
23. ASTM C138, Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
24. ASTM C143, Test Method for Slump of Hydraulic-Cement Concrete.
25. ASTM C150, Specification for Portland Cement.
26. ASTM C171, Standard Specification for Sheet Materials for Curing Concrete.
27. ASTM C172, Practice for Sampling Freshly Mixed Concrete.

28. ASTM C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
29. ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
30. ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
31. ASTM C494, Specification for Chemical Admixtures for Concrete.
32. ASTM C531, Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing's, and Polymer Concretes.
33. ASTM C579, Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing's, and Polymer Concretes.
34. ASTM C1077, Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
35. ASTM D638, Standard Test Method for Tensile Properties of Plastics.
36. ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
37. ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials.
38. ASTM E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
39. CRD-C 572, U. S. Army Corps of Engineers Specification for Polyvinylchloride Water stops.
40. CRD-C 621, Non-Shrink Grout.
41. CRSI MSP-1, Manual of Standard Practice.
42. ICC-ES AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

1.3 QUALITY ASSURANCE

A. Laboratory Trial Batch:
   1. Refer to Section 01 40 00 Quality Requirements.
   2. Owner shall employ third-party testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes. Contractor to abide by all third-party testing requirements.
   3. Tests on materials used in the production of concrete shall be required as specified in PART 2 -- PRODUCTS. These tests shall be performed by an independent testing laboratory approved by the Engineer.
   4. Trial concrete mixes shall be tested when required in accordance with Article 3.9.
   5. Field quality control tests, as specified in this Section, unless otherwise stated, will be performed by a materials testing consultant employed by the Owner. However, the Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications. Any individual who samples and tests concrete to determine if the concrete is being produced in accordance with this Specification shall be certified as a Concrete Field-Testing Technician, Grade I, in accordance with ACI CP-1 or equivalent. Testing laboratory shall conform to requirements of ASTM C-1077.
   6. Contractor shall provide a sample of reinforcing steel from each delivery if requested by Owner.
   7. Third-party testing is required for each truck delivery unless otherwise directed by Owner.

8. Each concrete mix design specified shall be verified by laboratory trial batch, unless indicated otherwise.
9. Perform the following testing on each trial batch:
    a. Aggregate gradation for fine and coarse aggregates.
    b. Slump.
    c. Air content.
    d. Compressive strength based on three cylinders each tested at seven days and at 28 days.

B. Field Tests
1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to ensure continued compliance with these Specifications. The specimens will be made by the Engineer or its representative.
    a. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days, and any additional time period as appropriate.
    b. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time as appropriate.
2. The cost of all laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Engineer in obtaining specimens for testing. The Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens, at no additional cost to the Owner.
3. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
1. Shop Drawings:
    a. List of concrete materials and concrete mix designs proposed for use. Include results of tests performed to qualify the materials and to establish the mix designs. Do not start laboratory trial batch testing until this submittal is approved by Engineer.
    b. Concrete placement drawings showing the location and type of all joints.
    c. Drawings for fabricating, bending, and placing concrete reinforcing. Comply with ACI SP-66. For walls and masonry construction, provide elevations to a minimum scale of 1/4-inch to one foot. Show bar schedules, stirrup spacing, adhesive dowels, splice lengths, diagrams of bent bars, arrangements, and assemblies, as required for fabricating and placing concrete reinforcing.
2. Product Data:
    a. Manufacturer’s specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.

B. Third-Party Submittals: Submit the following:
   1. Laboratory Trial Batch Reports: Submit laboratory test reports for concrete cylinders, materials, and mix design tests.
   2. Project identification name and number (if applicable).
   3. Date of test report.
   4. Complete identification of aggregate source of supply.
   5. Tests of aggregates for compliance with the Contract Documents.
   6. Scale weight of each aggregate.
   7. Absorbed water in each aggregate.
   8. Brand, type, and composition of cementitious materials.
   9. Brand, type, and amount of each admixture.
   10. Amounts of water used in trial mixes.
   11. Proportions of each material per cubic yard.
   12. Gross weight and yield per cubic yard of trial mixtures.
   13. Measured slump.
   14. Measured air content.
   15. Compressive strength developed at seven days and 28 days, from not less than three test cylinders cast for each seven day and 28-day test, and for each design mix.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 – Product Requirements.

B. Transportation, Delivery, and Handling:
   1. Deliver concrete reinforcing products to Site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings on approved Shop Drawings.
   2. Materials used for concrete shall be clean and free from foreign matter during transportation and handling and kept separate until measured and placed into concrete mixer.
   3. Implement suitable measures during hauling, piling, and handling to ensure that segregation of coarse and fine aggregate particles does not occur, and grading is not affected.
   4. Deliver materials from manufacturers in unopened containers that bear intact manufacturer labeling. Inspect packaging for damage before accepting.

C. Storage:
   1. Store materials according to manufacturer instructions.
   2. Store formwork materials above ground on framework or blocking. Cover wood for forms and other accessory materials with protective, waterproof covering. Provide for adequate air circulation or ventilation under cover.
   3. Store concrete reinforcing materials to prevent damage and accumulation of dirt and excessive rust. Store on heavy wood blocking so that reinforcing does not come into contact with the ground. Space framework or blocking supports to prevent excessive deformation of stored materials.
   4. Store concrete joint materials on platforms or in enclosures or covered to prevent contact with ground and exposure to weather and direct sunlight.
   5. For storage of concrete materials, provide bins or platforms with hard, clean surfaces.

D. 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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Admixtures:
   1. Air-Entraining Admixture: ASTM C260.
   2. Water-Reducing Admixture: ASTM C494, Type A.
   3. Water Reducing and Set-Adjusting Admixtures: ASTM C494, Types D and E.
   4. High Range Water-Reducing Admixture: ASTM C494, Type F/G.
   5. Use only admixtures that have been tested and approved in the mix designs.
   6. Do not use calcium chloride or admixtures containing chloride ions.

B. Aggregates: ASTM C33:
   1. Fine Aggregate:
      a. Washed natural sand.
      b. Gradation:
         1) Comply with ASTM C33.
         2) Represented by smooth granulometric curve within required limits.
      c. Free from injurious amounts of organic impurities according to ASTM C40.
   2. Coarse Aggregate:
      a. Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter.
      b. Coarse aggregate shall comply with the following:
         1) Crushed stone, processed from natural rock or stone.
         2) Washed gravel, either natural or crushed. Slag, pit gravel, and bank-run gravel are not allowed.
      c. Coarse Aggregate Size: ASTM C33, Nos. 57 or 67, unless otherwise approved by Engineer.

C. Concrete Mix:
   1. As specified per manufacturer.
   2. Portland Cement, sand, and water.
   3. Do not use ferrous aggregate or staining ingredients in grout mixes.

D. Membrane-Curing Compound Type A:
   1. Comply with ASTM C309, Type 1, Class A.
   2. Manufacturers:
      a. Super Diamond Clear VOX by the Euclid Chemical Company.
      b. MasteKure CC 300 SB by BASF Master Builder Solutions.
      c. Cure & Seal 30 Plus by Symons Corporation.
      d. Or equal. As specified in Section 01 60 00 – Product Requirements.

E. Portland Cement: Comply with ASTM C150/C150M, Type I and II:
   1. Minimum 28-day compressive strength of 4,000 psi.

F. Water: Clean, potable:
   1. 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.
         1) NBEC Grout by Five Star Products, Inc.
         2) Or equal. As specified in Section 01 60 00 – Product Requirements.

G. Epoxy Grout:
      a. Pre-packaged, non-shrink, non-metallic, 100 percent solids, solvent-free, moisture-insensitive, three-component epoxy grouting system.
      b. Minimum Seven-day Compressive Strength: 14,000 psi, when tested in accordance with ASTM C579.
      c. Products and Manufacturers:
         1) Euco High Strength Grout, by Euclid Chemical Company.
         2) Sikadur 42, Grout Pak, by Sika Corporation.
         3) Five Star Epoxy Grout, by Five Star Products, Inc.
         4) Or equal. As specified in Section 01 60 00 – Product Requirements.

H. Grout Fill:
      a. Grout mix shall consist of cement, fine and coarse aggregates, water, and admixtures complying with requirements specified in this Section for similar materials in concrete.
      b. Proportion and mix grout fill as follows:
         1) Minimum Cement Content: 564 pounds per cubic yard.
         2) Maximum Water-Cement Ratio: 0.45.
         3) Maximum Coarse Aggregate size: 1/2-inch, unless otherwise indicated.
         4) Minimum 28-day Compressive Strength: 4,000 psi.

I. Rapid-Curing Epoxy Grout:
   1. Manufacturers:
      a. Epoxy Grout
         1) Epoxy grout shall be "Sikadur 32 Hi-Mod" by Sika Corporation
         2) Duralcrete LV by Tamms Industries.
         3) Or equal. As specified in Section 01 60 00 – Product Requirements.
         4) Epoxy grout shall be modified as required for each application with aggregate per manufacturer's instructions.
   2. Description:
      a. High-strength, three-component epoxy grout formulated with thermosetting resins and inert fillers.
      b. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids, and alkalis.
   3. Performance and Design Criteria:
      a. As specified in the Contract Documents.

J. REINFORCING MATERIALS
   1. Reinforcing Bars: ASTM A615, Grade 60 deformed bars.
   2. Welded Wire Fabric: ASTM A185.

3. Steel Wire: ASTM A82.
4. Provide supports for reinforcing including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing in place.
    a. Use wire bar-type supports complying with CRSI MSP-1 recommendations, except as specified in this Section. Do not use wood, brick, or other unacceptable materials.
    b. For slabs on grade, use precast concrete blocks, four inches square minimum with compressive strength equal to or greater than the surrounding concrete, or supports with sand plates or horizontal runners where base materials will not support chair legs.
    c. For all concrete surfaces where legs of supports are in contact with forms, provide supports having either hot-dip galvanized, plastic-protected, or stainless-steel legs in accordance with CRSI MSP-1.
    d. Provide precast concrete supports over waterproof membranes.
5. Adhesive Dowels:
    a. Dowels:
        1) Dowel reinforcing bars shall comply with ASTM A615, Grade 60.
    b. Adhesive:
        1) Adhesive requirements in accordance with ICC-ES AC308.

2.2 CONCRETE MIX

A. General:
1. Normal weight: 145 pounds per cubic foot.
2. Use air-entraining admixture in all concrete. Provide not less than four percent, nor more than eight percent, entrained air for concrete exposed to freezing and thawing, and provide from three to five percent entrained air for other concrete.

B. Proportioning and Design of Class “A” Concrete Mix:
1. Minimum compressive strength at 28 days: 4,500 psi.
2. Maximum water-cement ratio by weight: 0.42.
3. Minimum cement content: 564 pounds per cubic yard.

C. Proportioning and Design of Class “B” Concrete Mix:
1. Minimum compressive strength at 28 days: 3,000 psi.
2. Maximum water-cement ratio by weight: 0.50.
3. Minimum cement content: 517 pounds per cubic yard.

D. Slump Limits:
1. Proportion and design mixes to result in concrete slump at point of placement of not less than one inch and not more than four inches.
2. When using high-range water reducers, slump prior to addition of admixture shall not exceed three inches. Slump after adding admixture shall not exceed eight inches at point of placement.

E. Adjustment of Concrete Mixes:
1. Concrete mix design adjustments may be requested by Contractor when warranted by characteristics of materials, Site conditions, weather, test results, or other, similar circumstances.

2. Submit for Engineer's approval laboratory test data for adjusted concrete mix designs, including compressive strength test results.
3. Implement adjusted mix designs only after Engineer's approval.
4. Adjustments to concrete mix designs shall not result in additional costs to Owner.

2.3 FORM MATERIALS

A. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection. Contractor shall be responsible for designing the formwork system to resist all applied loads including pressures from fluid concrete and construction loads.

B. Smooth Form Surfaces: Acceptable panel-type to provide continuous, straight, smooth, as-cast surfaces in accordance with ACI 301.

C. Unexposed Concrete Surfaces: Material to suit project conditions.

D. Provide 3/4-inch chamfer at all external corners. Chamfer is not required at re-entrant corners unless otherwise shown or indicated.

E. Form Ties:
1. Provide factory-fabricated, removable, or snap-off metal form ties, that prevent form deflection and prevent spalling of concrete surfaces upon removal. Materials used for tying forms are subject to approval of Engineer.
2. Unless otherwise shown or indicated, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1.5 inches from outer surface of concrete. Unless otherwise shown or indicated, provide form ties that, upon removal, will leave a uniform, circular hole not larger than one-inch diameter in the concrete surface.
3. Ties for exterior walls, below-grade walls, and walls subject to hydrostatic pressure shall be provided with water stops.
4. Wire ties are unacceptable.

2.4 RELATED MATERIALS

A. Water stops:
1. All water stops shall comply with ACI 350-06.
2. Polyvinyl Chloride (PVC) Water stops:
   a. Manufacturers: Provide products of one of the following:
      1) BoMetals, Inc.
      2) DuraJoint Concrete Accessories.
      3) Sika Greenstreak.
      4) Or equal. As specified in Section 01 60 00 – Product Requirements.
   b. Water stops shall comply with CRD-C 572. Water stop material shall have an off-white, milky color. Water stops shall be manufactured from virgin PVC. Do not use reclaimed or scrap material.
   c. Minimum Thickness: 3/8-inch.

d. Provide water stops with minimum of seven ribs equally spaced at each end on each side with the first rib located at the edge. Each rib shall be minimum 1/8-inch in height.
e. Construction Joints: Water stops shall be six-inch wide flat-strip type.
f. Expansion Joints: Water stops shall be nine-inch wide, ribbed with a center bulb. The center bulb shall have a minimum outside diameter of one-inch and a minimum inside diameter of 1/2-inch.
g. The required minimum physical characteristics for this material are:
    1) Tensile strength - 1,750 psi (ASTM D-638).
    2) Ultimate elongation - not less than 280% (ASTM D-638).
h. Contractor shall furnish certification that the proposed water stops meet the above requirements.
i. All water stop intersections, both vertical and horizontal, shall be made from factory fabricated corners and transitions. Only straight butt joint splices shall be made in field.

3. Expanding Rubber Water stops:
    a. Expanding rubber shall be designed to expand under hydrostatic conditions. Water stops shall be Adeka Ultra Seal MC-2010M by Adeka Ultra Seal/OCM, Inc., or Hydrotite CJ-1020-2K by Sika Greenstreak, for concrete thickness greater than nine inches. For thicknesses less than nine inches, Adeka Ultra Seal KBA-1510FF or Hydrotite CJ-1020-2K shall be used.
    b. Water stop shall be a chemically modified natural rubber product with a hydrophilic agent.
    c. Water stop has a stainless-steel mesh or coextrusion of non-hydrophilic rubber to direct expansion in the thickness direction and restrict the expansion in the longitudinal direction.
4. Hydrophilic Water stops:
    a. Products and Manufacturers:
        1) Duroseal Gasket, by BBZ USA, Inc.
        2) Adeka Ultraseal MC-2010M, by Asahi Denka Kogyo K.K.
        3) Hydrotite, by Greenstreak Plastic Products Company.
        4) Or equal. As specified in Section 01 60 00 – Product Requirements.
    b. Hydrophilic water stop materials shall be bentonite-free and shall expand by minimum of 80 percent of dry volume in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast.
    c. Water stop material shall be composed of resins and polymers that absorb water and cause a completely reversible and repeatable increase in volume.
    d. Water stop material shall be dimensionally stable after repeated wet-dry cycles with no deterioration of swelling potential.
    e. Select material in accordance with manufacturer’s recommendations for type of liquid to be contained.
    f. Minimum cross-sectional dimensions: 3/16-inch by 3/4-inch.
    g. Location of hydrophilic water stops shall be as shown or indicated on the Drawings, or where approved by Engineer.
    h. Hydrophilic Sealant: Shall adhere firmly to concrete, metal, and PVC in dry or damp condition and be indefinitely elastic when cured.
        1) Products and Manufacturers:
            i) Duroseal Paste, by BBZ USA, Inc.
            ii) Adeka Ultraseal P-201, by Asahi Denka Kogyo K.K.
            iii) Hydrotite, by Greenstreak Plastic Products Company.

iv) Or equal. As specified in Section 01 60 00 – Product Requirements.

5. Water stop Adhesive:
   a. Adhesive between water stops and existing concrete.
      1) Products and Manufacturers:
         i) 20+F Contact Cement by Miracle Adhesives Corporation
         ii) Neoprene Adhesive 77-198 by JGF Adhesives
         iii) Sikadur 31 Hi-Mod Gel by Sika Corporation
         iv) DP-605 NS Urethane Adhesive by 3M Adhesive Systems.
         v) Or equal. As specified in Section 01 60 00 – Product Requirements.
   b. Hydrophilic, non-bentonite water swelling elastic sealant shall be used to bond expanding rubber water stops to rough surfaces.
      1) Products and Manufacturers:
         i) P-201 by Adeka Ultra Seal/OCM, Inc.
         ii) Leakmaster LV-1 by Sika Greenstreak.
         iii) Or equal. As specified in Section 01 60 00 – Product Requirements.
6. Vapor Retarder:
   a. Products and Manufacturers:
      1) Stego Wrap 10-mil Vapor Retarder, by Stego Industries LLC.
      2) Griffolyn 10-mil, by Reef Industries.
      3) Moistop Ultra, by Fortifiber Industries.
      4) Or equal. As specified in Section 01 60 00 – Product Requirements.
   b. Vapor retarder membrane shall comply with the following.
      1) Water Vapor Transmission Rate, ASTM E96: 0.04 perms or lower.
      2) Water Vapor Retarder, ASTM E1745: Meets or exceeds Class C.
      3) Thickness of Retarder (plastic), ACI 302 1R: Not less than 10 mils.
      4) Provide accessories by same manufacturer as vapor retarder.
7. Membrane-Forming Curing Compound: ASTM C309, Type I.
8. Epoxy Bonding Agent:
   a. Two-component epoxy resin bonding agent.
   b. Products and Manufacturers:
      1) Sikadur 32, Hi-Mod LPL, by Sika Corporation.
      2) Eucopoxy LPL, by the Euclid Chemical Company.
      3) Or equal. As specified in Section 01 60 00 – Product Requirements.
9. Epoxy-Cement Bonding Agent:
   a. Three-component blended epoxy resin-cement bonding agent.
   b. Products and Manufacturers:
      1) Sika Armatec 110 EpoCem, by Sika Corporation.
      2) Duralprep A.C., by Euclid Chemical Company.
      3) Or equal. As specified in Section 01 60 00 – Product Requirements.
10. Preformed Expansion Joint Filler:
    a. Provide preformed expansion joint filler complying with ASTM D1752, Type I (sponge rubber) or Type II (cork).

PART 3 EXECUTION

3.1 INSPECTION

A. Contractor shall examine the substrate and the conditions under which the Work will be performed and notify Engineer in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 FORMWORK

A. Construct formwork in accordance with ACI 347 such that concrete members and structures are of correct size, shape, alignment, elevation, and position.

B. Provide openings in formwork to accommodate the Work of other trades. Accurately place and securely support items required to be built into formwork.

C. Clean and adjust forms prior to placing concrete. Apply form release agents or wet forms as required. Re-tighten forms during and after concrete placing, when required, to eliminate cement paste leaks.

D. Removing Formwork:
   1. Comply with ACI 301 and ACI 347, except as otherwise indicated in the Contract Documents.
   2. Do not remove formwork and shoring until supported concrete members have acquired minimum of 90 percent of specified compressive strength. Results of suitable quality control tests of field-cured specimens may be submitted to Engineer for review as evidence that concrete has attained sufficient strength for removal of supporting formwork and shoring prior to removal times indicated in the Contract Documents.
   3. Removal time for formwork is subject to Engineer's acceptance.
   4. Repair form tie-holes following in accordance with ACI 301.

3.3 REINFORCING, JOINTS, AND EMBEDDED ITEMS

A. Comply with the applicable recommendations of Laws and Regulations and standards referenced in this Section, including CRSI MSP-1, for details and methods of placing and supporting reinforcing.

B. Clean reinforcing to remove loose rust and mill scale, earth, ice, and other materials which act to reduce or destroy bond between reinforcing material and concrete.

C. Position, support, and secure reinforcing against displacement during formwork construction and concrete placing. Locate and support reinforcing by means of metal chairs, runners, bolsters, spacers, and hangers, as required.
   1. Place reinforcing to obtain minimum concrete coverages as shown on the Drawings and as required in ACI 318. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcing accurately in position during concrete placing. Set with ties so that twisted ends are directed away from exposed concrete surfaces.
   2. Do not secure reinforcing to formwork using wire, nails, or other ferrous metal. Metal supports subject to corrosion shall not be in contact with formed or exposed concrete surfaces.

D. Provide sufficient quantity of supports of strength required to carry reinforcing. Do not place reinforcing more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

E. Splices: Provide standard reinforcing splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown or indicated for minimum lap of spliced bars, as shown on the Drawings or in accordance with the requirements of ACI 318.

F. Install welded wire fabric in lengths as long as practical, lapping adjoining sections a minimum of one full mesh.

G. Do not place concrete until reinforcing is inspected and Engineer indicates that conditions are acceptable for placing concrete. Concrete placed in violation of this paragraph will be rejected. Notify Engineer in writing at least two working days prior to proposed concrete placement.

H. Joints:
   1. Provide construction, isolation, expansion, and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure. Place isolation and control joints in slabs-on-grade to stabilize differential settlement and random cracking.
   2. In mats and structural slabs and beams, locate joints in compliance with ACI 224R.
   3. Locations of joints shall be in accordance with the Contract Documents and as approved by Engineer in the Shop Drawings.
   4. Where construction joints are indicated to be roughened, intentionally roughen surfaces of previously placed concrete to amplitude of 1/4-inch.

I. Installation of Embedded Items:
   1. Sleeves, pipe stubs, inserts, anchors, expansion joint material, water stops, and other embedded items shall be positioned accurately and supported against displacement prior to concreting. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.
   2. Set and build into the Work anchorage devices and embedded items required for other Work that is attached to, or supported by, cast-in-place concrete. Use setting diagrams, templates, and instructions provided under other Sections and, when applicable, other contracts for locating and setting. Refer to Paragraph 1.1.B of this Section. Do not embed in concrete uncoated aluminum items. Where aluminum items are in contact with concrete surfaces, coat aluminum to prevent direct contact with concrete.

J. Adhesive Dowels:
   1. Where shown on the Drawings, reinforcing bars anchored into hardened concrete with a dowel adhesive system shall use a two-component adhesive mix which shall be injected with a static mixing nozzle following manufacturer's instructions.
   2. Determine location of existing reinforcing steel in vicinity of proposed holes prior to drilling. Adjust location of holes to be drilled to avoid drilling through or damaging existing reinforcing bars only when approved by Engineer.

3. All holes shall be drilled in accordance with the manufacturer's instructions except that core drilled holes shall not be permitted unless specifically allowed by the Engineer. Cored holes, if allowed by the manufacturer and approved by the Engineer, shall be roughened in accordance with manufacturer's requirements.
4. Thoroughly clean drill holes of all debris, drill dust, and water in accordance with manufacturer's instructions with compressed air and a wire brush prior to installation of adhesive and reinforcing bar.
5. Degree of hole dampness shall be in strict accordance with manufacturer recommendations. Installation conditions shall be either dry or water saturated. Water filled or submerged shall not be permitted unless specifically approved by the Engineer.
6. Twist dowels during insertion into partially filled hole to guarantee full wetting of bar surface with adhesive. Injection of adhesive into the hole shall be performed in a manner to minimize the formation of air pockets in accordance with the manufacturer's instructions.
7. Embedment Depth:
    a. The embedment depth of the bar shall be as shown on the Drawings. Although all manufacturers listed below are permitted, the embedment depth shown on the Drawings is based on "PE 1000+" by Powers Fasteners. If the Contractor submits one of the other named dowel adhesives from the list below, the Engineer shall evaluate the required embedment and the Contractor shall provide the required embedment depth stipulated by the Engineer specific to the approved dowel adhesive.
    b. Where the embedment depth is not shown on the Drawings, the embedment depth shall be determined to provide the minimum allowable bond strength equal to the tensile strength of the rebar according to the manufacturer's ICC-ES ESR.
    c. The embedment depth shall be determined using the actual concrete compressive strength, a cracked concrete state, maximum long-term temperature of 110 degrees F, maximum short-term temperature of 140 degrees F, continuous special inspection of all horizontal and overhead installations, and periodic special inspection of all other installations. In no case shall the embedment depth be less than the minimum, or more than the maximum, embedment depths stated in the manufacturer's ICC-ES ESR.
8. Engineer's approval is required for use of this system in locations other than those shown on the Drawings.
9. The adhesive system shall be IBC compliant for use in both cracked and uncracked concrete in all Seismic Design Categories and shall be:
    a. Epcon C6+ Adhesive Anchoring System as manufactured by ITW Redhead
    b. HIT-HY 200 Adhesive Anchoring System as manufactured by Hilti, Inc.
    c. SET-XP Epoxy Adhesive Anchors as manufactured by Simpson Strong-Tie Co.
    d. PE-1000+ Epoxy Adhesive Anchor System" by Powers Fasteners.
    e. Fast-set epoxy formulations shall not be acceptable.
    f. Or equal. As specified in Section 01 60 00 – Product Requirements.
10. All individuals installing dowel adhesive system shall be certified as an Adhesive Anchor Installer in accordance with the ACI-CRSI Anchor Installation Certification Program.

3.4 CONCRETE PLACING

A. Site Mixing: Use drum-type batch machine mixer, mixing not less than 1.5 minutes for one cubic yard or smaller capacity. Increase required mixing time by minimum of 15 seconds for each additional cubic yard or fraction thereof.

B. Ready-Mixed Concrete: Comply with ASTM C94.

C. Concrete Placing:
   1. Prior to placement, all reinforcement shall be secured.
   2. Place concrete in a continuous operation within planned joints or sections in accordance with ACI 304R.
   3. Do not begin placing concrete until work of other trades affecting concrete is completed.
   4. Wet concrete and subgrade surfaces to saturated surface dry condition immediately prior to placing concrete.
   5. Deposit concrete as near its final location as practical to avoid segregation due to re-handling or flowing.
   6. Avoid separation of the concrete mixture during transportation and placing. Concrete shall not free-fall for distance greater than four feet during placing.
   7. Complete concrete placing within 90 minutes of addition of water to the dry ingredients.

D. Consolidate placed concrete in accordance with ACI 309R using mechanical vibrating equipment supplemented with hand rodding and tamping, such that concrete is worked around placing and other embedded items and into all parts of formwork. Insert and withdraw vibrators vertically at uniformly spaced locations. Do not use vibrators to transport concrete within the formwork. Vibration of formwork or placing is not allowed.

E. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.
   1. In hot weather comply with ACI 305R.
   2. In cold weather comply with ACI 306R.

3.5 QUALITY OF CONCRETE WORK

A. Make concrete solid, compact, smooth, and free of laitance, cracks, and cold joints.

B. Concrete for liquid-retaining structures and concrete in contact with earth, water, or exposed directly to the elements shall be watertight.

C. Cut out and properly replace to extent directed by Engineer, or repair to satisfaction of Engineer, surfaces that contain cracks or voids, are unduly rough, or are in defective in any way. Patches or plastering are unacceptable.

D. Repair, removal, and replacement of defective concrete directed by Engineer shall be at no additional cost to Owner.

3.6 CONCRETE CURING

A. Use of curing compound:
   1. Curing compound should be applied as per manufacturer’s recommendations.

2. Curing compound shall be used only where specifically approved by the Engineer. Curing compound shall never be used for curing exposed walls with fluid or earth backfill on the opposite side. A continuous wet cure for a minimum of five days is required for these applications. Curing compound shall not be used on surfaces exposed to water in potable water storage tanks and treatment plants unless curing compound is certified in accordance with ANSI/NSF Standard 61.
3. When permitted, the curing compound shall maintain the concrete in a moist condition for the required time period, and the subsequent appearance of the concrete surface shall not be affected.
4. The compound shall be applied in accordance with the manufacturer's recommendations after water sheen has disappeared from the concrete surface and after finishing operations. Maximum coverage for the curing and sealing compound shall be 300 square feet per gallon for trowel finishes and 200 square feet per gallon for floated or broom surfaces. Maximum coverage for compounds placed where subsequent finishes will be applied shall be 200 square feet per gallon. For rough surfaces, apply in two directions at right angles to each other.

B. Protection and Curing.
1. All freshly placed concrete shall be protected from the elements, flowing water and from defacement of any nature during construction operations.
2. As soon as the concrete has been placed and horizontal top surfaces have received their required finish, provision shall be made for maintaining the concrete in a moist condition for at least a 5-day period thereafter except for high early strength concrete, for which the period shall be at least the first three days after placement. Horizontal surfaces shall be kept covered, and intermittent, localized drying will not be permitted.
    a. Walls that will be exposed on one side with either fluid or earth backfill on the opposite side shall be continuously wet cured for a minimum of five days. Use of a curing compound will not be acceptable for applications of this type.
3. The Contractor shall use one of the following methods to ensure that the concrete remains in a moist condition for the minimum period stated above.
    a. Ponding or continuous fogging or sprinkling.
    b. Application of mats or fabric kept continuously wet.
    c. Continuous application of steam (under 150°F).
    d. Application of sheet materials conforming to ASTM C171.
    e. Other means as approved by the Engineer.
4. The Contractor shall keep absorbent wood forms wet until they are removed. After form removal, the concrete shall be cured by one of the methods in paragraph D.
5. Any of the curing procedures used in Article 3.6 may be replaced by one of the other curing procedures listed in Article 3.6 after the concrete is one-day old. However, the concrete surface shall not be permitted to become dry at any time.

C. Curing Concrete Under Cold Weather Conditions
1. Suitable means shall be provided for a minimum of 72 hours after placing concrete to maintain it at or above the minimum as placed temperatures specified in this Section, for concrete work in cold weather. During the 72-hour period, the concrete surface shall not be exposed to air more than 20°F above the minimum as placed temperatures.
2. Stripping time for forms and supports shall be increased as necessary to allow for retardation in concrete strength caused by colder temperatures. This retardation is

magnified when using concrete made with blended cements or containing fly ash or ground granulated blast furnace slag. Therefore, curing times and stripping times shall be further increased as necessary when using these types of concrete.

3. The methods of protecting the concrete shall be approved by the Engineer and shall be such as will prevent local drying. Equipment and materials approved for this purpose shall be on the site in sufficient quantity before the work begins. The Contractor shall assist the Engineer by providing holes in the forms and the concrete in which thermometers can be placed to determine the adequacy of heating and protection. All such thermometers shall be furnished by the Contractor in quantity and type which the Engineer directs.
4. Curing procedures during cold weather conditions shall conform to the requirements of ACI 306.

D. Curing Concrete Under Hot Weather Conditions.
   1. When air temperatures exceed 85°F, the Contractor shall take extra care in placing and finishing techniques to avoid formation of cold joints and plastic shrinkage cracking. If ordered by the Engineer, temporary sunshades and/or windbreakers shall be erected to guard against such developments, including generous use of wet burlap coverings and fog sprays to prevent drying out of the exposed concrete surfaces.
   2. Immediately after screeding, horizontal surfaces shall receive an application of evaporation reducer. Apply in accordance with manufacturer's instructions. Final finish work shall begin as soon as the mix has stiffened sufficiently to support the workmen.
   3. Curing and protection of the concrete shall begin immediately after completion of the finishing operation. Continuous moist curing consisting of method a or b listed in paragraph 3.6.A.3 is mandatory for at least the first 24 hours. Method 2 may be used only if the finished surface is not marred or blemished during contact with the coverings.
   4. At the end of the initial 24-hour period, curing and protection of the concrete shall continue for at least six (6) additional days using one of the following methods:
      a. Ponding or continuous fogging or sprinkling.
      b. Application of mats or fabric kept continuously wet.
      c. Continuous application of steam (under 150°F).
      d. Application of sheet materials conforming to ASTM C171.
      e. Other means as approved by the Engineer.
   5. Curing procedures during hot weather conditions shall conform to the requirements of ACI 305.

E. Use of Curing Compound
   1. Curing compound shall be used only where specifically approved by the Engineer. Curing compound shall never be used for curing exposed walls with fluid or earth backfill on the opposite side. A continuous wet cure for a minimum of five days is required for these applications. Curing compound shall not be used on surfaces exposed to water in potable water storage tanks and treatment plants unless curing compound is certified in accordance with ANSI/NSF Standard 61.
   2. When permitted, the curing compound shall maintain the concrete in a moist condition for the required time period, and the subsequent appearance of the concrete surface shall not be affected.

3. The compound shall be applied in accordance with the manufacturer's recommendations after water sheen has disappeared from the concrete surface and after finishing operations. Maximum coverage for the curing and sealing compound shall be 300 square feet per gallon for trowel finishes and 200 square feet per gallon for floated or broom surfaces. Maximum coverage for compounds placed where subsequent finishes will be applied shall be 200 square feet per gallon. For rough surfaces, apply in two directions at right angles to each other.

F. Early Termination of Curing
   1. Moisture retention measures may be terminated earlier than the specified times only when at least one of the following conditions is met:
      a. The strength of the concrete reaches 85 percent of the specified 28-day compressive strength in laboratory-cured cylinders representative of the concrete in place, and the temperature of the in-place concrete has been constantly maintained at 50 degrees Fahrenheit or higher.
      b. The strength of concrete reaches the specified 28-day compressive strength as determined by accepted nondestructive methods or laboratory-cured cylinder test results.

3.7 FINISHING

A. Finishes on Formed Concrete Surfaces:
   1. After removal of forms, the finishes described below shall be applied in accordance with this Article. Unless the finish schedule specifies otherwise, all surfaces shall receive at least a Type I finish. The Engineer shall be the sole judge of acceptability of all concrete finish work.
      a. Type I - Rough: All fins, burrs, offsets, marks, and all other projections left by the forms shall be removed. Projections, depressions, etc. below finished grade required to be removed will only be those greater than 1/4-inch. All holes left by removal of ends of ties, and all other holes, depressions, bug holes, air/blow holes or voids shall be filled solid with cement grout after first being thoroughly wetted and then struck off flush. The only holes below grade to be filled will be tie holes and any other holes larger than 1/4-inch in any dimension. Honeycombs shall be chipped back to solid concrete and repaired as directed by the Engineer. All holes shall be filled with tools, such as sponge floats and trowels, that will permit packing the hole solidly with cement grout. Cement grout shall consist of one-part cement to three parts sand, epoxy bonding agent (for tie holes only) and the amount of mixing water shall be as little as consistent with the requirements of handling and placing. Color of cement grout shall match the adjacent wall surface.
      b. Type II - Grout Cleaned: Where this finish is required, it shall be applied after completion of Type I finish. After the concrete has been predampened, a slurry consisting of one-part cement (including an appropriate quantity of white cement in order to produce a color matching the surrounding concrete) and 1-1/2 parts sand passing the No. 16 sieve, by damp loose volume, shall be spread over the surface with clean burlap pads or sponge rubber floats. Mix proportions shall be submitted to the Engineer after a sample of the work is established and accepted. Any surplus shall be removed by scraping and then rubbing with clean burlap.

c. Type III - Smooth Rubbed: Where this finish is required, it shall be applied after the completion of the Type II finish. No rubbing shall be done before the concrete is thoroughly hardened and the mortar used for patching is firmly set. A smooth, uniform surface shall be obtained by wetting the surface and rubbing it with a carborundum stone to eliminate irregularities. Unless the nature of the irregularities requires it, the general surface of the concrete shall not be cut into. Corners and edges shall be slightly rounded by the use of the carborundum stone. Brush finishing or painting with grout or neat cement will not be permitted. A 100 square foot example shall be established at the beginning of the project to establish acceptability. Apply chemical floor hardener to exposed interior concrete floor areas when cured and dry, in accordance with hardener manufacturer's instructions.

B. Slab and Floor Finishes:
   1. The finishes described below shall be applied to floors, slabs, flow channels and top of walls in accordance with this Article. The Engineer shall be the sole judge of acceptability of all such finish work.
      a. Type "A" – Screeded: This finish shall be obtained by placing screeds at frequent intervals and striking off to the surface elevation required. When a Type "F" finish is subsequently to be applied, the surface of the screeded concrete shall be roughened with a concrete rake to 1/2" minimum deep grooves prior to final set.
      b. Type "B" – Wood or Magnesium Floated: This finish shall be obtained after completion of a Type "A" finish by working a previously screeded surface with a wood or magnesium float or until the desired texture is reached. Floating shall begin when the water sheen has disappeared and when the concrete has sufficiently hardened so that a person's foot leaves only a slight imprint. If wet spots occur, water shall be removed with a squeegee. Care shall be taken to prevent the formation of laitance and excess water on the finished surface. All edges shall be edged with a 1/8-inch tool as directed by the Engineer. The finished surface shall be true, even, and free from blemishes and any other irregularities.
      c. Type "C" – Cork Floated: This finish shall be similar to Type "B" but slightly smoother than that obtained with a wood float. It shall be obtained by power or band floating with cork floats.
      d. Type "D" – Steel Troweled: This finish shall be obtained after completion of a Type "B" finish. When the concrete has hardened sufficiently to prevent excess fine material from working to the surface, the surface shall be compacted and smoothed with not less than two thorough and complete steel troweling operations. In areas which are to receive a floor covering such as tile, resilient flooring, or carpeting, the applicable Specification Sections and Contract Drawings shall be reviewed for the required finishes and degree of flatness. In areas that are intermittently wet such as pump rooms, only one troweling operation is required to provide some trowel marks for slip resistance. All edges shall be edged with a 1/8-inch tool as directed by the Engineer. The finish shall be brought to a smooth, dense surface, free from defects and blemishes.
      e. Type "E" – Broom or Belt: This finish shall provide the surface with a transverse scored texture by drawing a broom or burlap belt across the surface immediately after completion of a Type "B" finish. All edges shall be

edged with a ⅛-inch tool as directed by the Engineer. Type "F" - Swept in Grout Topping: This finish shall be applied after a completion of a Type "A" finish. The concrete surface shall be properly cleaned, washed, and coated with a mixture of water and Portland Cement. Cement grout in accordance with this Section shall then be plowed and swept into neat conformance with the blades or arms of the apparatus by turning or rotating the previously positioned mechanical equipment. Special attention shall be paid to true grades, shapes and tolerances as specified by the manufacturer of the equipment. Before beginning this finish, the Contractor shall notify the Engineer and the equipment manufacturer of the details of the operation and obtain approval and recommendations.

f. Type "F" – Swept in Grout Topping: This finish shall be applied after a completion of a Type "A" finish. The concrete surface shall be properly cleaned, washed, and coated with a mixture of water and Portland Cement. Cement grout in accordance with this Section shall then be plowed and swept into neat conformance with the blades or arms of the apparatus by turning or rotating the previously positioned mechanical equipment. Special attention shall be paid to true grades, shapes and tolerances as specified by the manufacturer of the equipment. Before beginning this finish, the Contractor shall notify the Engineer and the equipment manufacturer of the details of the operation and obtain approval and recommendations.

g. Type “G” – Hardened Finish: This finish shall be applied after completion of a Type “B” or Type “C” finish and prior to application of a Type “D” finish. Hardeners shall be applied in strict accordance with the manufacturer’s requirements. Hardeners shall be applied using a mechanical spreader. The hardener shall be applied in two shakes with the first shake comprising 2/3 of the total amount. Type “D” finish shall be applied following completion of application of the hardener.
   1) Non-metallic floor hardener shall be applied where specifically required on the Contract Drawings at the rate of 1.0 pounds/ft^2.
   2) Non-oxidizing heavy duty metallic floor hardener shall be applied at the loading docks and where specifically required on the Contract Drawings or specified herein at the rate of 1.5 pounds/ft^2.

h. Type "H" – Non-Slip Finish: This finish shall be provided by applying a non-slip flooring additive concurrently with the application of a Type "D" finish and/or installation of floor sealants. Application procedure shall be in accordance with manufacturer's instructions. Finish shall be applied where specifically required on the Contract Drawings or specified herein

i. Type "J" – Raked Finish: This finish shall be provided by raking the surface as soon as the condition of the concrete permits by making depressions of ± ¼ inch.

C. Concrete Sealers:
   1. Concrete sealers shall be applied where specifically required on the Contract Drawings or specified herein.
   2. Sealers shall be applied after installation of all equipment, piping, etc. and after completion of any other related construction activities. Application of sealers shall be in strict accordance with manufacturer’s requirements.
   3. Sealers shall be applied to all floor slabs not painted and not intended to be immersed.

4. Floor slabs subjected to vehicular traffic shall be sealed with the concrete liquid densifier and sealer.
5. All other floor slabs to receive sealer shall be sealed with concrete floor sealer.

D. Finishes on Equipment Pads:
1. Formed surfaces of equipment pads shall receive a Type III finish.
2. Top surfaces of equipment pads, except those surfaces subsequently required to receive grout and support equipment bases, shall receive a Type "D" finish, unless otherwise noted. Surfaces which will later receive grout shall, before the concrete takes its final set, be made rough by removing the sand and cement that accumulates on the top to the extent that the aggregate will be exposed with irregular indentations in the surface up to 1/2 inch deep.

3.8 GROUT PLACING

A. General:
1. The different types of grout shall be used for the applications stated below unless noted otherwise in the Contract Documents. Where grout is called for in the Contract Documents which does not fall under any of the applications stated below, non-shrink grout shall be used unless another type is specifically referenced.
   a. Cement grout shall be used for grout toppings and for patching of fresh concrete.
   b. Non-shrink grout shall be used for grouting beneath base plates of structural metal framing. Dry packing is not allowed, unless otherwise indicated.
   c. Epoxy grout shall be used for bonding new concrete to hardened concrete.
   d. Epoxy base plate grout shall be used for precision seating of base plates including base plates for all equipment such as engines, mixers, pumps, vibratory and heavy impact machinery, etc.
2. New concrete surfaces to receive cement grout shall be as specified in this Section and shall be cleaned of all dirt, grease, and oil-like films. Existing concrete surfaces shall likewise be cleaned of all similar contamination and debris, including chipping, or roughening the surface if a laitance or poor concrete is evident. The finish of the grout surface shall match that of the adjacent concrete.
3. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
4. The Contractor, through the manufacturer of a non-shrink grout and epoxy grout, shall provide on-site technical assistance upon request, at no additional cost to the Owner.

B. Consistency:
1. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow.

C. Measurement of Ingredients:
1. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.

2. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

D. Grout Installation:
   1. General:
      a. The different types of grout shall be used for the applications stated below unless noted otherwise in the Contract Documents. Where grout is called for in the Contract Documents which does not fall under any of the applications stated below, non-shrink grout shall be used unless another type is specifically referenced.
         1) Cement grout shall be used for grout toppings and for patching of fresh concrete.
         2) Non-shrink grout shall be used for grouting beneath base plates of structural metal framing.
         3) Epoxy grout shall be used for bonding new concrete to hardened concrete.
         4) Epoxy base plate grout shall be used for precision seating of base plates including base plates for all equipment such as engines, mixers, pumps, vibratory and heavy impact machinery, etc.
      b. New concrete surfaces to receive cement grout shall be as specified in this Section and shall be cleaned of all dirt, grease, and oil-like films. Existing concrete surfaces shall likewise be cleaned of all similar contamination and debris, including chipping, or roughening the surface if a laitance or poor concrete is evident. The finish of the grout surface shall match that of the adjacent concrete. Curing and protection of cement grout shall be as specified in this Section.
      c. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
      d. The Contractor, through the manufacturer of a non-shrink grout and epoxy grout, shall provide on-site technical assistance upon request, at no additional cost to the Owner.
   2. Formwork:
      a. Construct leakproof forms anchored and shored to withstand grout pressures.
      b. Install formwork with clearances to permit proper placement of grout.
      c. As specified in this Section.
   3. Mixing:
      a. All mixing, surface preparation, handling, placing, and consolidation shall be completed according to the manufacturer’s recommendations.
   4. Placing of Grout:
      a. Grout shall be placed quickly and continuously, shall completely fill the space to be grouted and be thoroughly compacted and free of air pockets.
      b. The grout may be poured in place, pressure grouted by gravity, or pumped.
      c. The use of pneumatic pressure or dry-packed grouting requires approval of the Engineer.
      d. For grouting beneath base plates, grout shall be poured from one side only and thence flow across to the open side to avoid air-entrapment.
   5. Curing:
      a. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or by using wet burlap method.

b. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
c. After grout has attained its initial set, keep damp for minimum three days.

3.9 FIELD QUALITY CONTROL

A. Site Testing Services:
1. Owner shall employ independent testing laboratory to perform field quality control testing for concrete. Engineer will direct where samples are obtained.
2. Testing laboratory will provide all labor, material, and equipment required for sampling and testing concrete, including scale, glass tray, cones, rods, molds, air tester, thermometer, and other incidentals required.

B. Inspection and Testing of Grout:
1. Comply with ACI 318 and as specified in Section 01 40 00 – Quality Requirements.
2. Tests of grout components may be performed to ensure compliance with specified requirements.

C. Quality Control Testing During Construction:
1. Field Testing of Concrete
   a. The Contractor shall coordinate with the Engineer's project representative the on-site scheduling of the materials testing consultant personnel as required for concrete testing.
   b. Concrete for testing shall be supplied by the Contractor at no additional cost to the Owner, and the Contractor shall provide assistance to the materials testing consultant in obtaining samples. The Contractor shall dispose of and clean up all excess material.
2. Consistency
   a. The consistency of the concrete will be checked by the materials testing consultant by standard slump cone tests. The Contractor shall make any necessary adjustments in the mix as the Engineer and/or the materials testing consultant may direct and shall upon written order suspend all placing operations in the event the consistency does not meet the intent of the specifications. No payment shall be made for any delays, material, or labor costs due to such eventualities.
   b. Slump tests shall be made in accordance with ASTM C143. Slump tests will be performed as deemed necessary by the materials testing consultant and each time compressive strength samples are taken.
   c. Concrete with a specified nominal slump shall be placed having a slump within 1” (higher or lower) of the specified slump. Concrete with a specified maximum slump shall be placed having a slump less than the specified slump.
3. Unit Weight
   a. Samples of freshly mixed concrete shall be tested for unit weight by the materials testing consultant in accordance with ASTM C138.
   b. Unit weight tests will be performed as deemed necessary by the Engineer and each time compressive strength samples are taken.
4. Air Content
   a. Samples of freshly mixed concrete will be tested for entrained air content by the materials testing consultant in accordance with ASTM C231.

b. Air content tests will be performed as deemed necessary by the materials testing consultant and each time compressive strength samples are taken.
c. In the event test results are outside the limits specified, additional testing shall occur. Admixture quantity adjustments shall be made immediately upon discovery of incorrect air entrainment.

5. Compressive Strength
   a. Samples of freshly mixed concrete will be taken by the materials testing consultant and tested for compressive strength in accordance with ASTM C172, C31, and C39, except as modified herein.
   b. In general, one sampling shall be taken for each placement in excess of five (5) cubic yards, with a minimum of one (1) sampling for each day of concrete placement operations, or for each one hundred (100) cubic yards of concrete, or for each 5,000 square feet of surface area for slabs or walls, whichever is greater.
   c. Each sampling shall consist of at least five (5) 6x12 cylinders or (8) 4x8 cylinders. Each cylinder shall be identified by a tag, which shall be hooked or wired to the side of the container. The materials testing consultant will fill out the required information on the tag, and the Contractor shall satisfy himself that such information shown is correct.
   d. The Contractor shall be required to furnish labor to the Owner for assisting in preparing test cylinders for testing. The Contractor shall provide approved curing boxes for storage of cylinders on site. The insulated curing box shall be of sufficient size and strength to contain all the specimens made in any four consecutive working days and to protect the specimens from falling over, being jarred, or otherwise disturbed during the period of initial curing. The box shall be erected, furnished, and maintained by the Contractor. Such box shall be equipped to provide the moisture and to regulate the temperature necessary to maintain the proper curing conditions required by ASTM C31. Such box shall be located in an area free from vibration such as pile driving and traffic of all kinds and such that all specimens are shielded from direct sunlight and/or radiant heating sources. No concrete requiring inspection shall be delivered to the site until such storage curing box has been provided. Specimens shall remain undisturbed in the curing box until ready for delivery to the testing laboratory but not less than sixteen hours.
   e. The Contractor shall be responsible for maintaining the temperatures of the curing box during the initial curing of test specimens with the temperature preserved between 60°F and 80°F as measured by a maximum-minimum thermometer. The Contractor shall maintain a written record of curing box temperatures for each day curing box contains test specimens. Temperature shall be recorded a minimum of three times a day with one recording at the start of the workday and one recording at the end of the work day.
   f. When transported, the cylinders shall not be thrown, dropped, allowed to roll, or be damaged in any way.
   g. Compression tests shall be performed in accordance with ASTM C39. For 6x12 cylinders, two test cylinders will be tested at seven days and two at 28 days. For 4x8 cylinders, three test cylinders will be tested at seven days, three at 28 days. The remaining cylinders will be held to verify test results, if needed.

6. When ordered by the Engineer, additional tests shall be provided and paid for by the Contractor.

END OF SECTION

SECTION 03 40 01 - PRECAST CONCRETE CONTROL BUILDING

PART 1 GENERAL

1.1 SUMMARY

A. Furnish precast concrete, fully assembled, transportable building. The building shall be assembled in one module at manufacturer's plant and shipped to the job site for final installation. Modules shall be delivered and placed on cast in place slab foundation in accordance with manufacturer’s recommendations.

B. Design Basis for precast building: “EASI-SET” as manufactured by SMITH-CAROLINA Corporation, Reidsville, North Carolina. Building shall be provided by manufacturer with all necessary openings as specified by Contractor in conformance with manufacturer’s structural requirements.

1.2 REFERENCES

A. ACI 318-05, “Building Code Requirements for Reinforced Concrete”, American Concrete Institute.

B. ASCE 7-02, “Minimum Design Loads for Buildings and other Structures”, American Society of Civil Engineers

C. “Manual of Standard Practice”, Concrete Reinforcing Steel Institute.

D. NC Building Code

E. PCI MNL-116S - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products; latest Edition.

F. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete; latest Edition.

G. PCI MNL-127 - Recommended Practice for Erection of Precast Concrete; latest Edition.

H. UL-752 Level 4 Bullet Resistance, certified by an independent structural engineer. (Precast elements Only)

I. Fabricator shall be a producer member of the National Precast Concrete Association (NPCA).

J. Building fabricator shall have a minimum of five (5) years experience manufacturing and setting transportable precast concrete buildings.

K. Building designs to the pre-engineered “EASI-SET” or equal pre-approved by the owner ten days prior to the bid date.

1.3 DESIGN REQUIREMENTS

A. Minimum Dimensions. Refer to drawings for project specific dimensions:
   1. Exterior: 10’-0” x 12’-0” x 8’-8”
   2. Interior: 9’-6” x 11’-6” x 8’-0”
B. Standard Design Loads:
   1. Seismic load performance category “C”, Exposure Group I, III.
   2. Standard Roof Live Load - 60 psf.
   3. Standard Floor Load – 250 psf.
   4. Standard Wind Load - 130 mph.

C. Floor: Floor shall include a ½” turn down edge on all four sides to prevent migration of water into building along bottom of wall panels. Floor keyway joint shall be filled with non-shrink grout.

D. Sloped Roof: Roof shall slope ½" from front to back in 10' direction. The roof shall extend a minimum of 2 ½" beyond wall panels on all sides and include a ½” turn down edge with built in drip feature that caps all four walls to prevent migration of water into the building along top of wall panels. Roof shall have an integral architectural ribbed edge.

E. Roof, walls, and floor panels shall be produced as single component monolithic panels. No roof or vertical joints are acceptable, except at corners. Wall panels shall be set on top of floor panel or keyed into poured slab foundation. Wall panels shall be 4” thick minimum.

1.4 SUBMITTALS

A. Shop Drawings shall be provided for approval prior to production.

B. Building engineering calculations that are designed and sealed by a licensed engineer in the State of North Carolina shall be submitted.

C. Color chart for door and frame paint.

D. Exterior finish images.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete: Steel reinforced, 5000 psi minimum 28-day compressive strength, air-entrained (ASTM C260), water reduced normal weight.

B. Reinforcing Steel: ASTM A615, grade 60, deformed bar unless otherwise indicated.

C. Post-tensioning Strand: 41K Polystrand CP50, .50, 270 KSI, 7-wire strand, greased plastic sheath, (ASTM A416), Roof and floor shall be post-tensioned by a single, continuous tendon. Said tendon shall form a substantially rectangular configuration

having gently curving corners, and a corner where the tendon members are anchored. Tendons shall be greased and enclosed within sheathing. Building modules shall be post-tensioned together through floor and roof conduits.

D. Caulking: All joints between panels shall be caulked on the exterior and interior surface of the joints. Caulking shall be SIKAFLEX-1A elastic sealant or equal. Exterior caulk joint shall be 3/8” x 3/8” square so that sides of joints are parallel for correct caulk adhesion.

E. Panel Connections: All panels shall be securely fastened together with 3/8” thick steel brackets. Steel shall be of structural quality, hot-rolled carbon complying with ASTM A36 HR, prime coated after fabrication. All fasteners shall be anchored with ½” diameter bolts complying with ASTM A307 for low-carbon steel bolts. Cast-in anchors used for panel connections shall be Dayton-Superior #F-63, or equal.

2.2 FINISHES

A. Interior of Building: Smooth form finish concrete walls. Paint interior with one coat primer and two finish coats of white paint after installation on site.

B. Exterior of Building: As selected by Owner.

C. Door(s) and Frame(s): Doors and frames shall be top coated with Induron, Tnemec, or Sherwin Williams Industrial & Marine Coatings paint. Color chart shall be provided for color selection.

2.3 ACCESSORIES

A. Doors and Frames: Shall comply with the Steel Door Institute “Recommended Specifications for Standard Steel Doors and Frames” (SDI-100) and as herein specified. Building shall be equipped with single or double, insulated, 3’-0” x 6’-8” x 1 ¾”, hot dip galvanized, 14 gauge A40, full flush door and “Inter-lok” hot dip galvanized, 12 gauge A40 frame. Doors and frames shall be factory bonderized and primed. Refer to drawings for project specific door sizes.

B. Door Hardware:
1. Handle: Lindstrom stainless steel, 8-½" x 2" or equal.
2. Hinges: PB-31/NRP/32D 4 ½" x 4 ½" (stainless steel with non-removable hinge pins), 3 per door or equal.
3. Lock Set: PDQ Industries KR116-32D (stainless steel finish) or equal.
4. Threshold: National Guard 897V60 raised interior, extruded aluminum threshold with neoprene seal or equal.
5. Door Holder: Glynn-Johnson 904H US32D (stainless steel finish), overhead slide type surface mounted door holder or equal.
6. Drip Cap: National Guard 15D72 or equal.

PART 3 EXECUTION

3.1 SITE PREPARATION

A. The vertical soil capacity under stone base shall be, or compacted to be, a minimum of 1,500 pounds per square foot.

B. A poured in place foundation shall be installed. To be designed by the Engineer of Record.

C. Provide positive drainage for the fill, pad, or slab as required.

3.2 ACCESS

A. Contractor shall provide level unobstructed area large enough for crane and tractor-trailer to park adjacent to pad. Crane must be able to place outriggers within 5’-0” of edge of pad and the truck and crane must be able to get side-by-side under their own power. No overhead lines may be within a 75’ radius of center of pad.

3.3 DELIVERY, STORAGE, AND HANDLING

A. Lift and support units during manufacturing, yard handling, and installation only at lifting or supporting points or both, as shown on shop drawings, and using appropriate lifting devices.

B. Store units in a manner to prevent cracking, distortion, warping, staining, or other physical damage.

C. Transport units with proper equipment and methods and with qualified personnel.

D. Use all means necessary to protect materials before, during and after installation and also protect work of others.

3.4 INSTALLATION

A. Erect in accordance with Precast/Prestressed Concrete Institute Field Certification Program.

B. Install units using suitable lifting devices at points provided by manufacturer.

C. Align and level units as shown on shop drawings; minimize variations between adjacent units by jacking, loading or any other feasible method as recommended by manufacturer.

D. Erection Tolerances: Comply with PCI MNL-127.

E. Submit project record documents prior to Substantial Completion, showing all revisions and modifications made during fabrication and erection.

3.5 CLEANING AND PROTECTION

A. On a daily basis and at completion of work, remove surplus materials, rubbish and apparatus from project site.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products and finishes before Substantial Completion.

END OF SECTION

SECTION 05 05 00

ANCHOR SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Anchor bolts.

B. Requirement:
   1. Furnish all materials, labor and equipment required to provide anchor systems not specifically included in other sections, complete and in accordance with the requirements of the contract documents.
   2. This Section includes all anchor systems required for the Work, but not specified under other Sections.

1.2 REFERENCE STANDARDS

A. AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements.

B. AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

C. ACI 318 – Building Code Requirements for Structural Concrete.

D. ACI 355.2 – Qualifications of Post-Installed Mechanical Anchors in Concrete.

E. ACI 355.4 – Qualifications of Post-Installed Adhesive Anchors in Concrete.

F. ASTM F593 – Standard Specification for Stainless Steel Bolts; Hex Cap Screws, and Studs

G. AWS D1.1 – Structural Welding Code – Steel.

H. AWS D1.2 – Structural Welding Code – Aluminum.

I. NOMMA Guideline 1 – Joint Finishes.

1.3 SUBMITTALS

A. Section 01 33 00, Submittals.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.4 QUALITY ASSURANCE

A. The Owner may engage in third part testing to test any materials for conformance with the specification.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00, Product Requirements.

PART 2 PRODUCTS

2.1 ANCHORS

A. General:
   1. Where concrete anchors are called for on the Drawings, one of the types listed below shall be used; except, where one of the types listed below is specifically called for on the Drawings, only that type shall be used. The determination of anchors equivalent to those listed below shall be on the basis of test data performed by an approved independent testing laboratory. There are two types used:
      a. Expansion anchors shall be mechanical anchors of the wedge, sleeve, drop-in or undercut type.
      b. Adhesive anchors shall consist of threaded rods or bolts anchored with an adhesive system into hardened concrete. Adhesive anchors shall be two-part injection type using the manufacturer's static mixing nozzle and shall be supplied as an entire system.
   2. Expansion anchors shall not be used to hang items from above or in any other situations where direct tension forces are induced in anchor.
   3. Unless otherwise noted, all concrete anchors which are submerged or are used in hanging items or have direct tension induced upon them, or which are subject to vibration from equipment such as pumps and generators, shall be adhesive anchors.
   4. Adhesive anchors shall conform to the requirements of ACI 355.4 or alternately to AC 308. Expansion or mechanical anchors shall conform to the requirements of ACI 355.2 or alternately to AC 193. Anchors in Seismic Design Categories C through F shall conform to the International Building Code and ACI Appendix D requirements as applicable, including seismic test requirements.
   5. Fire Resistance: All anchors installed within fire resistant construction shall either be enclosed in a fire-resistant envelope, be protected by approved fire-resistive materials, be used to resist wind and earthquake loads only, or anchor non-structural elements.

B. Concrete Anchor Design:
   1. An anchor design consists of specifying anchor size, quantity, spacing, edge distance and embedment to resist all applicable loads. Where an anchor design is indicated on the Drawings, it shall be considered an engineered design and anchors shall be installed to the prescribed size, spacing, embedment depth and edge distance. If all parts of an anchor design are provided on the Drawings except embedment depth, the anchors will be considered an engineered design and the

Contractor shall provide the embedment depth as indicated in Paragraph 1.c unless otherwise directed by the Engineer. Where an anchor design is not indicated by the Engineer on the Drawings, the Contractor shall provide the anchor design per the requirements listed below.

a. Structural Anchors: All concrete anchors shall be considered structural anchors if they transmit load between structural elements; transmit load between non-structural components that make up a portion of the structure and structural elements; or transmit load between life-safety related attachments and structural elements. Examples of structural concrete anchors include but are not limited to column anchor bolts, anchors supporting non-structural walls, sprinkler piping support anchors, anchors supporting heavy, suspended piping or equipment, anchors supporting barrier rails, etc. For structural anchors, the Contractor shall submit an engineered design with signed and sealed calculations performed by an Engineer currently registered in the State of North Carolina. Structural anchors shall be of a type recommended by the anchor manufacturer for use in cracked concrete and shall be designed by the Contractor in accordance with ACI 318 Appendix D.
b. Non-Structural Anchors: All other concrete anchors may be considered non-structural concrete anchors. The Contractor shall perform an engineered design for non-structural anchors. The Engineer may request the Contractor provide anchor design details for review, but submission of a signed, sealed design is not required. Non-structural anchors shall be designed by the contractor for use in uncracked concrete.
c. Minimum anchor embedment shall be as indicated on the Drawings or determined by the Contractor's engineered design. Concrete anchors shall be embedded no less than the manufacturer's standard embedment (expansion or mechanical anchors) or to provide a minimum allowable bond strength equal to the allowable yield capacity of the rod/bolt (adhesive anchors).

2. Structural Anchors:
   a. Mechanical Anchors:
      1) Wedge Anchors: Wedge anchors shall be "Kwik Bolt TZ" by Hilti, Inc., "TruBolt +" by ITW Redhead, "Strong-Bolt 2" by Simpson Strong-Tie Co. or "Powerstud SD-1" or "Powerstud SD-2" by Powers Fasteners.
      2) Screw Anchors: Screw anchors shall be "Kwik HUS-EZ" and "KWIK HUS-EZ-I" by Hilti, Inc., "Titen HD" by Simpson Strong-Tie Co., or "Wedge-Bolt +" by Powers Fasteners. Bits specifically provided by manufacturer of chosen system shall be used for installation of anchors.
      3) Sleeve Anchors: Sleeve anchors shall be "HSL-3 Heavy Duty Sleeve Anchor" by Hilti, Inc. or "Power-Bolt +" by Powers Fasteners.
      4) Undercut Anchors: Undercut anchors shall be "HDA Undercut Anchor" by Hilti, Inc., "Torq-Cut Undercut Anchor" by Simpson Strong-Tie Co., "Atomic + Undercut Anchor" by Powers Fasteners
   b. Adhesive Anchors:
      1) Adhesive anchors shall be "Epcon G5" by ITW Redhead, "HIT HY-200" by Hilti, Inc., "AT-XP" or "SET-XP" by Simpson Strong-Tie Co., or "Powers 1000+" by Powers Fasteners.
      2) Structural adhesive anchor systems shall be IBC compliant and capable of resisting short term wind and seismic loads (Seismic Design Categories A through F) as well as long term and short term sustained static

loads in both cracked and uncracked concrete in all Seismic Design Categories. Structural adhesive anchor systems shall comply with the latest revision of ICC-ES Acceptance Criteria AC308 and shall have a valid ICC-ES report in accordance with the applicable building code. No or equal products will be considered unless prequalified and approved by the Engineer and Owner.

3. Non-Structural Anchors: In addition to the acceptable non-structural anchors listed below, all structural anchors listed above may also be used as non-structural anchors.
   a. Mechanical Anchors:
      1) Wedge Anchors: Wedge anchors shall be “Kwik Bolt 3” by Hilti, Inc., “Wedge-All” by Simpson Strong-Tie Co. or “TruBolt” by ITW Redhead.
      2) Screw Anchors: Screw anchors shall be “Kwik HUS” by Hilti, Inc., “Wedge-Bolt” by Powers Fasteners “Large Diameter Tapcon (LDT) Anchor” by ITW Redhead, or “Titen HD” by Simpson Strong-Tie Co. Bits specifically provided by manufacturer of chosen system shall be used for installation of anchors.
      3) Sleeve Anchors: Sleeve anchors shall be “HSL Heavy Duty Sleeve Anchors” by Hilti, Inc. “Power-Bolt” by Powers Fasteners “Dynabolt Sleeve Anchor” by ITW Redhead, or “Sleeve-All” by Simpson Strong-Tie Co.
      4) Drop-In Anchors: Drop-in anchors shall be “Drop-In” by Simpson Strong-Tie Co., “HDI Drop-In Anchor” by Hilti, Inc. or “Multi-Set II Drop-In Anchor” by ITW Redhead.
      5) Undercut Anchors: Undercut anchors shall be “HDA Undercut Anchor” by Hilti, Inc., or “Torq-Cut” by Simpson Strong-Tie Co.
   b. Adhesive Anchors:
      1) Adhesive anchors shall be “Epcon A7” or “Epcon C6” by ITW Redhead, “HIT HY-200” by Hilti, Inc., “SET Epoxy Tie” or “AT” by Simpson Strong-Tie Co., or “Powers AC 100+ Gold” or “T308+ Epoxy” by Powers Fasteners.
      2) Non-structural adhesive anchors systems shall be IBC compliant and capable of resisting short term wind and seismic (Seismic Design Categories A and B) as well as long term and short term sustained static loads in uncracked concrete
      3) Non-structural adhesive anchor embedment depth of the rod/bolt shall provide a minimum allowable bond strength that is equal to the allowable yield capacity of the rod/bolt unless noted otherwise on the Drawings.
      4) No or equal products will be considered unless prequalified and approved by the Engineer and Owner.
   c. Concrete Anchor Rod/Bolt Materials:
      1) Concrete anchors used to anchor structural steel shall be a threaded steel rod per manufacturer’s recommendations for proposed adhesive system but shall not have a yield strength (fy) less than 58 ksi nor an ultimate strength (fu) less than 72.5 ksi, unless noted otherwise. Where steel to be anchored is galvanized, concrete anchors shall also be galvanized unless otherwise indicated on the Drawings.
      2) Concrete anchors used to anchor aluminum, FRP, or stainless steel shall be Type 316 stainless steel unless noted otherwise. All underwater concrete anchors shall be Type 316 stainless steel.

3) Nuts, washers, and other hardware shall be of a material to match the anchors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00, Administrative Requirements.

B. Verify that field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Section 01 70 00, Execution and Closeout Requirements.

B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, and free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment until permanent bracing and attachments are installed.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00, Execution and Closeout Requirements.

B. Replace damaged or improperly functioning hardware.

C. After erection, touch up, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

D. Touch up factory-applied finishes according to manufacturer-recommended procedures.

3.5 ADJUSTING

A. Section 01 70 00, Execution and Closeout Requirements.

B. Adjust operating hardware and lubricate as necessary for smooth operation.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bollards.

B. Requirement:
   1. Furnish all materials, labor and equipment required to provide all metal fabrications not specifically included in other sections, complete and in accordance with the requirements of the contract documents.

C. Related Requirements:
   1. Section 09 91 00 - Paint and Protective Coatings.

1.2 REFERENCE STANDARDS

A. ACI 318 – Building Code Requirements for Structural Concrete.

B. AISC348 – The 2009 RCSC Specification for Structural Joints.

C. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

D. AWS D1.1 – Structural Welding Code – Steel.

E. AWS D1.2 – Structural Welding Code – Aluminum.

F. NOMMA Guideline 1 – Joint Finishes.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittals.

B. Material certifications shall be submitted along with any shop drawings for metal products and fabrications required by other sections of the specifications.

C. Qualifications Statement:
   1. Submit qualifications for licensed professional.
   2. AWS certified welding qualifications.

1.4 QUALITY ASSURANCE

A. The Owner may engage in third part testing to test any materials for conformance with the specification.

B. The Owner may engage in third party testing to perform testing of welded connections.

C. All steel welding shall be performed by welders certified in accordance with AWS D1.1 and AWS D1.2.

D. Finish joints according to NOMMA Guideline 1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements.

B. Inspection: Accept metal fabrications on-site in labeled shipments. Inspect for damage.

C. All unidentified steel will be rejected and shall be removed from the site and replaced by the contractor at no additional cost to the Owner.

D. Protect metal fabrications from damage by exposure to weather or by ground contact.

1.6 EXISTING CONDITIONS

A. Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 BOLLARDS

A. Bollards shall be 6-inch diameter schedule 40 galvanized steel pipe in accordance with ASTM A53.

B. Bollards shall be concrete filled and crowned as detailed in drawings with a minimum compressive strength of 3,000 psi.

C. All anchors shall be concealed as indicated on Drawings.

2.2 FABRICATION

A. All measurements and dimensions shall be based on field conditions and shall be verified by the contractor prior to fabrication.

B. All fabricated work shall be shop fitted together as much as practicable, and delivered to the field, complete and ready for erection. All miscellaneous items such as stiffeners, fillets, connections, brackets, and other details necessary for a complete installation shall be provided.

C. All work shall be fabricated and installed in a manner that will provide for expansion and contraction, prevent shearing of bolts, screws, and other fastenings, ensure rigidity, and provide a close fit of sections.

D. Finished members shall conform to the lines, angles, and curves shown on the Drawings and shall be free from distortions of any kind.

E. All cuts shall be neat and accurate, with parts exposed to view neatly finished. Flame cutting is allowed only when performed utilizing a machine.

F. All shop connections shall be welded unless otherwise indicated on the Drawings or specified herein. Bolts and welds shall conform to this Section. All fastenings shall be concealed where practicable.

G. Fabricated items shall be shop painted when specified in Section 09 91 00 – Painting and Protective Coatings.

H. Continuously seal joined members by continuous welds.

I. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small, uniform radius.

J. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

K. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements.

B. Verify that field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Clean and strip where site welding is required.

C. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, and free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment until permanent bracing and attachments are installed.

C. Field-weld components indicated on Drawings

D. Perform field welding according to AWS D1.1 and D1.2.

E. Obtain approval of Architect/Engineer prior to site cutting or field adjustments.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00, Execution and Closeout Requirements.

B. Welding: Inspect welds according to AWS D1.1 and D1.2.

C. Replace damaged or improperly functioning hardware.

D. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

E. Touch up factory-applied finishes according to manufacturer-recommended procedures.

3.5 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust operating hardware and lubricate as necessary for smooth operation.

END OF SECTION

SECTION 05 53 00

METAL GRATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General gratings.

B. Requirements:
   1. Furnish all materials, labor, and equipment required to provide all gratings in accordance with the Contract Documents.

C. Related Requirements:
   1. Section 05 05 00 – Anchor Systems.
   2. Section 05 50 00 – Metal Fabrications.
   3. Section 09 91 00 – Paint and Protective Coatings.

1.2 REFERENCE STANDARDS

A. American Welding Society:
   1. AWS A2.4 – Standard Symbols for Welding, Brazing, and Nondestructive Examination.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit span and deflection tables and manufacturer's certificate.

C. Shop Drawings: Indicate details of gratings, plates, component supports, anchorages, openings, perimeter construction details, and tolerances. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Qualifications Statement:
   1. Submit qualifications for licensed professional.
   2. AWS certified welders.

1.4 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A. General – Grating, including support frames, fastenings, and all necessary appurtenances for a complete installation, shall be furnished as indicated on the Drawings.
   1. All exposed bearing ends of grating shall be enclosed in a perimeter band of the same dimensions and material as the main bars, including ends at all cutouts.
   2. Grating shall be fabricated into easily removable sections and shall be fastened at each corner and as required with fasteners provided by the grating manufacturer. No fasteners shall be permitted to project above the walking surface.
   3. Grating shall be designed for a loading of 150 psf unless otherwise required by the Drawings. Grating deflection shall not exceed 1/4 inch under a uniform load of 100 psf. Minimum grating depth shall be 1-1/2 inches, unless structural requirements based on clear span require more depth.

B. Aluminum Grating
   1. Aluminum grating shall be of I-bar type and shall consist of extruded bearing bars positioned and locked by crossbars. All supports, cross members, etc. shall be aluminum. Plank clips for grating hold-downs or other required attachments, shall be aluminum or stainless steel. Bolts shall be stainless steel.
   2. Grating shall be “19-SI-4 I-Bar Swage Locked” by Alabama Metal Industries Corporation (AMICO), “IB” by Harsco Industrial IKG, “I-Bar 19SGI4", by Ohio Grating Inc., or “I-Bar” by Thompson Fabricating LLC.

2.2 FABRICATION

A. All measurements and dimensions shall be based on field conditions and shall be verified by the Contractor prior to fabrication. Such verification shall include coordination with adjoining work.

B. All fabricated work shall be shop fitted together as much as practicable, and delivered to the field, complete and ready for erection. All miscellaneous items such as stiffeners, fillets, connections, brackets, and other details necessary for a complete installation shall be provided.

C. All work shall be fabricated and installed in a manner that will provide for expansion and contraction, prevent shearing of bolts, screws, and other fastenings, ensure rigidity, and provide a close fit of sections.

D. Finished members shall conform to the lines, angles, and curves shown on the Drawings and shall be free from distortions of any kind.

E. All shearings shall be neat and accurate, with parts exposed to view neatly finished. Flame cutting is allowed only when performed utilizing a machine.

F. All shop connections shall be welded unless otherwise indicated on the Drawings or specified herein. Bolts and welds shall conform to Section 05 05 00 – Anchor Systems. All fastenings shall be concealed where practicable.

G. Fabricated items shall be shop painted when specified in Section 09 91 00 – Painting and Protective Coatings.

H. Fabricate gratings and plates to accommodate design loads to sizes indicated.

I. Bolt or weld joints of intersecting metal sections.

J. Removable Panels: With recessed handles.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Verify that opening sizes and dimensional tolerances are acceptable.

C. Verify that supports and anchors are correctly positioned.

3.2 INSTALLATION

A. Place frames in correct position, plumb and level.

B. Mechanically cut finish surfaces. Do not flame cut.

C. Anchor by welding or bolting through flange blocks. Shall conform to Section 05 05 00 – Anchor Systems.

D. Set perimeter closure flush with top of grating and surrounding construction.

E. Secure to prevent movement.

3.3 CLEANING

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Clean welds and damaged coatings and apply two coats of touchup primer.

END OF SECTION

SECTION 09 91 00

PAINTING AND PROTECTIVE COATINGS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and apply paint systems.
      a. Contractor is responsible for surface preparation and painting of all new and existing interior and exterior items and surfaces throughout the Project areas included in the general contract and other contracts described in this Section.
   2. Extent of painting includes the Work specified below. Painting shown in schedules may not provide Contractor with complete indication of all painting Work. Refer to Article 2.2 of this Section where all surfaces of generic types specified are specified for preparation and painting according to their status, intended function, and location, using the painting system for that surface, function, and location as specified, unless specifically identified on the Drawings as a surface not to receive specified painting system.
      a. All new and specifically identified existing surfaces and items except where natural finish of material is specified as a corrosion-resistant material not requiring paint; or is specifically shown as indicated by written note or specified as a surface not to be painted.
      b. Surface preparation and painting of all new and specifically identified existing items, both interior and exterior, and other surfaces, including items furnished by OWNER, are included in the Work, except as otherwise shown or specified.

B. Coordination:
   1. Review installation, removal, and demolition procedures under other Sections and coordinate them with the Work specified in this Section.
   2. Coordinate painting of areas that will become inaccessible once equipment and similar fixed items have been installed.
   3. Furnish information to Engineer on characteristics of finish materials proposed for use and ensure compatibility with prime coats used. Provide barrier coats over incompatible primers or remove and repaint as required. Notify Engineer in writing of anticipated problems using specified painting systems with surfaces primed by others. Reprime equipment primed in factory and other factory-primed items that are damaged or scratched.

C. Work Not Included: The following Work is not included as painting Work, or are included under other Sections:
   1. Shop Priming: Shop priming of structural metal, miscellaneous metal fabrications, other metal items and fabricated components such as shop-fabricated or factory-painted.
   2. Pre-finished Items:

a. Items furnished with such finishes as baked-on enamel, porcelain, and polyvinylidene fluoride shall only be touched up at Site by Contractor using manufacturer's recommended compatible field-applied touchup paint.
b. Items furnished with finishes such as chrome plating or anodizing.

3. Concrete floors, unless specifically shown as a surface to be painted.
4. Face brick, glazed structural tile, and prefaced, ground-faced or split-faced concrete unit masonry.
5. Exterior face of architectural precast concrete.
6. Collector bearings, shafts and chains, wood flights, wood stop logs, and wood or fiberglass baffles.
7. Operating Parts and Labels:
   a. Do not paint moving parts of operating units, mechanical and electrical parts such as valve and damper operators, linkages, sensing devices, interior of motors, and fan shafts.
   b. Do not paint over labels required by governing authorities having jurisdiction at Site, or equipment identification, performance rating, nameplates, and nomenclature plates.
   c. Cover moving parts and labels during the painting with protective masking. Remove all protective masking upon completion of Work. Remove all paint, coatings, and splatter that comes in contact with such labels.
8. Structural and miscellaneous metals covered with concrete need not receive primers, intermediate, or finish coats of paint.
9. Existing structures, equipment, and other existing surfaces and items unless otherwise shown or specified.

D. Description of Colors and Finishes:
   1. Color Coding of Pipelines, Valves, Equipment, and Ducts:
      a. Color-coding of pipelines, valves, equipment, and ducts shall comply with applicable standards of ANSI A13.1, ANSI Z535.1, CFR 1910.144, Recommended Standards for Water Works, and Recommended Standards for Wastewater Facilities. For piping and equipment not covered by the above standards, conform to Owner’s color standards, if any.
      b. For equipment located on roofs and equipment that is exposed-to-view, color will be selected by Engineer/Owner.

1.2 REFERENCES

A. Referenced Standards: Standards referenced in this Section are:
   1. ANSI A13.1, Scheme for Identification of Piping Systems.
   2. ANSI Z535.1, Safety Color Code.
   3. ASTM D16, Terminology for Paint, Related Coatings, Materials and Applications.
   4. ASTM D2200, Pictoral Surface Preparation Standards for Painting Steel Surfaces.
   5. ASTM D4262, Testing Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
   6. ASTM D4263, Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
   7. ASTM D4541, Test Methods for Pull-Off Strength of Coatings Using Portable Adhesion-Testers.
   8. ASTM E329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

9. Great Lakes Upper Mississippi River Board of Public Health and Environmental Managers (GLUMRB) Recommended Standards for Water Works.
10. GLUMRB, Recommended Standards for Wastewater Facilities.
11. Ozone Transport Commission, (OTC), OTC Model Rule for Architectural and Industrial Maintenance Coatings.
12. SSPC PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
13. SSPC VIS 1, Visual Standard for Abrasive Blast Cleaned Steel.
14. SSPC VIS 2, Method of Evaluating Degree of Rusting/Painted Steel Surfaces.
15. SSPC Volume 2, Systems and Specifications.

1.3 DEFINITIONS

A. Coating terms defined in ASTM D16 apply to this Section.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Engage a single applicator regularly performing installation of painting systems, with documented skill and successful experience in installing types of products required and agrees to employ only tradesmen trained, skilled, and with successful experience in installing types of products specified.

B. Source Quality Control:
   1. Obtain products from manufacturers that will provide services of a qualified manufacturer's representative at Site at commencement of painting Work to advise on products, mock-ups, installation, and finishing techniques, at completion of the Work to advise Engineer on acceptability of completed Work, and during course of Work as requested by Engineer.
   2. Submit "or equal" products, when proposed, with direct comparison to products specified, including information on durability, adhesion, color and gloss retention, percent solids, VOC's grams per liter, and recoatability after curing.
   3. "Or equal" manufacturers shall furnish same color selection as manufacturers specified, including intense chroma and custom pigmented colors in painting systems.
   4. Color Pigments: Provide pure, non-fading, applicable types to suit surfaces and services indicated. Comply with the following:
      a. Lead and Chromate: Lead and chromate content shall not exceed amount allowed by authorities having jurisdiction.
      b. Through Contractor, paint manufacturer shall notify Engineer of colors that are not suitable for long-term color retention in areas subject to hydrogen sulfide fume exposure.
      c. Manufacturer shall identify colors that meet requirements of authorities having jurisdiction at Site for use in locations subject to contact with potable water or water that will be treated to become potable.
      d. Comply with paint manufacturers' recommendations on preventing coating contact with levels of carbon dioxide and carbon monoxide that may cause yellowing during application and initial stages of curing of paint coatings.

C. Regulatory Requirements:

1. Comply with VOC content limits of Ozone Transport Commission (OTC), Model Rule for Architectural and Industrial Maintenance Coatings.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Product Data:
      a. Copies of manufacturer's technical data sheets, including surface preparation, number of coats, dry film thickness, test performance data including paint analysis, VOC, and chemical component content in comparison to maximum allowed by the Contact Documents, and application instructions for each product proposed for use.
      b. Submit proof of acceptability of proposed application techniques by paint manufacturer selected.
      c. Copies of Contractor's proposed protection procedures in each area of the Work explaining methods of protecting adjacent surfaces from splatter, for confining application procedures in a manner that allows other work adjacent to surface preparation and painting Work to proceed safely and without interruption, and for maintaining acceptable application, curing, and environmental conditions during and after painting systems application.
      d. List each material and cross-reference to the specific painting system and application, including a list of site-specific surfaces to which painting system will be applied. Identify by manufacturer's catalog number and general classification. State number of gallons of each product being purchased for delivery to Site and square foot area calculated to be covered by each painting system specified based on theoretical loss of 20 percent. Where actual area to be covered by paint system exceeds area submitted to Engineer for that system, proof of additional material purchase shall be provided to Engineer. Calculated coverage shall be as specified for each component of each painting system specified. This requirement does not take precedence over Contractor's responsibility to provide dry film thickness required for each component of each painting system.
      e. Identify maximum exposure times allowable for each paint system component before next coat of paint can be applied. Submit proposed methods for preparing surfaces for subsequent coats if maximum exposure times are exceeded.
      f. Information on curing times and environmental conditions that affect curing time of each paint system component and proposed methods for accommodating variations in curing time. Identify this information for each painting system in the Work.
      g. Specification for spray equipment with cross-reference to paint manufacturer's recommended equipment requirements.
   2. Samples:
      a. Copies of manufacturer's complete color charts for each coating system.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Certificate from paint manufacturer stating that materials meet or exceed Contract Documents requirements.
   2. Test Reports:

a. Certified laboratory test reports for required performance and analysis testing in compliance with ASTM E329.
b. Adhesion testing plan and procedures.
c. Results of adhesion testing on existing surfaces containing paints or other coatings to be top coated with paint systems specified. Prior to adhesion testing, submit a testing plan establishing methods, procedures, and number of tests in each area where existing coatings are to remain and become substrate for painting Work. Based on results of adhesion testing, recommend methods, procedures, and painting system modifications, if necessary, for proceeding with Work.
d. Proposed methods for testing, handling, and disposal of waste generated during Work.
e. Results of alkalinity and moisture content tests performed per ASTM D4262 and ASTM D4263.
f. Results of film thickness, holidays, and imperfections tests.

3. Manufacturer's Instructions: Provide paint manufacturer's storage, handling, and application instructions prior to commencing painting Work at Site.
4. Manufacturer's Site Reports: Provide report of paint manufacturer's representative for each visit to Site by paint manufacturer's representative.
5. Special Procedure Submittals:
   a. Proposed protection procedures for each area of Work, explaining methods of protecting adjacent surfaces from splatter, for confining application procedures in a manner that allows other work adjacent to surface preparation and painting Work to proceed safely and without interruption.
   b. Site-specific health and safety plan.
   c. Procedures for maintaining acceptable application, curing and environmental conditions during and after painting systems application.
   d. Procedures for providing adequate lighting, ventilation, and personal protection equipment relative to painting Work.

C. Closeout Submittals: Submit the following:
1. Maintenance Manual: Upon completion of the painting Work, furnish Engineer two (2) hard copies and one (1) electronic copy of detailed maintenance manual including the following information:
   a. Complete and updated product catalog of paint manufacturer's currently available products including complete technical information on each product. Identify product names and numbers of each product used in the painting Work.
   b. Name, address, e-mail address and telephone number of manufacturer, local distributor, applicator, and technical representative.
   c. Detailed procedures for routine maintenance and cleaning.
   d. Detailed procedures for light repairs such as dents, scratches, and staining.

1.6 DELIVERY, STORAGE AND HANDLING

A. Product Delivery Requirements: Deliver products to Site in original, new, and unopened packages and containers, accurately and legibly and accurately labeled with the following:
1. Container contents, including name and generic description of product.
2. Manufacturer's stock number and date of manufacture.

3. Manufacturer's name.
4. Contents by volume, for major pigment and vehicle constituents.
5. Grams per liter of volatile organic compounds.
6. Application instructions.
7. Color name and number.

B. Product Storage Requirements:
1. Store acceptable materials at Site.
2. Store in an environmentally controlled location as recommended in paint manufacturer's written product information. Keep area clean and accessible. Prevent freezing of products.
3. Store products that are not in actual use in tightly covered containers.
4. Comply with health and fire regulations of authorities having jurisdiction at Site.

C. Product Handling Requirements:
1. Do not open containers or mix components until necessary preparatory work has been completed and approved by Engineer and painting Work will start immediately.
2. Maintain containers used in storing, mixing, and applying paint in a clean condition, free of foreign materials and residue.

1.7 SITE CONDITIONS

A. Site Facilities:
1. Supplemental heat sources, as required to maintain both ambient and surface temperatures within range recommended by paint manufacturer for paint system applications, are not available at the Site.
2. Provision of supplemental heat energy sources, power, equipment, and operating, maintenance, and temperature-monitoring personnel is Contractor's responsibility.
3. Do not use heat sources that emit carbon dioxide or carbon monoxide into areas being painted. Properly locate and vent heat sources to exterior so that paint systems and personnel are unaffected by exhaust products.

B. Existing Conditions:
1. Existing surfaces to receive painting Work shall have their surfaces prepared to meet requirements of painting systems specified. Prior to initiating painting Work, perform adhesion tests on existing surfaces to be painted. Perform testing per ASTM D4541 or other method acceptable to Engineer. Number and location of tests shall be sufficient to determine the condition of existing coatings and suitability of existing coatings to remain to provide an acceptable substrate for new coatings. Submit testing plan prior to testing and provide Engineer the adhesion test results.
2. Provide abrasive blasting, scraping, or other abrading or surface film removal, or preparatory techniques accepted by Engineer.
3. Before commencing painting in an area, surfaces to be painted and floors shall be cleaned of dust.
4. After painting operations have started in a given area, cleaning only with commercial vacuum cleaning equipment with high-efficiency particulate air (HEPA) filters and dust containment systems.

C. Environmental Requirements:
   1. Comply with manufacturer's published requirements.

D. Protection:
   1. Cover or otherwise protect finished Work of other trades and those surfaces not being painted concurrently and not to be painted.
   2. During surface preparation and painting, facility shall remain in operation. Use procedures that prevent contamination of process or cause or require facility shutdown.
   3. Coordinate and schedule surface preparation and painting to avoid exposing personnel to hazards associated with painting Work. Provide required personnel safety equipment per requirements of authorities having jurisdiction at Site.
   4. Submit protection procedures to be employed. Do not begin surface preparation and painting Work until Engineer accepts protection techniques proposed by Contractor.
   5. When working with flammable materials, provide fire extinguishers and post temporary signs warning against smoking and open flame.

PART 2 PRODUCTS

2.1 PAINTING SYSTEM MANUFACTURERS

A. Products and Manufacturers: Where referenced under painting systems, provide painting systems manufactured by the following:
   1. Tnemec Company, Incorporated (TCI).
   2. The Carboline Company, part of StonCor Group, an RMP Company (TCC).
   3. Sherwin-Williams Company (SWC).
   4. Or equal.

2.2 PAINTING SYSTEMS

A. The following schedule lists coatings systems and coating system designations.

No.	Finish Coating System	Coating System Designation						
		A	C	E	F	G	H	P
1.	Epoxy Enamel – One Coat	X			X	X		
2.	Epoxy Enamel – Two Coats	X	X	X	X	X		X
3.	Epoxy Enamel / NSF – Two Coats		X	X				
4.	Epoxy Enamel – Three Coats	X	X	X				
5.	Epoxy Enamel / NSF – Three Coats		X	X				
6.	Epoxy Enamel – First Coat Aliphatic Polyurethane – Finish Coat	X	X	X	X	X		X
7.	Epoxy Enamel – First and Second Coat Aliphatic Polyurethane – Finish Coat			X	X	X		
8.	Universal Primer – First Coat Aliphatic Polyurethane – Finish Coat	X		X				

No.	Finish Coating System	Coating System Designation						
		A	C	E	F	G	H	P
9.	Medium Consistency Coal Tar – Two Coats	X	X	X				
10.	Coal Tar Epoxy – Two Coats	X	X	X				
11.	Vinyl Ester – Two Coats			X				
12.	Heat Resistant – Two Coats						X	
13.	High Heat Resistant – Two Coats						X	
14.	Universal Primer – First Coat Silicone Alkyd Copolymer – Second Coat							X

2.3 SURFACES NOT TO BE COATED

A. Unless otherwise specified, the following surfaces shall be left uncoated:
   1. Exposed Aluminum
   2. Polished or finished stainless steel.
      a. Unfinished stainless steel, except flashing and counter flashings, shall be coated.
   3. Galvanized surfaces, except piping, conduit, ductwork, and other items specifically noted.
   4. Rubber and plastics, except as specified.
   5. Exterior concrete.
   6. Surfaces specified to be factory finished.

2.4 FIELD COATING

A. Items to be field coated include the following. Field coating shall be in accordance with the field priming schedule, the coating schedule, and the manufacturer's recommendations. Field coating shall be completed after installation.
   1. Surfaces not indicated to be shop finished and surfaces where blast cleaning can be performed in the field.
   2. All interior ferrous metal surfaces except stainless steel.
   3. Other items as otherwise specified.

2.5 METAL SURFACES COATING SCHEDULE

Surface to be Coated	Finish Coating System
Non-galvanized and galvanized structural and miscellaneous steel exposed to view or to the elements in exterior locations.	A6
Non-galvanized and galvanized structural and miscellaneous steel exposed to view inside buildings.	A2
Unless otherwise specified, pumps, motors, speed reducers, and other machines and equipment exposed to view.	E8
Actuator surfaces for slide gates, control weirs, unless factory finished.	Outdoor – E7 Indoor – E6
Surfaces of cranes and hoists exposed to view indoors.	E2
Ductile Iron and steel piping inside buildings, including valves, fittings, flanges, bolts, supports, and accessories, and galvanized surfaces after proper priming.	A2
Ductile Iron and steel piping above grade exposed to the elements and to view outdoors, including valves, fittings, flanges, bolts, supports, and accessories, and galvanized surfaces after proper priming.	A6
Copper pipe and tubing, including fittings and valves exposed to view in exterior locations.	F6
All metal surfaces, unless otherwise specified, which will be submerged, all or in part, including valves, and scum baffles, and sluice gates, but excluding piping laid in the ground.	E5
Ductile iron and steel piping in manholes, wetwells, vacuum chamber, and similar locations, including valves fittings, flanges, bolts, supports, and accessories.	E5
All metal harness anchorage for buried piping	A10
Exterior surfaces of carbon steel chemical tanks.	Indoor – A1
Supports and miscellaneous metal for equipment handling corrosive chemicals.	Outdoor – A7 Indoor – A2
Aluminum in contact with concrete.	F1
Engine exhaust piping.	H12
Fire Hydrants (non-factory coated or repair only)	P14

2.6 CONCRETE AND MASONRY SURFACES COATING SCHEDULE

Surface to be Coated	Finish Coating System
All concrete and concrete block in corrosive area (except floors and surfaces scheduled to receive other coatings) which are exposed to view.	Indoor – C2 Outdoor – C7

2.7 MISCELLANEOUS SURFACES COATING SCHEUDLE – NOT USED

2.8 PIPING IDENTIFICATION SCHEDULE

A. Exposed piping and piping in accessible chases shall be identified with lettering or tags designating the service of each piping system, marked with flow directional arrows, and color coded.

B. Piping scheduled to be color coded shall be completely coated with the indicated colors, except surfaces specified to remain uncoated shall include sufficiently long segments of the specified color to accommodate the lettering and arrows. All other piping shall be coated to match adjacent surfaces, unless otherwise directed by Engineer.

C. Location. Lettering and flow direction arrows shall be provided on pipe near the equipment served, adjacent to valves, on both sides of wall and floor penetrations, at each branch or tee, and at least every 50 feet in straight runs of pipe. If, in the opinion of Engineer, this requirement will result in an excessive number of labels or arrows, the number required shall be reduced as directed.

D. Metal Tags. Where the outside diameter of pipe or pipe covering is ⅝-inch or smaller, aluminum or stainless-steel tags shall be provided instead of lettering. Tags shall be stamped as specified and shall be fastened to the pipe with suitable chains. Pipe identified with tags shall be color coded as specified.

E. Lettering. Lettering shall be painted or stenciled on piping or shall be applied as snap-on markers. Snap-on markers shall be plastic sleeves, Brady "Bradysnap-On B-915", Seton "Setmark" or equal. Letter size shall be as follows:

Outside Diameter of Pipe or Covering	Minimum Height of Letters
⅝-inch and smaller	Metal tags – ¼-inch
¾ to 4-inches	¾-inch
5-inches and larger	2-inches

F. Color Coding and Lettering. All piping for the following services shall be color coded. Bands shall be 6 inches wide spaced along the pipe at 5-foot intervals. For services not listed, the color coding and lettering shall be as directed by the Engineer. Coding shall comply with applicable standards: ANSI A13.1, ANSI Z535.1 and CFR 1910.144.

PIPE IDENTIFICATION		
Service	Color of Pipe	Color of Letters
Alum (solution)	Yellow with green bands	Black
Bollards	Yellow	-
Chlorine (solution)	Yellow	Black
Compressed Air	Light green	Black
Condensate	Light gray with brown bands	Black
Condenser Water (supply or return)	Dark blue with white bands	White
Drain	Dark gray	White
Fire Protection Water	Red	White
Fuel Oil	Black	White
Hoist/Trolleys/Cranes	Yellow	-
Hydrofluosilicic Acid	Yellow with blue bands	Black

PIPE IDENTIFICATION		
Service	Color of Pipe	Color of Letters
Instrument Air	Light green with dark green bands	Black
Natural Gas or Propane	Yellow with red bands	Black
Nonpotable	Dark blue with white bands	Black
Raw Water	Light blue with red bands	Black
Odor Scrubber Chemical - Bioxide	Orange	Black
Oil – Hydraulic	Black with white bands	White
Sodium Hypochlorite	Orange	White
Plumbing Vents	Dark gray	White
Polymer	Light brown with red bands	White
Polyphosphate	Light brown with gray bands	White
Potable Water (hot or cold)	Light blue	Black
Reclaimed Water	Purple	White
Refrigerant	Yellow with white bands	Black
Residuals	Light brown	White
Sample	Light gray with green bands	Black
Sodium Hydroxide	Orange	Black
Tempered Water	Dark blue with orange bands	White
Wastewater	Gray	White

PART 3 EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which painting Work is to be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

B. Do not paint over existing paint where there is no assurance that existing paint will provide an acceptable surface for long-term adherence and durability of painting systems specified, or where paint manufacturer requires removal of all existing paint to recommend use of specified painting system.

3.2 SURFACE PREPARATION

A. General:
   1. Remediate lead-based paint, if existing, before applying new paint.
   2. Comply with paint manufacturer's published recommendations for products, surface condition, and surface preparation.

3.3 PROTECTION OF PROPERTY AND STRUCTURES

A. Protect property and structures adjacent to the Work from waste residues resulting from cleaning, surface preparation, and painting Work.

B. During blast cleaning and surface preparation of interior and exterior surfaces, control exhausting of dust and grit using shrouding, negative-pressure containment/dust collection systems, or other means to protect adjacent property and structures and prevent dust and grit from escaping. Similarly, control removal and temporarily store residues to protect adjacent property and structures.

C. For painting of exterior surfaces, use rollers or other acceptable methods as required to protect adjacent property and structures from wind-blown paint residues.

D. Submit proposed procedures for cleaning, surface preparation, and paint application that describe in detail methods to be used to protect adjacent property and structures from residues. Do not proceed with cleaning, surface preparation, or painting until proposed procedures are accepted by Engineer.

3.4 MATERIALS PREPARATION

A. General: Mix and prepare painting products in strict accordance with paint manufacturer's product data sheets.

3.5 APPLICATION

A. General:
   1. Apply paint systems by brush, roller, or spray per paint manufacturer's recommendations and in strict accordance with paint manufacturer's product data sheets.
   2. Surfaces of items not normally exposed-to-view do not require same color as other components of system of which they are a part but require same painting system specified for exposed surfaces of system.
   3. Omit field-applied primer on metal surfaces that have been primed in the shop. Touch-up paint to shop-primed coats and pre-finished items only when approved by ENGINEER using compatible primers and paint manufacturer’s recommended compatible field-applied finishes.
   4. Welds shall be stripe-coated with intermediate or finish coat of paint after application of prime coat.

B. Minimum/Maximum Paint Film Thickness: Comply with manufacturer’s published recommendations for coating type and surface.

C. Scheduling Surface Preparation and Painting: Comply with manufacturer’s published recommendations for coating type and surface.

D. Brush Application:
   1. Brush-out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections are unacceptable. Neatly draw all glass and color break lines.

2. Brush-apply all primer or first coats, unless otherwise allowed to use mechanical applicators.

E. Mechanical Applicators:
   1. Use mechanical methods for applying paint when allowed by applicable ordinances, paint manufacturer, and approved by Engineer.
   2. Limit roller applications, if approved by Engineer, to interior wall finishes for second and third coats. Apply each roller coat to provide equivalent hiding as brush-applied coats.
   3. Where spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double back with spray equipment for purpose of building up film thickness of two coats in one pass.

F. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint Work not in compliance with specified requirements as required by Engineer.

3.6 FIELD QUALITY CONTROL

A. Notify ENGINEER after completing each coat of paint. After inspection and checking of film thickness, holidays, and imperfections by Owner, and after acceptance by Engineer, proceed with succeeding coat.
   1. Engineer will witness all testing and shall be notified of scheduled testing at least twenty-four hours in advance.
   2. Apply additional coats, if required, to produce specified film thickness and to correct holidays and to completely fill all surface air holes.

B. For magnetic substrates, measure thickness of dry film nonmagnetic coatings following recommendations of SSPC PA-2. These procedures supplement manufacturers' approved instructions for manual operation of measurement gauges and do not replace such instructions.

C. Record time, location, number of coats, dry film thickness, holidays, and other imperfections and submit testing results to Engineer.

3.7 PROTECTION

A. Provide "Wet Paint" signs as required to protect newly painted finishes. After completing painting Work, remove temporary protective wrappings provided for protection of the Work and work of other Contractors.

3.8 ADJUSTMENT AND CLEAN-UP

A. Correct damage to work of other trades by cleaning, repairing, or replacing, and repainting, as acceptable to Engineer.

B. During progress of the Work, remove from Site all discarded paint products, rubbish, cans, and rags at end of each workday.

C. Upon completion of painting, clean paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

D. At completion of Work of other trades, touch-up and restore all damaged or defaced painted surfaces as determined by Engineer.

3.9 SCHEDULES

A. The schedules listed below, following the “End of Section” designation, are a part of this Specification section.
   1. Table A - Painting Schedule.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install signage.
   2. Extent of signage is shown and specified.
   3. Types of products required include the following:
      a. Health, safety and warning
      c. Stainless steel fasteners, supports, very-high-bond high-performance mounting tape, primers and other accessories.

B. Coordination:
   1. Coordinate adhesives and fasteners with mounting surfaces. Review other Sections to ensure compatibility of signage mounting accessories with various surfaces on which signage will be installed.
   2. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before signage Work.

C. Related Sections:
   1. Section 03 05 00 - Concrete.
   2. Section 09 91 00 – Painting and Protective Coatings.
   3. Division 26.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. AA DSA-45, Designation System for Aluminum Finishes.
   2. ANSI Z535.1, Marking Physical Hazards Safety Color Code.
   3. ANSI Z535.2, Environmental and Facility Safety Signs.
   4. ANSI Z535.3, Criteria for Safety Symbols.
   5. NFPA 704, System for the Identification of the Hazards of Materials for Emergency Response.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Signage Manufacturers:
      a. Engage firms specializing in producing types of products specified, in compliance with the Contract Documents, with documented record of successful in-service performance, and that possess sufficient production capacity to avoid delaying the Work.
      b. Submit to CFPUA name and experience record of manufacturers.

B. Component Supply and Compatibility:
   1. Obtain each separate type of signage from a single Supplier and from a single manufacturer.

C. Regulatory Requirements: Comply with applicable requirements of the following:
   1. OSHA, 29 CFR Part 1910.144, Safety Color Code for Marking Physical Hazards.
   2. OSHA, 29 CFR Part 1910. 145, Specification for Accident Prevention Signs and Tags.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Schedule of all signage required for the Work, indicating signage type location, and other information to demonstrate compliance with the Contract Documents.
      b. Sign plan indicating sign locations.
      c. Fabrication and erection information for each type of signage
      d. Mounting and Installation Data:
         1) Drawings of and information on anchorages and accessory items.
         2) Submit location template drawings for items supported or anchored to permanent construction.
   2. Product Data:
      a. Copies of manufacturer’s technical data, including catalog information and specifications, for each product specified.
   3. Samples:
      a. Each color and finish of exposed materials and accessories required for signage.
      b. Sample Signage:
         1) Full-size Sample of each type of permanent room and space identification sign, and informational and directional sign incorporating all features specified.
         2) Full-sized Sample right-to-know signs, labels and tags.

B. Informational Submittals: Submit the following:
   1. Manufacturer's Instructions:
      a. Templates for anchorages to be installed in concrete or masonry.
      b. Manufacturer's instructions and recommendations for support and foundations of signs installed outdoors.

PART 2 – PRODUCTS

2.1 SYSTEM PERFORMANCE

A. General:
   1. Details shown or indicated for signage, such as alpha-numeric and text type representation, letter spacing, designs of borders, and other graphic features,

are generic and intended only to establish text, general positions, and symbols.
2. Colors shall be brilliant, distinctive shades, matching the safety colors specified in ANSI Z535.1 and OSHA 1910.144.
3. Accident prevention signs and tags shall comply with OSHA 1910.145.
4. Health, safety, and warning signs shall comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, OSHA 1910.144, and 1910.145, unless otherwise shown or indicated. Colors shall be as indicated in Table 1 of ANSI Z535.1. In addition to text, safety symbol pictograms shall be incorporated into each sign.

2.4 PANEL SIGNS – HEALTH, SAFETY AND WARNING

A. Product Description: Provide rigid fiberglass reinforced plastic signs with fade-resistant embedded graphics.

B. Products and Manufacturers: Provide one of the following:
1. Graphic Blast Word and Picture Series, by Best Sign Systems, Inc.
2. Blast Etched Fiberglass Signs, by Visigraph Corporation.
3. Or equal.

C. General:
1. Size and Thickness: 0.125-inch thick; 10 inches by 14 inches, unless otherwise shown or indicated.
2. Exposure: As recommended by sign manufacturer for both indoor and outdoor use and with an upper service temperature limit of 190degrees F. Average durability for outdoor use shall be 15 years.

D. Safety Instruction Signs: Standard color of sign background shall be white; panel shall be green with white letters and numbers. Letters and numbers used against white background shall be black.

E. Caution Signs: Standard color of sign background shall be yellow; panel shall be black with yellow letters and numbers.

F. Danger Signs: Standard color of sign background shall be white; panel shall be black with red insert with white letters and numbers. Letters and numbers used against white background shall be black.

G. Warning Signs: Standard color of sign background shall be orange; panel shall be black with orange insert with black letters and numbers. Letters and numbers used against orange background shall be black.

H. No Smoking Signs: Standard color of sign background shall be white. Letters and numbers used against white background shall be red.

I. Biohazard Signs: Standard color of sign background shall be white; panel shall be black with white letters. Sign shall include red international biohazard pictogram on white background.

L. Auxiliary Products:
   1. Mounting Brackets: Provide sign manufacturer's standard mounting brackets for installing projected or double-sided signs.

2.16 SOURCE QUALITY CONTROL

A. Fabrication Tolerances:
   1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within tolerance of plus or minus 1/16-inch measured diagonally across each sign.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine substrates and conditions under which signage will be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:
   1. Location:
      a. Install signage and appurtenances at the locations shown or indicated. When locations are not shown or indicated, install signage at locations directed by CFPUA.
      c. Lightly mark and locate position of each sign. Obtain CFPUA's acceptance of marked locations before mounting.
   2. Installation – General:
      a. Install signs level, plumb, and at proper height.
      b. Signage shall be securely mounted with concealed, very-high-bond acrylic foam tape, specified adhesives, or mechanical fasteners where specified. Attach signs to surfaces in accordance with sign manufacturer's instructions, unless otherwise shown or indicated.
      c. Provide very-high-bond acrylic foam tape on back of signage using a full perimeter of specified tape. Leave no gaps in tape perimeter at back of signage; peel off second release liner and press onto surfaces.
   3. Repair or replace damaged units.

3.3 PROTECTION AND CLEANING

A. After installation, clean soiled signage surfaces in accordance with manufacturer's written instructions.

B. Protect signage from damage until completion of the Work.

END OF SECTION

SECTION 26 05 02

BASIC ELECTRICAL WORK

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PART 1 GENERAL

1.1 GENERAL PROVISIONS DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to complete the electrical Work.
   3. Demolition: Electrical demolition shall be in accordance with Section 02 41 00 – Demolition.
   3. Demolition: Responsibility for electrical demolition is indicated in Section 01 10 00 – Summary.
   4. Utility Companies:
      a. Electric Utility Company: Perform the Work in connection with the electric service and utility metering in accordance with requirements of Duke.

B. Coordination:
   1. Review installation procedures and schedules under other contracts and coordinate with other contractors the installation of electrical items to be installed with or within formwork, walls, partitions, ceilings, and panels constructed by other contractors.
      a. Furnish as required to other contractors detailed drawings or sketches of the locations of conduits and other built-in items.
      b. Coordinate with other contractors regarding progress of construction where conduits and built-in items will be installed. Install conduits and built-in items in manner that does not delay work of other contractors.
   2. Coordination and Intent of Electrical Drawings:
      a. Dimensions on Drawings related to equipment are based on equipment of certain manufacturers. Verify the dimensions of equipment furnished to space available at the Site and allocated to the equipment.
      b. Drawings show the principal elements of the electrical Work and are not intended as detailed working drawings for the electrical Work. Drawing's supplement and complement the Specifications and other Contract Documents relative to principal features of electrical systems.
      c. Equipment and devices provided under this Contract shall be properly connected and interconnected with other equipment and devices for successful operation of complete systems, whether or not all connections and interconnections are specifically mentioned or shown in the Contract Documents.
      d. Drawings are provided for Contractor's guidance in fulfilling the intent of the Contract Documents. Contractor shall comply with Laws and Regulations, including safety and electrical codes, and provide materials, equipment, appurtenances, and specialty items necessary for complete and operable systems.
   3. Obtain from Owner record drawings required to execute the Work.
   4. Field Coordination:
      a. Provide materials, equipment, and services to interface with existing circuits. Field-verify system and equipment requirements prior to modifying existing systems.

b. Coordinate the interface of equipment with Owner's personnel and field conditions.
c. Field-compare existing starter and panel control circuit terminations from record documents with existing circuits.
d. Field-trace existing circuits as required to interface the equipment provided.
e. Field-identify terminations for starters and panel controls for re-connection.

C. Related Sections:
1. Section 02 41 00 - Demolition.
2. Section 03 05 00 - Concrete.
3. Section 09 91 00 - Painting and Protective Coatings.
4. Section 31 23 34.01 - Excavation, Trenching, Dewatering and Backfilling.

D. Area Classifications:
1. Materials, equipment, and incidentals shall be suitable for the area classification(s) shown, specified, and required.
2. Wet Locations: Comply with NEC and NEMA requirements for wet locations. Enclosures in wet locations shall comply with NEMA 4 unless specified otherwise.
3. Corrosive Locations: Comply with NEC and NEMA requirements for corrosive locations. Enclosures in corrosive locations shall conform to NEMA 4X requirements unless specified otherwise.
4. Hazardous Locations: Comply with NEC requirements for the Class and Division designated.

E. Electrical Power Distribution System Study
1. Shall be prepared and accepted by the Owner.
2. Shall identify and coordinate all necessary electrical devices and equipment that are required for the facilities.

1.2 MATERIAL DESCRIPTIONS

A. Low-Voltage Electrical Power Conductors and Cables Scope:
1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install low-voltage conductors and cabling.
2. Types of cabling required include:
a. Insulated cable for installation in raceways.
3. Conductor type shall comply with the following:
a. VFD conductors (other than pump manufacturer cables): VFD cables.
b. Other conductors: Single conductor copper cables.

B. Low-Voltage Electrical Power Conductors and Cables Related Sections:
1. This Section – Identification for Electrical Systems.
2. Section 31 23 34.01 - Excavation, Trenching, Dewatering and Backfilling.

C. Grounding and Bonding Scope:
1. Contractor shall provide labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install complete grounding for electrical systems, structures, and equipment.

D. Hangers and Supports Scope:

1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install hangers and supports for electrical systems.
2. Area Classifications: Materials shall by suitable for the area classification(s) shown or indicated on the Drawings, and specified in This Section, General Provisions Description.

E. Hangers and Supports Related Sections:
1. This Section, General Provisions Description.
2. This Section, Rigid Conduits.

F. Rigid Conduits Scope:
1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install conduit and fittings to form complete, coordinated and, for metallic raceways, grounded raceway systems.
2. When specific, detailed conduit routings for various systems are not shown on the Drawings, Contractor shall establish routings based on single-line, riser, and interconnection diagrams and other information on the Drawings. Contractor shall provide for the proper installation of conduits in each system.

G. Rigid Conduits Coordination:
1. Conduit runs shown are diagrammatic. Coordinate conduit installation with piping and other systems and equipment and locate to avoid interferences.
2. For conduits to be embedded in concrete slabs, confirm adequate slab thickness and coordinate location of conduits with placement of reinforcing steel, water stops, expansion joints, and other features of the concrete slab.

H. Rigid Conduits Related Sections:
1. Section 31 23 34.01 - Excavation, Trenching, Dewatering and Backfilling.
2. This Section, Hangers and Supports for Electrical Systems.
3. This Section, Identification for Electrical Systems.

I. Flexible Conduits Scope:
1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install flexible metallic conduit and fittings.

J. Sealed Fittings Scope:
1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install conduit sealing fittings with sealing fiber and sealing compound.

K. Pull, Junction and Terminal Box Scope:
1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install pull, junction, and terminal boxes.

L. Pull, Junction and Terminal Box Related Sections:
1. This Section, General Provisions Description.
2. This Section, Hangers and Supports for Electrical Systems.
3. This Section, Identification for Electrical Systems.

M. Outlet Boxes Scope:
   1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install outlet boxes for mounting wiring devices and lighting fixtures.

N. Outlet Boxes Related Sections:
   1. This Section, General Provisions Description.
   2. This Section, Hangers and Supports for Electrical Systems.
   3. This Section, Identification for Electrical Systems.
   4. This Section, Low-Voltage Receptacles.
   5. This Section, Snap Switches.

O. Identification for Electrical Systems Scope:
   1. Contractor shall provide all labor, materials, equipment, and incidentals shown, specified, and required to furnish and install identification for electrical apparatus and electrical Work.

P. Identification for Electrical Systems Related Sections:
   1. This Section, Low Voltage Electrical Power Conductors and Cables.

1.3 STANDARD REFERENCES

A. Standards referenced for Low-Voltage Electrical Power Conductors and Cables are:
   1. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.
   2. ASTM B3, Specification for Soft or Annealed Copper Wire.
   3. ASTM B8, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
   4. UL 44, Thermoset-Insulated Wires and Cables.
   5. UL 1277, Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

B. Standards referenced for Grounding and Bonding are:
   1. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.
   2. ASTM B8, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
   3. UL 467, Grounding and Bonding Equipment.

C. Standards referenced for Rigid Conduits are:
   1. ANSI C80.5, Standard for Electrical Rigid Metal Steel Conduit – Aluminum (ERMC-A).
   2. ANSI/NEMA FB1, Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.
   3. NEMA TC2, Electrical Polyvinyl Chloride (PVC) Conduit.
   4. NEMA TC3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
   5. UL 6A, Electrical Rigid Metal Conduit – Aluminum.
   6. UL 514B, Conduit, Tubing, and Cable Fittings.
   7. UL 651, Safety Schedule 40 and 80 Rigid PVC Conduit and Fittings.

8. UL 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.
9. UL 1242, Electrical Intermediate Metal Conduit – Steel.
10. UL 2277, Flexible Motor Supply Cable and Wind Turbine Tray Cable.

D. Standards referenced for Flexible Conduits are:
1. UL 360, Liquid-Tight Flexible Metal Conduit.

E. Standards referenced for Sealed Fitting are:
1. UL 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations, Class 1, Groups A, B, C and D and Class II, Groups E, F and G.

F. Standards referenced for Pull, Junction and Terminal Boxes in this Section are.
1. AASHTO, Standard Specifications for Highway Bridges.
2. UL 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

G. Identification for Electrical Systems Regulatory Requirements: Comply with the following:
1. NEC Article 110, Requirements for Electrical Installation.
2. NEC Article 210, Branch Circuits.
3. NEC Article 215, Feeders.
4. NEC Article 504, Intrinsically Safe Systems.
5. NEC Article 702, Optional Standby Systems.
6. 40 CFR 1910.145 (OSHA) – Specification for Accident Prevention Signs and Tags.
7. NFPA 70E, Electrical Safety in the Workplace.

1.4 GENERAL PROVISIONS QUALITY ASSURANCE

A. Qualifications:
1. Electrical Subcontractor:
a. Electrical Subcontractor shall have not less than five years' experience installing electrical systems of the types required for the Project.
b. Electrical Subcontractor shall possess a valid electricians' and contractors' license in the jurisdiction where the Site is located.

B. Component Supply and Compatibility:
1. Materials and equipment similar to each other shall be from the same manufacturer for uniformity.

C. Regulatory Requirements:
1. Permits: Refer to the General Conditions, Supplementary Conditions, and other parts of the Contract Documents for responsibilities relative to obtaining and paying for permits, licenses, and inspection fees.

1.5 MATERIALS QUALITY ASSURANCE

A. Low-Voltage Electrical Power Conductors and Cables Regulatory Requirements: Comply with the following:
1. NEC Article 300, Wiring Methods.
2. NEC Article 310, Conductors for General Wiring.

B. Grounding and Bonding Quality Assurance Regulatory Requirements

1. National Electrical Code, (NEC).
    a. NEC Article 250, Grounding and Bonding.

C. Rigid Conduits Regulatory Requirements: Comply with the following:
    1. NEC Article 344, Rigid Metal Conduit.
    2. NEC Article 352, Rigid Nonmetallic Conduit.

D. Flexible Conduits Regulatory Requirements: Comply with the following:
    1. NEC Article 350, Liquid-Tight Flexible Metal Conduit.

E. Sealed Fitting Regulatory Requirements: Comply with the following:
    1. NEC Article 500, Hazardous (Classified) Locations.

F. Pull, Junction and Terminal Boxes Regulatory Requirements:
    1. NEC Article 314, Outlet, Device, Pull and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures.

G. Outlet Boxes Regulatory Requirements:
    1. NEC Article 314, Outlet, Device, Pull and Junction Boxes; Fittings; and Handhole Enclosures.
    2. NEC Article 501, Class I locations.
    3. UL 514A, Metallic Outlet Boxes.
    4. UL 514B, Fittings for Conduit and Outlet Boxes.

1.6 GENERAL PROVISIONS SUBMITTALS

A. General:
    1. To the extent practical, submit Shop Drawings and other Contractor submittals for each Specification Section into the smallest number of submittals possible. Do not furnish partial submittals.
    2. Review of equipment submittals does not relieve Contractor of responsibility for providing complete and successfully operating systems.

B. Action Submittals: Submit the following:
    1. Shop Drawings:
        a. Internal wiring diagram and drawings indicating all connections to components and numbered terminals for external connections.
        b. Dimensioned plan, section, elevations, and panel layouts showing means for mounting, conduit connection, and grounding.
        c. List of components including manufacturer’s name and catalog number (or part number) for each.
        d. Point-to point interconnection wiring diagrams as specified for each component.
    2. Product Data:
        a. Manufacturer's name and product designation or catalog number.
        b. Electrical ratings.
        c. Manufacturer’s technical data and specifications.
        d. Manufacturer’s indication of compliance with applicable reference standards.

C. Informational Submittals: Submit the following:
    1. Manufacturer’s Instructions:

a. Installation data and instructions.
b. Instructions for handling, start up, and troubleshooting.
2. Source Quality Control Submittals: Results for required shop testing.
3. Field Quality Control Submittals: Results for required field testing.

D. Closeout Submittals: Submit the following:
1. Record Documentation:
a. System Record Drawings: Include the following:
1) One-line wiring diagram of the electrical distribution system.
2) Actual, in-place conduit and cable layouts with schedule of conduit sizes and number, and size of conductors.
3) Layouts of the power and lighting arrangements and the grounding system.
4) Control schematic diagrams, with terminal numbers and control devices identified, for all equipment.
b. Record documents shall indicate final equipment and field installation information.

1.7 MATERIAL SUBMITTALS

A. Low-Voltage Electrical Power Conductors and Cables:
1. Action Submittals: Product Data: Manufacturer's literature, specifications, and engineering data for low volt insulated cable proposed for use.
2. Informational Submittals: Field Quality Control Submittals: Written results of field insulation resistance tests.

B. Grounding and Bonding:
1. Action Submittals: Product Data: Manufacturer's technical information for grounding materials proposed for use.
2. Informational Submittals: Field Quality Control Submittals: Results of ground resistance tests at each test point.

C. Hangers and Supports:
1. Action Submittals: Product Data:
a. Manufacturer's name, product designation, and catalog number of each material item proposed for use.
b. Manufacturer's specifications including material, dimensional and weight data, and load capacity for each supporting system component proposed for use.
c. Pictorial views and corresponding identifying text of each component proposed for installation.
2. Informational Submittals: Manufacturer's installation instructions, including recommended tightening torque values for all nuts and bolts.

D. Rigid Conduits:
1. Action Submittals: Product Data: Manufacturer's catalog cuts and product data for conduit, fittings, and appurtenances.
2. Closeout Submittals: Record Drawings: Show actual routing of exposed and concealed conduit runs in record documents in accordance with Section 01 78 39 - Project Design Drawing Requirements.

E. Flexible Conduits:

1. Action Submittals: Product Data: Manufacturer’s literature and technical information for flexible conduit and fittings proposed for use.

F. Sealed Fitting:
   1. Action Submittals: Product Data: Manufacturer’s literature and technical information for sealing fittings, sealing fiber, and sealing compound proposed for use.

G. Pull, Junction and Terminal Boxes:
   1. Action Submittals: Product Data: Manufacturer’s technical information for pull, junction, and terminal boxes proposed for use.

H. Outlet Boxes:
   1. Action Submittals: Product Data: Manufacturer’s technical information for outlet boxes proposed for use.

I. Identification For Electrical Systems:
   1. Action Submittals: Product Data: Manufacturer’s literature, cut sheets, specifications, dimensions, and technical data for all products proposed under this Section.

PART 2 PRODUCTS

2.1 MATERIAL

A. Performance Criteria:
   1. Electrical equipment shall be capable of operating successfully at full-rated load, without failure, with ambient outside air temperature of -30 degrees F to 104 degrees F and an elevation of 2000 feet above mean sea level.
   2. Unless specified otherwise, electrical equipment shall have ratings based on 75 degrees C terminations.

B. Testing Laboratory Labels: Electrical material and equipment shall bear the label of Underwriters' Laboratories, Inc., or other nationally recognized, independent testing laboratory, where standards have been established and label service applies and approved by the Authority Having Jurisdiction.

2.2 WIRING AND MATERIAL METHODS

A. Wire per the method indicated in the table below for the environmental condition/location in each space. If more than one environmental condition is present, the most severe condition governs.

Environmental Condition / Location	Raceways	Wire	Enclosures
Dry / Indoors	Rigid Al	THWN-2	NEMA 1 or 12, Note 1
Outdoors	Rigid Al	THWN-2 or	NEMA 4X SS

		XHHW-2	
Outdoors VFD Circuits	Rigid A	XLPE VFD Cable	
Underground	PVC	RHW-2	Note 2
Underground VFD Circuits	PVC	XLPE VFD Cable	
Class I, Div 1 or 2 where raceway is continuous from hazloc to equipment termination	Rigid Al, Note 3	RHW-2 or XHHW-2	NEMA 4X SS
Class I, Div 1 or 2 where raceway is routed from wetwell to cable tray with 5' air gap to electrical terminations	PVC	Pump manufacturer cable	

Note 1: NEMA 1 or 12 enclosures are acceptable where the building/enclosure is conditioned by an HVAC unit and approved by CFPUA and recommended by the project engineer.

Note 2: Polymer concrete in soil. Cast iron in concrete or pavement.

Note 3: Where aluminum conduit is in contact with soil or concrete, coat with asphaltum or bitumastic type paint/coating.

2.3 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES MATERIALS

A. Insulated Cable In Raceways:
   1. Manufacturers: Provide products of one of the following:
      a. Southwire.
      b. The Okonite Company.
      c. American Insulated Wire.
      d. General Cable.
      e. Belden.
      f. Or equal.
   2. Material:
      a. Single conductor copper cable complying with ASTM B3 and ASTM B8 with flame-retardant, moisture- and heat-resistant insulation rated for 90 degrees C in dry or wet locations, listed by UL as Type XHHW-2, THWN-2 or RHW-2 complying with UL 44.
      b. VFD Cable: Multiconductor copper cable complying with UL 2277; moisture-resistant XLPE insulation rated for 90 degrees C, 1000V minimum rating, ground conductor, overall copper shield, abrasion-, chemical-, and UV/sunlight-resistant PVC jacket.
   3. Wire Sizes: Not smaller than No. 12 AWG for power and lighting and No. 14 AWG for 120-volt control circuits.
   4. Stranding: 600-volt cable shall be stranded.

B. Cable Connectors, Solderless Type:
   1. Products and Manufacturers: Provide products of one of the following:
      a. T&B Sta-Kon.
      b. Burndy Hylug.

c. Or equal.

2. For wire sizes No. 4 AWG and above, use either compression type or bolted type with silver-plated contact faces.
3. For wire sizes up to and including No. 6 AWG, use compression type. Alarm and control wire shall be terminated using forked type connectors at terminal boards.
4. For wire sizes No. 250 KCMIL and larger, use connectors with at least two cable clamping elements or compression indents and provision for at least two bolts for joining to apparatus terminal.
5. Properly size connectors to fit fastening device and wire size. Connectors shall be rated for 90 degree C, 600 volts.

C. Cable Splices:
1. Products and Manufacturers:
a. Pre-Insulated Solderless Compression Splices: Provide one of the following:
1) Ilsco.
2) NSI.
3) Or equal.
b. Spring Connectors: Provide one of the following:
1) Buchanan B-Cap.
2) T&B Wire Connector.
3) Or equal.
2. For wire sizes No. 8 AWG and larger, splices shall be made up with pre-Insulated solderless connectors with one spare port for future conductor connection.
3. For wire sizes No. 10 AWG and smaller, splices may be made up with pre-insulated spring connectors.
4. For wet locations, splices shall be waterproof. Spring connector splices shall be waterproofed with sealant filler.
5. Splices shall be suitably sized for cable, rated 90 degrees C, and 600 volts.

D. Wire and Cable Markers:
1. Provide wire and cable markers in accordance with This Section, Identification for Electrical Systems.

E. Low-Voltage Electrical Power Conductors and Cables Source Quality Control: Factory Tests: Factory-test wire and cable in accordance with UL standards.

2.4 GROUNDING AND BONDING MATERIALS

A. Bare Ground Cable:
1. Manufacturers: Provide products of one of the following:
a. Cablec Corporation.
b. General Cable Corporation.
c. Southwire Cable Company.
d. Or equal.
2. Material: Soft-drawn, bare copper stranded cable complying with ASTM B8. No. 4/0 AWG minimum size unless otherwise shown or indicated on the Drawings.

B. Ground Rods:
1. Manufacturers: Provide products of one of the following:
a. Copperweld, Bimetallics Division.

b. ITT Blackburn Company.
c. Or equal.

2. Material: Copper-clad rigid steel rods, 3/4-inch diameter, ten feet long.

C. Grounding Connectors:
1. Products and Manufacturers: Provide one of the following:
a. Pressure Connectors:
1) O.Z./Gedney, Division of General Signal Corporation.
2) Burndy Corporation.
3) Or equal.
b. Welded Connections:
1) Cadweld by Erico Products, Incorporated.
2) Therm-O-Weld by Burndy Corporation.
3) Or equal.
2. Material: Pressure connectors shall be copper alloy castings, designed and fabricated specifically for items to be connected and assembled with Durium or silicone bronze bolts, nuts, and washers. Welded connections shall be by exothermic process utilizing molds, cartridges, and hardware designed specifically for connection to be made.

D. Ground Test Well
1. Manufacturer
a. Advanced Lightning Technology
b. Or equal.
2. Diameter and Material: 12.75-inch outside diameter, Schedule 80 PVC.
3. Depth: Two feet.
4. Cover: Provide test well with cast iron cover marked, “Ground” with cast iron ring to support lid.

E. Ground system components shall comply with UL 467.

2.5 HANGERS AND SUPPORTS MATERIALS

A. Manufacturers: Provide products of one of the following:
1. B-Line.
2. Kindorf.
3. Unistrut
4. Or equal.

B. Strut, Fittings, and Accessories:
1. General
a. Unless otherwise shown or indicated, strut shall be 1-5/8 inches by 1-5/8 inches stainless steel. Double struts shall be two pieces of the same strut, welded back-to-back at the factory.
b. Attachment holes, when required, shall be factory-punched on hole centers approximately equal to the cross-sectional width and shall be 9/16-inch diameter.
c. Fittings, braces, brackets, hardware, and accessories shall be Type 316 stainless steel.
d. Strut nuts shall be spring captured Type 316 stainless steel.

e. Square and round washers shall be Type 316 stainless steel.
2. Strut shall be 12-gauge Type 316 stainless steel.

C. Hanger Rods:
1. Material: Stainless steel.
2. Size: Not less than ⅜-inch diameter, unless otherwise shown on the Drawings or specified.

D. Beam Clamps for Attaching Threaded Rods or Bolts to Beam Flanges for Hanging Struts or Conduit Hangers: Beam clamps shall be stainless steel equipped with stainless steel square head set screw and shall include threaded hole sized for attaching the all-thread rod or threaded bolt.

E. Miscellaneous Hardware:
1. Bolts, screws, and washers shall be stainless steel.
2. Hex Nuts: Shall be stainless steel and include nylon inserts.

2.6 RIGID CONDUITS MATERIALS

A. Aluminum Conduit, Elbows, and Couplings:
1. Manufacturers: Provide products of one of the following:
a. Allied Tube and Conduit.
b. Wheatland Tube Company.
c. Or equal.
2. Material: Rigid, heavy-wall aluminum, smooth interior, tapered threads, and carefully reamed ends; ¾-inch NPS minimum size.

B. Metallic Conduit Fittings, and Outlet Bodies:
1. Manufacturers: Provide products of one of the following:
a. Crouse-Hinds Company.
b. Appleton Electric Company.
c. Or equal.
2. Material and Construction: Aluminum bodies and covers consistent with conduit material. Units shall be threaded type with five full threads. Materials shall comply with ANSI/NEMA FB1 and be listed by UL. Do not use “LB” fittings. Use type “LBD” fittings where use of fittings is unavoidable.
3. Use: Conduits shall be gasketed and watertight in hazardous, wet, and corrosive locations.

C. Non-metallic Conduit and Fittings:
1. PVC Plastic Conduit:
a. Manufacturers: Provide products of one of the following:
1) Amoco Chemicals Corp.
2) Carlon Electrical Products.
3) Or equal.
b. Material: PVC, rated for 90 degrees C, complying with NEMA TC3 and UL 514B and 651.
1) Exposed: Schedule 80.
2) Concealed: Schedule 40.
3) Underground: Schedule 40.

c. Fittings: Form elbows, bodies, terminations, expansions, and fasteners of same material and manufacturer as base conduit. Provide cement by same manufacturer as base conduit.

D. Conduit Hubs:
1. Manufacturers: Provide products one of the following.
a. Myers Electrical Products Company.
b. Or equal.
2. Material: Threaded conduit hub, vibration-proof, weatherproof, with captive O-ring seal, aluminum with insulated throat and bonding screw.
3. Use: Provide for all conduit terminations to boxes, cabinets, and other enclosures in areas designated as wet locations.

E. Conduit Bushings and Locknuts:
1. Manufacturers: Provide products one of the following:
a. O-Z/Gedney.
b. Appleton Electric Company.
c. Or equal.
2. Insulated Bushings: aluminum body with plastic liner. Threaded type with steel clamping screw. Provide with bronze grounding lug, as required.
3. Locknuts: aluminum for all diameters.
4. Use: Provide for all conduit terminations to boxes, cabinets, and other enclosures except threaded type in areas designated as dusty locations.

2.7 RIGID CONDUITS ACCESSORIES

A. Fasteners: To the extent possible, fastener material shall be consistent with conduit material. Fasten raceway systems to supporting structures using the following:
1. To Wood: Wood screws.
2. To Hollow Masonry Units: Toggle bolts.
3. To Brick Masonry: Expansion bolts by Price, or equal.
4. To Concrete: Anchors.
5. To Steel: Beam clamps in accordance with This Section, Hangers and Supports for Electrical Systems.

B. Duct Sealing Compound
1. Soft, fibrous, slightly tacky, non-hardening sealing compound.
2. Remains workable at all temperatures.
3. Manufacturer:
a. Type DUX by O-Z/Gedney.
b. Or equal.

2.8 RIGID CONDUITS IDENTIFICATION

A. Warning Tape: Where underground, provide warning tape in accordance with This Section, Identification for Electrical Systems.

2.9 FLEXIBLE CONDUIT MATERIALS

A. Flexible Conduit:

1. Material: Flexible aluminum core with smooth, abrasion-resistant, liquid-tight, polyvinyl chloride cover. Continuous copper ground built in for sizes ¾-inch through 1.25-inch. Material shall be UL-listed.
2. Products and Manufacturers: Provide one of the following:
   a. Anaconda Sealtite Type EFL by Anamet Electrical, Inc.
   b. Liquatite Type ALT. by Electric-Flex Company.
   c. Or equal.

B. Flexible Conduit Fittings:
1. Material and Construction: Aluminum. Fittings shall adapt the conduit to standard threaded connections, shall have an inside diameter not less than that of the corresponding standard conduit size and shall be UL listed.
2. Manufacturers: Provide products of one of the following:
   a. Crouse-Hinds Company.
   b. Appleton Electric Company.
   c. Or equal.
3. Use: Provide for connections to transformers or motorized equipment in non-hazardous areas.

2.10 SEALED FITTINGS MATERIALS

A. Manufacturers: Provide products of one of the following:
1. Crouse Hinds Company.
2. Appleton Electric Company.
3. Or equal.

B. Materials and Construction:
1. Aluminum.
2. Ample opening with threaded closure for access to conduit hub for making dam.
3. In corrosive locations, fittings shall include factory-applied 40-mil PVC coating.
4. Construct fitting to allow 40 percent cross-sectional fill.

C. Sealing fiber for forming the dam within the hub and sealing compound shall be suitable for use with fittings furnished and shall be products of fitting manufacturer.

D. Sealing fitting, fiber, and sealing compound shall conform to UL 886.

2.11 PULL, JUNCTION AND TERMINAL BOXES MATERIALS

A. Pull, Junction, and Terminal Boxes:
1. General – Applicable to All Boxes:
   a. Description and Performance Criteria:
      1) Located indoors in prefabricated FRP shelters: NEMA 4X, 316 stainless steel.
      2) Located indoors in prefabricated, precast concrete enclosures: NEMA 1 when HVAC is provided for the enclosure and approved by CFPUA and recommended by the Engineer. Otherwise, enclosure shall be NEMA 4X, 316 stainless steel.
      3) Located outdoors: NEMA 4X, 316 stainless steel.

4) In slabs or pavement potentially subject to vehicular traffic: Flush-mounted, cast iron pullboxes. Boxes and covers shall be constructed for H-20 loading in accordance with AASHTO Standard Specifications for Highway Bridges.

b. Manufacturers: Provide products of one of the following:
   1) Appleton Electric Company.
   2) Crouse-Hinds Company.
   3) Hoffman Engineering Company.
   4) Or equal.

c. Terminal strips and terminal blocks in terminal boxes shall be mounted on terminal box sub-panels.

d. Identification: Boxes shall be identified in accordance with This Section, Identification for Electrical Systems.

2. Materials and Construction - Wet, Corrosive, or Hazardous Locations:
   a. Rating:
      1) Pull boxes in wet, corrosive, or outdoor areas shall be NEMA 4X.
      2) Boxes for areas classified as hazardous locations, where required by NEC, shall be explosion-proof and comply with UL 886.
   b. Material: Copper-free aluminum alloy or Type 316 stainless steel.
   c. Gasket:
      1) Provide neoprene gaskets for wet and corrosive locations.
      2) Gaskets shall be an approved type designed for the purpose. Improvised gaskets are not acceptable.
   d. Access: Stainless steel cover bolts.
   e. Features:
      1) External mounting lugs.
      2) Drilled and tapped conduit holes.
      3) Boxes where conduits enter building or structure below grade shall have 1/4-inch drain hole at bottom of the box.
      4) Provide threaded connections for explosion proof boxes.

B. Terminal Blocks:
   1. Products and Manufacturers: Provide one of the following:
      a. Allen-Bradley Company, Bulletin, Model 1492.
      b. General Electric Company, Model CR151K.
      c. Or equal.
   2. Material and Construction:
      a. NEMA-rated nylon modular terminal blocks.
      b. 600-volt rated.
      c. Control and alarm circuit terminals shall be screwed type with permanently affixed numeric identifiers beside each connection.
      d. Power terminals shall be copper and rated for the circuit ampacity.

2.12 OUTLET BOXES MATERIALS

A. Device Boxes:
   1. Manufacturers: Provide products of one of the following:
      a. Crouse-Hinds Company.
      b. Appleton Electric Company.
      c. Or equal.

2. Material:
    a. In Wet Locations: Cast aluminum.
    b. Cast boxes shall be hub-type and include external mounting lugs.
    c. Metallic outlet boxes shall comply with UL 514A.
    d. Fittings for outlet boxes shall comply with UL 514B.
3. Cover Plates:
    a. Located indoors: Type 302 stainless steel alloy.
    b. Located outdoors: Cast aluminum.
    c. Stainless steel screws and hardware.

2.13 IDENTIFICATION FOR ELECTRICAL SYSTEM MANUFACTURED UNITS

A. Engraved Identification Devices (Nameplates and Legend Plates):
1. Nameplates:
    a. Laminated thermoset plastic, 1/16-inch thick, engraved condensed block black lettering on white background, square corners, and beveled front edges, or match existing.
    b. Size: As required.
    c. Letter Size: Minimum 3/16-inch.
2. Legend Plates:
    a. Legend plates for pushbuttons, pilot lights, selector switches, and other panel-mounted devices shall be large size with dimensions of approximately 2-7/16 inches wide by 2-13/32 inches tall (Allen Bradley large automotive size), plastic, custom engraved with black letters on white background.
        1) Provide standard-size legend plates where devices are mounted on motor control centers and spacing of devices precludes using automotive-size legend plates.
    b. Lettering size and line weight shall be the same for all legend plates on the same panel or enclosure. Maximum size shall be ¼-inch and minimum size shall be ⅛-inch.
3. Attach engraved nameplates with high-performance, double-coated tape with adhesive, 3M #06383 or equal.

B. Safety Signs and Voltage Markers:
1. Cable Tray Safety Signs:
    a. Products and Manufacturers: Provide one of the following:
        1) B-302-86139 by Brady.
        2) Or equal.
    b. Cable tray safety signs shall be pressure-sensitive vinyl conforming to 40 CFR 1910.145, 5 inches by 3.5 inches in size, and shall read, “DANGER – HIGH VOLTAGE”
2. Low-Voltage Safety Signs:
    a. Products and Manufacturers: Provide one of the following:
        1) B-302-86060 by Brady.
        2) Or equal.
    b. Low voltage safety signs shall be pressure-sensitive vinyl complying with 40 CFR 1910.145, five inches by 3.5 inches in size, and shall read, “DANGER – 480 VOLTS”.
3. Low-Voltage Markers:
    a. Products and Manufacturers: Provide one of the following:

1) CV442xx by Brady.
2) Or equal.

b. Low voltage markers shall be either pressure-sensitive vinyl or vinyl cloth with black lettering on orange background and shall read, “120 VOLTS”, “208 VOLTS”, “120/208 VOLTS”, or “240 VOLTS” as required.

C. Arc-flash Safety Signs:
1. Products and Manufacturers: Provide one of the following:
a. Brady.
b. Or equal.
2. Warning signs shall be adhesive-backed polyester.
3. Warning signs shall read, “Warning – Arc Flash and Shock Hazard. Appropriate PPE Required”.

D. Voltage System Identification Directories:
1. General:
a. Directories shall be laminated thermoset plastic, 1/16-inch thick, engraved block black letters on white background, square corners, and beveled front edges.
b. Directories shall identify all voltage systems.
c. Directories shall list the colors that identify ungrounded and grounded conductors of each system.
d. Colors shall be in accordance with This Section, Low Voltage Electrical Power Conductors and Cables.
e. Example Directory Text:

Voltage System Identification		
System	**A, B, C**	**Neutral**
277/480	Brown, Orange, Yellow	Gray
120/208	Black, Blue, Red	White

2. Small directories for equipment shall have text height of not less than ¼-inch.

E. Wire Identification:
1. Heat Shrinkable Wire and Cable Labeling System:
a. Products and Manufacturers: Provide one of the following:
1) B-341 by Brady.
2) Or equal.
b. White heat-shrinkable irradiated polyolefin shrink-on sleeves. Labels shall be thermal printed. Labels shall be not less than two inches wide.
2. Wrap-Around Wire and Cable Labeling System:
a. Products and Manufacturers: Provide one of the following:
1) THT-XX-427 by Brady.
2) Or equal.
b. Self-laminating white/transparent self-extinguishing vinyl strips. Length shall be sufficient to provide at least 2.5 wraps. Labels shall be thermally printed and not less than two inches wide.

F. Detectable Underground Warning Tape:
1. Products and Manufacturers: Provide one of the following:
a. Indentoline by Brady.

b. Or equal.

2. Material: Polyethylene or polyester with detectable metal core and polyester underlaminate.
3. Width: Two inches.
4. Color and Labeling: Yellow or red with permanently imprinted black letters: “CAUTION – Buried Electric Line”, repeated continuously over full length of tape.

G. Thermal Printing System:
1. Utilize thermal transfer process to provide non-smearing labels and markers.
2. Wire and Cable Markers:
a. Portable, Products and Manufacturers: Provide one of the following:
1) TLS2200 by Brady.
2) Or equal.
b. Desktop, Products and Manufacturers: Provide one of the following:
1) 200M by Brady.
2) Or equal.
3. Cable Markers:
a. Portable, Products and Manufacturers: Provide one of the following:
1) Handimark by Brady.
2) Or equal.
b. Desktop, Products and Manufacturers: Provide one of the following:
1) Labelizer PLUS by Brady.
2) Or equal.

H. Generator System Warning Signs:
1. Generator warning signs shall be labeled in accordance with NEC Article 702.
2. Material, Colors, Letters: Plastic with white letters on red background. Letters shall be not less than ⅜-inch high.
3. Attachment: Use stainless steel self-tapping screws.
4. Location warning sign shall read, “WARNING – THIS SITE EQUIPPED WITH A DIESEL DRIVEN STAND-BY GENERATOR”.
5. Generator ground warning sign shall read, “WARNING – GENERATOR GROUNDED CIRCUIT CONDUCTOR IS CONNECTED TO THE GROUNDING ELECTRODE CONDUCTOR IN THIS ENCLOSURE. DO NOT OPERATE GENERATOR WHILE EITHER CONDUCTOR IS DISCONNECTED TO AVOID SEVERE SHOCK HAZARD AND POSSIBLE EQUIPMENT DAMAGE. REMOVAL OF THIS CONNECTION COULD RESULT IN ELECTRIC SHOCK EVEN WHILE NOT OPERATING, PROCEED WITH EXTREME CAUTION.”

2.14 IDENTIFICATION FOR ELECTRICAL SYSTEM FABRICATION

A. Engraved Identification Devices (Nameplates and Legend Plates):
1. Nameplate and legend plate text is preliminary and subject to change pending final review and approval of nomenclature by Engineer after start-up and testing.

PART 3 EXECUTION

3.1 GENERAL PROVISIONS INSPECTION

A. Examine conditions under which Work will be performed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions are corrected.

3.2 GENERAL PROVISIONS INSTALLATION

A. General:
   1. Install materials and equipment in accordance with the Contract Documents, Laws and Regulations, approved (and accepted, as applicable) Shop Drawings and other Contractor submittals, and manufacturer's recommendations.
   2. Provide tools and equipment required to trace circuits necessary for proper execution of the Work.
   3. Define and identify all wiring, circuit terminations, and equipment to be modified to ensure proper interface of components. The Contract Price includes all costs associated with field services specified for a complete and functional system.

B. Staging, Sequencing, and Coordination with Existing Facilities:
   1. Schedule, sequence, and install materials and equipment in accordance with Section 01 30 00 – Dev Administration Requirements and Section 01 70 00 Dev Execution and Closeout Requirements.
   2. Perform the Work in a manner that will not interfere with the existing equipment and facilities or cause interruption of the functions of the Site, unless specified otherwise or otherwise allowed by Owner.
   3. When operation of existing facilities and Site will be disrupted due to Contractor's operations, Contractor shall coordinate with the Owner. Contractor shall be required to keep the existing facilities in operation unless otherwise allowed by Owner.
   4. Where the Work ties in with existing installations, take precautions and provide safeguards in connecting the Work to existing operating circuits to prevent interruption to existing circuits. Connection of Work to existing circuits shall be performed in the presence of Owner and Engineer.
   5. Interruptions of existing circuits, not addressed in Section 26 20 05 – Electrical Distribution Equipment shall be coordinated with the Owner who will determine the length of time a circuit may be de-energized to maintain the Owner's processes in dependable and safe operation.

3.3 GENERAL PROVISIONS FIELD QUALITY CONTROL

A. Field Quality Control – General:
   1. Perform field quality control for electrical Work in accordance with the Contract Documents.

B. Site Tests:
   1. Prior to requesting certificate of Substantial Completion, demonstrate to Engineer that the electrical systems and electrically-operated equipment installed or modified under the Contract operates in accordance with the Contract Documents and operates as required
   2. Perform the following operational tests on electrical systems:
      a. Operate power circuits to verify proper operation and connection to electrical systems materials and equipment, including mechanical key-interlocks for circuit breakers.

b. Remove and re-apply power supply to automatic transfer equipment to verify operation. Activate standby power systems to verify their automatic start-up, proper de-energization, and cool down upon resumption of normal power supply.
c. Operate control circuits, including pushbuttons, indicating lights, and similar devices, to verify proper connection and function. Operate all devices, such as pressure switches, flow switches, and similar devices, to verify that shutdowns and control sequences operate as required.
d. Operate lighting systems and receptacle devices to verify proper operation and connections.

3. Prepare and submit report on the equipment demonstration and operating field quality control tests. Report shall include complete information on the tests performed and results.

C. Manufacturer's Services:
1. Furnish at the Site qualified, factory-trained representative(s) of equipment manufacturers for the services indicated in the Contract Documents.

3.4 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES INSTALLATION

A. Install cables complete with proper terminations at both ends. Check and correct for proper phase sequence and proper motor rotation.

B. Pulling:
1. Use insulating types of pulling compounds containing no mineral oil.
2. Pulling tension shall be within limits recommended by wire and cable manufacturer.
3. Use dynamometer where mechanical means are used.
4. Cut off section subject to mechanical means.

C. Bending Radius: Limit to minimum of six times cable overall diameter.

D. Slack: Provide maximum slack at all terminal points.

E. Splices:
1. Where possible, install cable continuous, without splice, from termination to termination. All splices not specifically indicated on the drawings shall require approval of the Engineer.
2. Where required, splice as shown and also where required for cable installation. Splices below grade, in manholes, handholes, and wet locations shall be waterproof.
3. Splices are not allowed in conduits.

F. Identification:
1. Identify conductors in accordance with This Section, Identification for electrical Systems.
2. Identify power conductors by circuit number and phase at each terminal or splice location.
3. Identify control and status wiring using numeral tagging system.

G. Color-code power cables as follows:
1. No. 8 AWG and Smaller: Provide colored conductors.

2. No. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, wrapped in overlapping turns to cover an area of at least two inches.
3. Colors: Match color scheme in use at the Site. If the Site does not have an existing color scheme, use the following colors:

System	Conductor	Color
All Systems	Equipment Grounding	Green
240/120 Volts Single-Phase, Three-Wire	Grounded Neutral One Hot Leg Other Hot Leg	White Black Red
208Y/120 Volts Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	White Black Red Blue
240/120 Volts Three-Phase, Four-Wire Delta, Center Tap Ground on Single-Phase	Grounded Neutral Phase A High (wild) Leg Phase C	White Black Orange Blue
480Y/277 Volts Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	Gray Brown Orange Yellow

3.5 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES FIELD QUALITY CONTROL

A. Site Tests:
   1. Test each electrical circuit after permanent cables are in place, to demonstrate that circuit and equipment are connected properly and will perform satisfactorily, free from improper grounds and short circuits.
   2. Individually test 600-volt cable mechanical connections after installation and before they are put in service, with calibrated torque wrench. Values shall be in accordance with manufacturer's recommendations.
   3. Individually test 600-volt cables for insulation resistance between phases and from each phase to ground. Test after cables are installed and before they are put in service, with Megger for one minute at voltage rating recommended by cable manufacturer or in accordance with ANSI/NETA ATS recommendations.
   4. Insulation resistance for each conductor shall not be less than value indicated in IEEE 525-2016 for the circuit run length. Cables not meeting recommended value or that fail when tested under full load conditions shall be replaced with a new cable for full length.
   5. Where existing cables are spliced to cables provided under the Project, test existing cables prior to splicing. Test cables at 1,000 vdc for one minute. Entire spliced cable installation shall be re-tested after splice is completed. Existing cable that fails or has value less than two megohms shall be brought to attention of Engineer and splicing shall not proceed until condition is acceptable.

3.6 GROUNDING AND BONDING INSPECTION

A. Examine conditions for the Work and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with Work until unsatisfactory conditions are corrected.

3.7 GROUNDING AND BONDING EQUIPMENT GROUNDING

A. Ground electrical equipment in compliance with Laws and Regulations and the Contract Documents.

B. Equipment grounding conductors shall be bare stranded copper cable of adequate size installed in conduit where required for mechanical protection. Ground conductors, pulled into conduits with non-grounded conductors, shall be insulated. Insulation shall be green.

C. Control panels grounding conductors shall be insulated stranded copper cable of adequate size.

D. Connect ground conductors to conduit with copper clamps, straps, or with grounding bushings.

E. Connect to piping with copper clamps. Use copper bonding jumpers on gasketed joints.

F. Connect to equipment by means of lug compressed on cable end. Bolt lug to equipment frame using holes or terminals provided on equipment specifically for grounding. Do not use hold-down bolts. Where grounding provisions are not included, drill suitable holes in locations recommended by equipment manufacturer or designated by Engineer.

G. Connect to motors by bolting directly to motor frames, not to soleplates or supporting structures.

H. Connect to service water piping by means of copper clamps. Use copper bonding jumpers on gasketed joints.

I. Scrape bolted surfaces clean and coat with conductive oxide-resistant compound.

J. Connect grounding electrode conductors to ground rods and rebar with exothermic welds.

3.8 GROUNDING AND BONDING FIELD QUALITY CONTROL

A. Site Tests:
   1. Test completed grounding systems for resistance to ground using an electrical three-terminal ground resistance tester or clamp-on ground resistance tester. Test all grounded cables and metal parts for continuity of connection. Notify Engineer and Owner two weeks in advance for witness testing.
   2. Grounding system maximum resistance shall not exceed five ohms under normally dry conditions when measured by resistance tester. Resistance values above five ohms shall be brought to Engineer’s attention. Provide additional ground rods as required to attain a resistance to ground of less than five ohms for each ground grid.

3.9 HANGERS AND SUPPORTS INSTALLATION

A. Inspection: Examine conditions under which the Work will be installed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Provide hangers and supports for electrical systems with necessary channels, fittings, brackets, and related hardware for mounting and supporting materials and equipment. Provide anchor systems, concrete inserts, and associated hardware for proper support of electrical systems.

C. Install equipment and devices on hangers and supports as shown on the Drawings, as specified, and as required.

D. Install hangers and supports level, true, free of rack, and parallel and perpendicular to building walls and floors, so that the hangers and supports are installed in a neat, professional, workmanlike manner.

E. Coordinate installation of hangers and supports with equipment, cabinets, consoles, panels, enclosures, boxes, conduit, cable tray, wireway, busway, cable bus, piping, ductwork, lighting fixtures, and other systems and equipment. Locate hangers and supports clear of interferences and access ways.

F. Anchor Bolts, Expansion Anchors, and Concrete Inserts: Shall be in accordance with the requirements of this Section.

G. Mounting of Conduit:
   1. Provide space of not less than 1/4-inch between conduit surfaces and abutting or near surfaces except struts, cable trays, steel beams, and columns.
   2. Fasten conduit to struts, cable trays, steel beams, and columns using specified clamps and straps as shown, specified, and required.
   3. Devices shall be compatible with size of conduit and type of support. Following installation, size identification shall be visible and legible.
   4. Install conduit supports and fasteners in accordance with This Section, Rigid Conduits.

H. Supports for Cabinets, Consoles, Panels, Enclosures, and Boxes:
   1. Freestanding: Unless otherwise specified or shown on the Drawings, provide supports for floor-mounted equipment, cabinets, consoles, panels, enclosures, and boxes. Such supports shall be 3.5-inch high concrete equipment base with a 45-degree chamfered edge. Base shall extend two inches beyond outside dimensions of equipment on all sides.
   2. Wall-Mounted:
      a. Provide space not less than 1/4-inch between cabinets, consoles, panels, enclosures, and boxes and the surface on which each is mounted. Provide non-metallic or stainless-steel spacers as required.
      b. Do not mount equipment, enclosures, panels, and boxes directly to beams or columns. Mount struts to beams or columns using beam clamps, and mount equipment, enclosures, panels, and boxes to the struts.
   3. Floor Stand Rack:
      a. Where equipment, cabinets, consoles, panels, enclosures, and boxes cannot be wall-mounted, provide an independent floor stand rack.

b. Floor stand rack shall consist of struts, plates, brackets, connection fittings, braces, accessories, and hardware assembled in a rigid framework suitable for mounting of intended materials and equipment.
c. Provide floor stand racks with brackets and bases for rigidly mounting the framework to the ceiling or floor, as applicable; or equip floor stand racks with beam clamps, angle plates, washers, and bolts for fastening to beam flanges, as applicable.
d. When equipment, cabinets, consoles, panels, enclosures, and boxes weigh more than 100 pounds:
    1) Main vertical supports of floor stand rack assemblies shall be back-to-back struts.
    2) Bracing, clamping, and anchoring of each floor stand rack shall be sufficient to ensure rigidity of the floor stand rack with the intended equipment, enclosures, conduit, cable tray, busway, cable bus, and wireway installed. Floor stand racks shall not be deflected more than ⅛-inch by a 100-pound force applied at any point on the floor stand rack in any direction.

I. Drilling into beams or columns is not allowed unless authorized by Engineer.

J. Tighten nuts and bolts to the manufacturer's recommended torque values.

K. Field Cutting:
1. Cut edges of strut and hanger rod shall have rounded corners, edges beveled, and burrs removed. If field cutting the strut is required, use clean, sharp, dedicated tools. Remove oil, shavings, and other residue of cuttings prior to installation.

3.10 RIGID CONDUITS INSTALLATION

A. Inspection: Examine conditions under which the Work will be performed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Install in accordance with Laws and Regulations.

C. Supports:
1. Rigidly support conduits by clamps, hangers, or Unistrut-type channels. Conduit supports and accessories shall be in accordance with This Section, Hangers and Supports for Electrical Systems.
2. Support single conduits by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the support surface. Support multiple runs of conduits on trapeze type hangers.

D. Fastenings: Fasten raceway systems rigidly and neatly to supporting structures using specified materials.

E. Exposed Conduit:
1. Install parallel or perpendicular to structural members or walls.
2. Where possible, run-in groups. Provide conduit racks of suitable width, length, and height, arranged to suit field conditions. Provide support every ten feet, minimum.

3. Install on structural members in protected locations.
4. Locate clear of interferences.
5. Provide six inches of clearance from hot fluid lines and 1/4-inch from walls.
6. Install vertical runs plumb. Unsecured drop length shall not exceed 12 feet.

F. Underground Conduits:
1. Install individual, underground conduits minimum of 20 inches below grade, unless otherwise shown or indicated.
2. Perform excavation, bedding, backfilling, and surface restoration, including pavement replacement where required, in accordance with Section 31 23 34.01 - Excavation, Trenching, Dewatering and Backfilling.
3. Install warning tape 12 inches below finished grade over buried conduits.

G. Empty Conduits:
1. Install nylon pull wire in each empty conduit and cap conduits not terminating in boxes with permanent fittings designed for the purpose.

H. Field Bends: No indentations. Diameter of conduit shall not vary more than 15 percent at bends.

I. Joints:
1. Apply conductive compound to joints before assembly.
2. Make up joints tight and, for metallic raceways, ground thoroughly.
3. Use standard tapered pipe threads for conduit and fittings.
4. Cut conduit ends square and ream to prevent damaging wire and cable.
5. Use full threaded couplings. Split couplings are not allowed.
6. Use strap wrenches and vises to install conduit. Replace conduit with wrench marks.

J. Terminations:
1. Install insulated bushings on conduits entering boxes or cabinets, except when threaded hubs are used.
2. Provide locknuts on both inside and outside of enclosure, except when threaded hubs are used.
3. Use of bushings in lieu of locknuts is not allowed.
4. Install conduit hubs on conduits entering boxes or cabinets in wet and corrosive areas.

K. Moisture Protection:
1. Plug or cap conduit ends at time of installation to prevent entrance of moisture and foreign materials.
2. Underground and embedded conduit connections shall be watertight.
3. Drainage: Conduit runs shall be fully drainable. Avoid pockets or depressions in conduit runs.
4. Seal conduit openings within control and instrumentation panels and distribution equipment with duct sealing compound to provide watertight seal.

L. Corrosion Protection:
1. Dissimilar Metals:
a. Prevent occurrence of electrolytic action between dissimilar metals.

b. Do not use copper products in connection with aluminum, and do not use aluminum in locations subject to drainage of copper compounds on bare aluminum.
c. Back paint aluminum in contact with masonry or concrete with two coats of aluminum-pigmented bituminous paint.

M. Reused Existing Conduits:
1. Pull rag swab through conduits to remove water and to clean conduit prior to installing new cable.
2. Repeat swabbing until all foreign material is removed.
3. Pull mandrel through conduit, if necessary, to remove obstructions.

N. Core drill for individual conduits passing through existing concrete slabs and walls. Notify Engineer in writing in advance of core drilling. Prior to core drilling, drill sufficient number of small exploratory holes to establish that the area to be core drilled is free of existing embedded conduits. Seal spaces around conduit as specified herein.

O. Non-metallic Conduit:
1. Install in accordance with manufacturer's recommendations.
2. Provide manufacturer's recommended adhesives or sealants for watertight connections.
3. Transition to PVC-coated rigid steel conduit before making turn up to enclosures.

3.11 RIGID CONDUITS FIELD QUALITY CONTROL

A. Site Tests:
1. Test conduits by pulling through each conduit a cylindrical mandrel with length not less than two pipe inside diameters, having an outside diameter equal to 90 percent of conduit's inside diameter.
2. Repair or replace conduits that do not successfully pass testing, and re-test.

3.12 FLEXIBLE CONDUITS INSTALLATION

A. Inspection: Examine conditions under which the Work will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Install at motors, transformers, field instruments, and equipment subject to vibration or require movement for maintenance purposes. Provide necessary reducer where equipment furnished cannot accept ¾-inch diameter flexible conduit. Limit flexible conduit length to three feet maximum.

C. Install in conformance with the Laws and Regulations.

3.13 SEALED FITTING INSTALLATION

A. Inspection: Examine conditions under which the Work is to be installed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Install for hazardous locations as required by Laws and Regulations and as shown.

C. Provide fittings for proper use relative to mounting position.

D. Use oversized fittings with reducing bushings when necessary to maintain cable fill requirements of the conduit system.

3.14 PULL, JUNCTION AND TERMINAL BOXES INSTALLATION

A. Inspection: Examine conditions under which the Work will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Mount boxes so that sufficient access and working space is provided and maintain clearance of not less than 1/4-inch from walls.

C. Securely fasten boxes to walls or other structural surfaces on which boxes are mounted. Provide independent supports that comply with This Section, Hangers and Supports for Electrical Systems, where boxes will not be mounted on walls or other structural surface.

D. Install pull boxes where shown or indicated, and provide pull boxes where one or more of the following conditions exist:
   1. Conduit runs containing more than three 90-degree bends.
   2. Conduit runs exceeding 200 feet in length.

E. Provide removable, flame-retardant, insulating cable supports in boxes with any dimension exceeding three feet.

F. Field-apply PVC touch-up to scratched PVC boxes damaged during installation. Touch-up work shall be in accordance with manufacturer's recommendations and instructions.

G. Size junction, pull, and terminal boxes in accordance with NEC Article 314 and other Laws and Regulations.

H. Provide terminal blocks in boxes where shown and where cable terminations or splices are required.

3.15 OUTLET BOXES INSTALLATION

A. Inspection: Examine conditions under which the Work is to be installed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

B. Fasten boxes rigidly and neatly to supporting structures.

C. Securely fasten equipment to walls or other surfaces on which materials or equipment is mounted. Provide independent supports complying with This Section, Hangers and Supports for Electrical Systems, where boxes are not mounted on walls or other surface capable of supporting the materials or equipment.

D. For units mounted on masonry or concrete walls, provide suitable ½-inch spacers to prevent mounting back of box directly against wall.

E. Leave no open conduit holes in boxes. Close unused openings with capped bushings.

F. Label each circuit in boxes and identify each circuit in accordance with This Section, Identification for Electrical Systems.

G. Install outlet boxes in accordance with NEC Article 314.

3.16 IDENTIFICATION FOR ELECTRICAL SYSTEMS INSTALLATION

A. Provide electrical identification in accordance with manufacturer recommendations and as required for proper identification of equipment and materials.

B. Engraved Identification Devices (Nameplates and Legend Plates):
   1. Provide nameplate with 1.5-inch high letters to identify each console, cabinet, panel, or enclosure as shown or indicated.
   2. Provide nameplates for field-mounted motor starters, disconnect switches, manual starter switches, pushbutton stations, and similar equipment operating components, which shall describe motor or equipment function and circuit number.
   3. Provide nameplates with ½-inch high letters to identify each junction and terminal box shown or indicated.
   4. On switchgear, provide nameplates for each main and feeder circuit including control fuses, and for each indicating light and instrument.
      a. Provide nameplate with 1.5-inch high letters giving switchgear designation, voltage rating, ampere rating, short circuit rating, manufacturer's name, general order number, and item number.
      b. Identify individual door for each compartment with nameplate giving item designation and circuit number.
   5. Motor Control Centers:
      a. Provide nameplate with 1.5-inch letters with motor control center designation.
      b. Identify individual door for each unit compartment with nameplate identifying controlled equipment.
   6. Except conduit, all electrical appurtenances including lighting panels, convenience outlets, fixtures, and lighting switches, shall be provided with nameplates indicating appropriate circuit breaker number(s).
   7. Push Buttons:
      a. Provide legend plates for identification of functions.
      b. Provide nameplates for identification of controlled equipment.
      c. Provide red buttons for stop function.
      d. Provide black buttons for other functions.
   8. Pilot Lights:
      a. Provide legend plates for identification of functions.
      b. Provide nameplates for identification of controlled equipment.
      c. Shall have lens colors as shown or indicated. Where no color is indicated, provide the following lens colors:

Color	Legend
Green	Running, Open
Red	Stopped, Closed
Amber	Alarm
Blue	Power
White	Status

9. Selector Switches:
    a. Provide legend plates for identification of functions.
    b. Provide nameplates for identification of controlled equipment.
10. Panel Mounted Instruments:
    a. Provide nameplates for identification of function.
11. Interiors of Cabinets, Consoles, Panels, Terminal Boxes, and Other Enclosures:
    a. Provide nameplates for identification.
    b. Provide each item inside cabinet, console, panel, terminal box, or enclosure with laminated plastic nameplate as shown on approved Shop Drawings and Contractor's other submittals. Install nameplates with adhesive.
    c. Interior items requiring nameplates include:
        1) Terminal blocks and strips.
        2) Bus bars.
        3) Relays.
        4) Rear of face-mounted items.
        5) Rear of door-mounted items.
        6) Interior mounted items that require identification when mounted externally.
    d. Circuit Breaker Directory:
        1) Provide engraved laminated plastic directory listing function and load controlled for each circuit breaker within panel used for power distribution.
12. Re-label existing equipment whose designation have changed.

C. Safety Signs and Voltage Markers:
1. Provide safety signs and voltage markers on and around electrical equipment as shown or indicated.
    a. Install rigid safety signs using stainless steel fasteners.
    b. Clean surfaces before applying pressure-sensitive signs and markers.
2. Provide cable tray safety signs on both sides of cable trays at maximum intervals of 20 feet. Install signs on side rails of tray as acceptable to Engineer.
    a. Cable trays that contain conductors greater than 208 volts and less than 600 volts shall be labeled with low voltage safety signs.
    b. Cable trays that contain conductors of 120/208 volts shall be labeled with low voltage markers.
    c. Do not label cable trays that contain only instrument signal cables.
    d. Label cable trays that contain intrinsically safe wiring or cables in accordance with NEC Article 504.
3. Install low voltage safety signs on equipment doors that provide access to uninsulated 480-volt conductors, including terminal devices.
4. Install low voltage markers on each terminal box, safety disconnect switch, and panelboard installed, modified, or relocated as part of the Work and containing 120/208 volt conductors.

D. Voltage System Identification Directories

1. Provide voltage system identification directories as required by NEC Article 210 and NEC Article 215.
2. For panelboards, switchboards, motor control centers, and other branch circuit or feeder distribution equipment that are not located in electrical rooms, provide voltage system identification directory mounted on equipment.
    a. Directories shall be affixed using epoxy glue. Screws or bolts shall not penetrate equipment enclosures.
    b. Directories shall be readily visible and not obscure labels and other markings on equipment.

E. Arc-flash Safety Signs:
1. Provide arc-flash safety signs as required by NEC Article 110.
2. Provide signs for switchboards, panelboards, motor control centers, and industrial control panels. Provide signs for control panels that contain 480 volt equipment.

F. Wire and Cable Identification:
1. Color-coding of insulated conductors shall comply with This Section, Low Voltage Electrical Power Conductors and Cables.
2. Use heat-shrinkable wire labels where wire or cable is terminated. Use wrap-around labels where wire or cable is to be labeled but is not terminated.
3. Do not provide labels for the following:
    a. Bare (uninsulated) conductors, unless otherwise shown or indicated as labeled.
4. Provide wire and cable labels for the following:
    a. New, rerouted, or revised wire or cable.
    b. Insulated conductors.
    c. Wire and cable terminations:
        1) Wire labels shall be applied between ½-inch and one inch of completed termination
        2) Apply cable labels between ½-inch and one inch of cable breakout into individual conductors.
            a) Label individual conductors in a cable after breakout as specified for wires.
    d. Wire or cable exiting cabinets, consoles, panels, terminal boxes, and enclosures.
        1) Label wires or cables within two inches of entrance to conduit.
    e. Wire or cable in junction boxes and pull boxes
        1) Label wires or cables within two inches of entrance to conduit.
    f. Wire and cable installed in cable tray.
        1) Wire and cable shall have labels at maximum intervals of 20 feet.
    g. Wire and cable installed without termination in electrical manholes.
        1) Wire and cable shall have wrap-around labels applied within one foot of exiting manhole.
5. Wire and Cable Identification System:
    a. Wire and cable labels shall be imprinted with an identifying designator.
        1) Wire and cable extending between two devices or items and that does not undergo a change of function shall be identified by a single unique designator as specified below.
    b. Field Wiring:
        1) Wire or cable designator shall consist of:

a) Three left-most characters shall consist of the Contract number under which wiring or cable was installed.
b) Fourth character from the left shall be an asterisk (*), a plus sign (+) or a hyphen (-). Do not use other punctuation symbols in a wire designator.
c) Remaining characters shall be alphanumeric and make wire designator unique.
d) Numbering shall reflect actual designations used in the Work and shall be documented in record documents.

c. Cabinet, Console, Panel, and Enclosure Wiring, Internal:
1) New Cabinets, Consoles, Panels, and Enclosures:
a) Wire and cable inside cabinets, consoles, panels, and enclosures shall have designators as specified in Section 40 78 00 – Panel Mounted Instruments and Devices.

6. Modified Cabinets, Consoles, Panels, and Enclosures:
a. New or rerouted wire or cable in existing cabinets, consoles, panels, and enclosures shall be labeled as shown on the Drawings or be assigned a ten-character designator equivalent to field wire designator.

G. Terminal Strip Labeling:
1. Label panel side of terminal to match panel wire number.
2. Label field side of terminal to match field wire number. Terminal number shall not include the Contract number.

H. Generator System Warning Signs:
1. Provide warning signs for generator systems as required by NEC.
2. Install generator location warning sign on or immediately adjacent to service equipment, or to “normal” source disconnecting means when generator is located out of sight of service equipment or disconnecting means.
3. Install generator grounding warning sign on enclosure or immediately adjacent to point where generator neutral is connected to grounding electrode system if connection is made remote from generator.

END OF SECTION

SECTION 26 05 36

CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install cable trays.

B. Coordination:
   1. Coordinate installation of cable trays with other systems and equipment. Locate cable trays clear of interferences.
   2. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before cable tray Work.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. NEMA VE 1, Metal Cable Tray Systems.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with electrical code in effect at the Site and the following:
   1. NEC Article 392, Cable Trays.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Product Data:
      a. Manufacturer’s technical information for cable tray materials and system proposed for use.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers: Provide products of one of the following:
   1. B-Line Systems.
   2. Chalfant Manufacturing Company.
   3. Enduro Systems, Inc.
   4. Or equal.

B. Cable Tray System:

1. Type: Ladder, rungs welded to side rails.
2. Material: Aluminum.
3. Rung Spacing: Nine inches on centers, minimum.
4. Inside Depth: Four inches minimum or as otherwise shown or indicated.
5. Radius: Six inches to two feet as shown, indicated, or required.
6. Width: Six inches to three feet as shown, indicated, or required.
7. Support Span: Not to exceed twelve feet, unless otherwise shown or indicated.
8. Loading Capacity: NEMA 12C or greater.
9. Cable tray system shall comply with NEC Article 392 and NEMA VE1.
10. Cover: Solid, aluminum.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Installation, General:
   1. Install cable trays in accordance with manufacturer's instructions and recommendations. Provide complete cable tray system prior to installing cables.
   2. Install cable trays exposed and in accessible locations.
   3. Ground cable tray system components.
   4. Where required, connect conduit to cable tray using cable tray conduit clamps.
   5. Provide barrier strips in cable trays to isolate instrumentation and communication cables from 120VAC and greater power and control wiring.
   6. Provide cover for cable tray. Attach with manufacturer's hardware.

END OF SECTION

SECTION 26 05 43

ELECTRICAL SITE WORK

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install underground ductbanks.
   2. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install manholes and handholes for electrical systems Work.

B. Coordination:
   1. Ductbank routing on the Drawings is diagrammatic. Coordinate installation with piping and other Underground Facilities and locate ductbanks clear of interferences.
   2. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before underground ductbank Work.
   3. Coordinate handhole installation with piping, sheeting other excavation supports, and other Underground Facilities, and locate clear of interferences.
   4. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before handhole for electrical systems Work.

C. Related Sections:
   1. Section 31 23 34.01 - Excavation, Trenching, Dewatering and Backfilling.
   2. Section 03 05 00 - Concrete.
   3. Section 26 05 02 - Basic Electrical Work.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI/SCTE 77, Specification for Underground Enclosure Integrity.

1.3 QUALITY ASSURANCE

A. Component Supply and Compatibility:
   1. Obtain all handholes furnished under this Section from a single Supplier, unless otherwise acceptable to Engineer.
   2. Handhole Supplier shall review and approve the Shop Drawing submittals for the handholes furnished.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Handholes: Submit schedule of handholes to be furnished and dimensions and pertinent data for each.

2. Product Data:
    a. Manufacturer's technical information, specifications, and literature for manholes, handholes, castings, and accessories proposed for use.

B. Closeout Submittals: Submit the following:
    1. Record Drawings:
        a. Include actual routing of underground ductbank runs on record documents in accordance with Section 01 70 00 - Execution and Closeout Requirements.

PART 2 PRODUCTS

2.1 DUCT BANK MATERIALS

A. Duct: Provide conduit and fittings in accordance with Section 26 05 02 – Basic Electrical Work. Conduit types shall be as follows:
    1. Schedule 40 PVC conduits for power circuits.

B. Backfill: Provide backfill, including select backfill, in accordance with Section 31 23 34.01 - Excavation, Trenching, Dewatering and Backfilling.

C. Reinforcing: Provide Ductbank reinforcing in accordance with Section 03 05 00 - Concrete.

D. Concrete: Provide ductbank concrete in accordance with Section 03 05 00 - Concrete.

E. Grounding: Provide ground cable in accordance with Section 26 05 02 - Basic Electrical Work, Grounding and Bonding for Electrical Systems.

F. Conduit Spacers: Conduit spacers shall be nonmetallic, interlocking type to maintain spacing between conduits. Provide spacers suitable for all conduit types used in multiple sizes.

G. Duct Sealing Compound:
    1. Products and Manufacturers: Provide one of the following:
        a. 0-Z/Gedney, Type DUX.
        b. Or equal.

2.2 SMALL HANDHOLES

A. Material and Construction:
    1. Manufacturer: Provide products of one of the following:
        a. Strongwell Quazite.
        b. Or equal.
    2. Material: Precast polymer concrete.
    3. Duct entrances sized and located to suit ductbanks.
    4. Enclosures and covers shall be UL-listed.
    5. Enclosures, boxes, and covers shall comply with test provisions of ANSI/SCTE 77 for Tier 22 applications.

PART 3 EXECUTION

3.1 DUCTBANK INSPECTION

A. Examine conditions under which the Work is to be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 DUCTBANK INSTALLATION

A. Excavation and Backfilling:
   1. Provide excavation and backfilling for ductbank installation in accordance with Section 31 23 34.01 - Excavation, Trenching, Dewatering and Backfilling.
   2. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material, or other materials that can damage or contribute to corrosion of ducts or cables or prevent adequate compaction of backfill.

B. Ductbank Layout:
   1. Top of ductbank concrete shall be a minimum of 2.5 feet below grade, unless shown or indicated otherwise on the Drawings.

C. Ductbank Assembly:
   1. Assemble ductbanks using non-magnetic saddles, spacers, and separators. Position separators to provide minimum three-inch concrete separation between outer surfaces of each conduit. Provide side forms for each ductbank.
   2. Make bends with sweeps of not less than four-foot radius or five-degree angle couplings.

D. Concrete Placing:
   1. Provide minimum four-inch concrete covering on each side, top, and bottom of concrete envelopes around conduits. Concrete covering shall be as shown or indicated on the Drawings.
   2. Provide red dye in concrete for easy identification during subsequent excavation; all concrete in entire ductbank, including top and bottom, shall be dyed.
   3. Firmly fix conduits in place during concrete placing. Carefully place and vibrate concrete to fill spaces between conduits.

E. Conduit Transitions:
   1. Conduit installations shall be watertight throughout entire length of ductbank.
   2. Plug and seal empty spare conduits entering structures. Conduits in use entering structures shall be sealed watertight with duct sealing compound.

F. Detectable Underground Warning Tape:
   1. Provide detectable underground warning tapes complying with Section 26 05 02 - Basic Electrical Work, Identification for Electrical Systems, over the full length of each underground ductbank.
   2. Install warning tapes approximately 12 inches below grade.

3. Provide multiple tapes across the width of each ductbank. Locate center of a warning tape above each edge of ductbank, and at intervals across top width of ductbank so that clear space between tapes does not exceed six inches.

G. Reused Existing Ducts:
   1. Pull rag swab through duct to remove water and to clean conduits prior to installing new cable.
   2. Repeat swabbing until all foreign material is removed.
   3. Pull mandrel through duct, if necessary, to remove obstructions.

END OF SECTION

SECTION 26 20 05

ELECTRICAL DISTRIBUTION EQUIPMENT

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PART 1 GENERAL

1.1 EQUIPMENT DESCRIPTIONS

A. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified, and required to furnish and install equipment as listed below:
   1. Dry-Type Low-Voltage Distribution Transformers.
   2. Switchboards.
   3. Panelboards.
   4. Low-Voltage Receptacles.
   5. Snap Switches.
   6. Disconnect Switches.
   7. Enclosed Circuit Breakers.
   8. Surge Protective Devices.

1.2 REFERENCES

A. Dry-Type Low-Voltage Distribution Transformers standards referenced are:
   1. NEMA ST-20, Dry Type Transformers for General Applications.
   2. NEMA TP-1, Guide for Determining Energy Efficiency for Distribution Transformers.
   3. NEMA TP-2, Standard Test Method for Measuring the Energy Consumption for Distribution Transformers.
   4. UL 1561, Dry Type General Purpose and Power Transformers.

B. Switchboards standards referenced are:
   1. NEMA PB2, Dead-Front Distribution Switchboards.
   2. UL 891, Dead-Front Switchboards.

C. Panelboards standards referenced are:
   1. NEMA PB 1, Panelboards.
   2. UL 67, Panelboards.

D. Low-Voltage Receptacles standards referenced are:
   1. UL 498, Standard for Attachment Plugs and Receptacles.
   2. UL 514D, Cover Plates for Flush-Mounted Wiring Devices.
   3. UL 943, Standard for Ground-Fault Circuit-Interrupters.
   4. UL 1449, Standard for Surge Protective Devices.

E. Snap Switches standards referenced are:
   1. UL 20, General Use Snap Switches.

F. Disconnect Switches Standards referenced are:
   1. UL 98, Enclosed and Dead-Front Switches.
   2. NEMA KS 1, Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
   3. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

G. Enclosed Circuit Breaker Standards referenced in this Section are:
   1. NFPA 70, National Electrical Code.
   2. NEMA AB 1, Molded-case Circuit Breakers
   3. UL 50, Enclosures for Electrical Equipment
   4. UL 50E, Enclosures for Electrical Equipment, Environmental Considerations
   5. UL 489, Molded-case Circuit Breakers

H. Surge Protective Devices Standards referenced are:
   1. ANSI/UL 1449, Surge Protective Devices.
   2. IEEE C62.11, Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV)
   3. IEEE C62.41, Recommended Practice on Surge Voltages in Low-voltage AC Power Circuits.
   4. IEEE C62.45, Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1,000 V and Less) AC Power Circuits.
   5. UL 1283, Electromagnetic Interference Filters.

1.3 QUALITY ASSURANCE

A. Dry-Type Low-Voltage Distribution Transformers Regulatory Requirements:
   1. NEC Article 450, Transformers.

B. Switchboards Qualifications:
   1. Manufacturer: Shall have not less than five years' experience manufacturing and servicing materials and equipment substantially similar to those required and upon request shall submit documentation of not less than five installations in satisfactory operation for at least five years each.
   2. Manufacturer shall manufacture circuit protective devices within the assembly.

C. Switchboards Component Supply and Compatibility:
   1. Obtain all materials and equipment included in this Section regardless of component manufacturer from a single switchboard manufacturer.
   2. Switchboard manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.
   3. Components shall be suitable for the specified service conditions and shall be integrated into overall assembly by switchboard manufacturer.

D. Switchboards Regulatory Requirements: Comply with the following:
   1. NEC Article 408, Switchboards and Panelboards.

E. Panelboards Regulatory Requirements; Comply with the following:
   1. NEC Article 408, Switchboards and Panelboards.

F. Low-Voltage Receptacles Regulatory Requirements: Comply with the following:
   1. Americans with Disabilities Act.
   2. NEC Article 406, Receptacles, Cord Connectors, and Attachment Plugs (Caps).

G. Snap Switches Regulatory Requirements
   1. Americans with Disabilities Act

H. Disconnect Switches Regulatory Requirements:
   1. NEC Article 404, Switches.
   2. Disconnect switches shall bear the UL label.

I. Enclosed Circuit Breaker Qualifications:
   1. Manufacturer: Manufacturer shall have not less than five years of experience producing substantially similar equipment to that required and, upon request, shall submit documentation of not less than five installations in satisfactory operation for not less than five years in the United States.

J. Surge Protective Devices Qualifications:
   1. Manufacturer: Shall have at least five years' experience manufacturing and servicing products substantially similar to those required and shall be able to submit documentation of at least five installations in satisfactory operation for at least five years each.

K. Surge Protective Devices Component Supply and Compatibility:
   1. Obtain all products included in this Section regardless of component manufacturer from a single SPD manufacturer.

2. SPD manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.
3. Components shall be suitable for the specified service conditions and shall be integrated into overall assembly by SPD manufacturer.

L. Surge Protective Devices Regulatory Requirements: Comply with the following:
1. NEC 110.9, Requirements for Electrical Installations, Interrupting Rating.
2. NEC 240.21, Overcurrent Protection, Location in Circuit.

1.4 SUBMITTALS

A. Dry-Type Low-Voltage Distribution Transformers Action Submittals:
1. Shop Drawings: Schedule of transformers to be furnished with ratings and other required technical data.
2. Product Data: Supplier’s technical information for transformers proposed for use.

B. Switchboards Action Submittals:
1. Shop Drawings:
a. Three-line diagrams.
b. Dimensional information including front view elevation and plan view.
c. Construction details of enclosures with conduit entry locations and connection details between assemblies.
d. Components list and nameplate schedule.
e. Summary sheets with schedules of equipment.
2. Product Data:
a. Manufacturer’s technical information, including catalog information.
b. Manufacturer's technical specifications with assembly and component ratings.
c. Time current curves for protective devices.

C. Switchboards Informational Submittals:
1. Certificates:
a. Certifications required in this Section, including seismic requirements.
2. Source Quality Control Submittals:
a. Report of results of testing and inspections performed at manufacturer’s shop.
3. Site Quality Control Submittals:
a. Report of results of field testing.
4. Supplier Reports:
a. Submit written report of results of each visit to Site by Supplier’s service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
5. Qualifications Statements:
a. Manufacturer, when requested by Engineer.

D. Switchboards Closeout Submittals:
1. Operations and Maintenance Data:
a. Submit in accordance with Section 01 33 00 – Submittals and Section 01 70 00 - Execution and Closeout Requirements.
b. Include acceptable test reports, maintenance data and schedules, description of operation, wiring diagrams, and list of spare parts recommended for one year of operation with current price list.

c. Include record drawings of control schematics, with point-to-point wiring diagrams.

E. Panelboards Action Submittals:
   1. Shop Drawings: Listing of panelboards to be furnished with identification of their proposed location, and all electrical characteristics, including number and rating of branch circuit breakers and enclosure type.
   2. Product Data: Manufacturer's technical information for panelboards proposed for use, including product literature and specifications. Indicate options and features to be provided.

F. Low-Voltage Receptacles Action Submittals:
   1. Product Data: Manufacturer's technical information for receptacles and cover plates proposed for use.

G. Snap Switches Action Submittals:
   1. Product Data: Manufacturer's technical information for switches proposed for use.

H. Disconnect Switches Action Submittals:
   1. Shop Drawings:
      a. Listing of each switch to be furnished, including location, rating, and NEMA enclosure type for each.
   2. Product Data:
      a. Manufacturer's technical information for disconnect switches proposed for use.

I. Disconnect Switches Maintenance Material Submittals:
   1. Extra Stock Materials:
      a. Furnish one set of spare fuses for each fused disconnect switch to be installed.

J. Enclosed Circuit Breaker Action Submittals:
   1. Shop Drawings:
      a. Outline drawings with dimensions, materials of construction, installation details, accessories, and equipment ratings for voltage, amperage and short-circuit.
   2. Product Data:
      a. Manufacturer's technical information for enclosed circuit breakers proposed for use.

K. Enclosed Circuit Breaker Informational Submittals:
   1. Source Quality Control Submittals:
      a. Perform standard factory tests on equipment furnished under this Section. Tests shall be in accordance with applicable NEMA and UL standards. Submit results of required source quality control tests and inspections.
   2. Site Quality Control Submittals:
      a. Results of required field quality control tests and inspections.
   3. Qualifications Statements:
      a. Submit manufacturer qualifications when requested by Engineer.

L. Enclosed Circuit Breaker Closeout Submittals:

1. Operation and Maintenance Data:
    a. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, and description of operation.
    b. Recommended Spare Parts and Extra Stock Materials: Include list of additional spare parts or extra stock materials recommended for use with enclosed molded-case circuit breakers. Describe each recommended part, quantity recommended, current unit price, and ordering information.
    c. Comply with Section 01 70 00 - Execution and Closeout Requirements.

M. Surge Protective Devices Action Submittals:
1. Shop Drawings:
    a. Electrical and mechanical drawings for each type of unit, showing electrical ratings, dimensions, mounting provisions, connection details, and layout diagrams.
    b. Components list and nameplate schedule.
    c. Summary sheets with schedules of equipment.
2. Product Data:
    a. Manufacturer’s technical information, including catalog information.
    b. Manufacturer's technical specifications with assembly and component ratings.

N. Surge Protective Devices Informational Submittals:
1. Certifications:
    a. Certification that SPD devices comply with standards referenced in this Section.
2. Source Quality Control Submittals:
    a. Report of results of testing and inspections performed at manufacturer’s shop.
3. Supplier Reports:
    a. Submit written report of results of each visit to Site by Supplier’s service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
4. Qualifications Statements:
    a. Manufacture, when requested by Engineer.

O. Surge Protective Devices Closeout Submittals:
1. Operations and Maintenance Data:
    a. Submit in accordance with Section 01 33 00 – Submittals and Section 01 70 00 - Execution and Closeout Requirements.
    b. Include acceptable test reports, maintenance data and schedules, description of operation, wiring diagrams, and list of spare parts recommended for one year of operation with current price list.
2. Warranty Documentation: Submit example warranty at time of shipment of the equipment. Include final warranty accepted by Engineer in the operations and maintenance manual for the equipment.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Switchboards
1. Delivery: Upon delivery, check for evidence of water that may have entered equipment during transit.

2. Handle equipment in accordance with manufacturer's instructions. One copy of these instructions shall be furnished with equipment at time of delivery.
3. Storage: Store switchboards equipment in a clean, dry location with controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.

B. Panelboards Packing, Shipping, Handling, and Unloading:
1. Packing:
a. Inspect prior to packing to assure that assemblies and components are complete and undamaged.
b. Protect mating connections.
c. Cover all openings into enclosures with-vapor inhibiting, water-repellent material.
2. Deliver materials and equipment to Site to ensure uninterrupted progress of the Work. Deliver anchorage materials to be embedded in concrete in ample time to prevent delaying the Work. Upon deliver, check materials and equipment for evidence of water that may have entered equipment during transit.
3. Comply with Section 01 60 00 - Product Requirements.

C. Panelboards Storage and Protection:
1. Store panelboards in a clean, dry location. Protect equipment with coverings.
2. Comply with Section 01 60 00 - Product Requirements.

D. Surge Protective Devices delivery, storage, and handling.
1. Delivery: Upon delivery, check for evidence of water that may have entered equipment during transit.
2. Storage:
a. Store SPD equipment in a clean, dry location. Protect equipment with coverings.
b. Protect equipment from corrosion and deterioration.

1.6 SURGE PROTECTIVE DEVICES WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive Owner of other rights or remedies Owner may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under the Contract Documents. The obligations of Contractor under the Contract Documents shall not be limited in any way by the provisions of the specified special warranty.

B. Special Warranty on Materials and Equipment:
1. Provide manufacturer's written warranty, running to the benefit of Owner, agreeing to correct, or at option of Owner, remove or replace materials or equipment specified in this Section found to be defective during a period of five years after the date of Substantial Completion.

PART 2 PRODUCTS

2.1 DRY-TYPE LOW-VOLTAGE DISTRIBUTION TRANSFORMERS MATERIALS

A. Dry Type Two-Winding Transformer:
   1. Type: Dry type, air cooled, low temperature rise. Transformers 15 kVA and larger shall be energy efficient, complying with NEMA TP-1 Class 1 efficiency levels. Transformers less than 15 kVA shall be general purpose.
   2. Rating: KVA, primary voltage and connection, secondary voltage and connection, frequency and number of phases shall be as shown on the Drawings.
   3. Insulation: Insulation and average winding temperature rise (in a 40 degree C maximum ambient) for rated kVA per the following table. Energy efficient transformers shall be capable of 15 percent continuous overload at 150 degrees C temperature rise.

kVA Rating	Insulation Class (degrees C)	Temperature Rise (degrees C)
1 to 15 kVA	185	115
25 to 500 kVA	220	115

   4. Winding Taps, Transformers 15 kVA and Less: Two 5-percent below rated voltage, full capacity taps on primary winding.
   5. Winding Taps, Transformers 25 kVA and Larger: Two 2-1/2-percent above rated voltage and four 2-1/2+ percent below rated voltage, full capacity taps on primary.
   6. Basic impulse level shall be 10 kV.
   7. Sound Level: NEMA ST-20 standard.
   8. Enclosure: UL listed for the application.
      a. Indoors in prefabricated FRP enclosures: NEMA 4X, 316 stainless steel.
      b. Indoors in prefabricated, precast concrete enclosures: NEMA 1 when HVAC is provided for the enclosure and approved by CFPUA and recommended by the Engineer. Otherwise, enclosure shall be NEMA 4X, 316 stainless steel.
      c. Outdoors: NEMA 3R painted stainless steel or NEMA 4X, 316 stainless steel.
   9. Identification: Identify transformers in accordance with Section 26 05 02, Basic Electrical Work, Identification for Electrical Systems, with the transformer number and voltages, connection data, kVA ratings, impedance, and overload capacity.
   10. Transformers shall comply with NEMA ST-20, NEMA TP-1, NEMA TP-2, and UL 1561.
   11. Transformers shall bear the label of the Underwriters' Laboratories, Inc.

B. Manufacturers: Provide products of one of the following:
   1. Cutler-Hammer.
   2. General Electric Company.
   3. Square D Company.
   4. Siemens.
   5. Or equal.

2.2 SWITCHBOARDS MATERIALS

A. Manufacturers: Provide equipment of one of the following:
   1. Eaton/Cutler-Hammer.

2. General Electric.
3. Schneider Electric/Square D Company.
4. Or equal.

B. Ratings:
1. Switchboard shall be 600-volt class, suitable for operation on three-phase, 60-Hertz system.
2. System operating voltage, number of wires, bus ampacity, and short circuit withstand capability and interrupting rating shall be as shown on the Drawings, or as otherwise indicated in the Contract Documents.

C. General:
1. Switchboards shall be dead-front type with individual and group-mounted devices, front-accessible.
2. Arrange switchboards with number of sections and compartments required for distribution arrangement shown.
3. Provide switchboard in accordance with the arrangement shown on the Drawings. Switchboard shall consist of bus system, structure, circuit breakers, metering, and enclosure.
4. Switchboards shall be in accordance with NEMA PB2, UL 891, and NEC Article 408.
5. Where configured with a main service disconnect, switchboard shall be service entrance type and UL-labeled as such. Equip service entrance switchboards with bonding jumper to bond enclosure and ground bus to the neutral bus, and a barrier to isolate service bus bars and terminals.

D. Bus Bars:
1. Switchboard bus bars shall be tin-plated copper, supported with high-impact, non-tracking insulating material. Secure bus joints with Belleville type washers, and braced bus joints for mechanical forces exerted during short circuit conditions. Mount main horizontal bus bars with all three phases arranged in the same vertical plane.
2. Bus bar sizes shall be based upon a maximum temperature rise of 65 degrees C over a 40-degree C ambient in accordance with NEMA PB2 and UL 891.
3. Provide copper ground bus, minimum size of 1/4-inch by two inches, secured to each vertical section and extending entire length of equipment. Ground bus current capacity shall equal one-half the capacity of main power bus.
4. Conductor hardware shall be high-tensile strength and zinc-plated. Provide bus joints with conical spring-type washers.

E. Structure:
1. Equipment structure shall be completely self-supporting and shall include required number of vertical sections bolted together to form a single metal-enclosed enclosure.
2. Enclosures:
   a. Indoors in prefabricated FRP enclosures: NEMA 4X, 316 stainless steel.
   b. Indoors in prefabricated, precast concrete enclosures:
      1) When HVAC is provided for the enclosure and where approved of by CFPUA and recommended by the Engineer: NEMA 12. Exterior and interior steel surfaces of switchboard shall be properly cleaned and

provided with rust-inhibiting phosphatized coating by switchboard manufacturer. Color and finish of switchboard shall be light gray.

2) Otherwise, enclosure shall be NEMA 4X, 316 stainless steel.

c. Outdoors: NEMA 4X, 316 stainless steel.

3. Enclosure structure frame shall be die-formed, 12-gauge steel bolted together and reinforced.
4. Equipment shall have identifying nameplates in accordance with Section 26 05 02 - Basic Electrical Work. Provide nameplates for each circuit breaker circuit and provide typewritten directory of circuits.
5. Cover sides and rear of enclosure with removable, bolt-on covers. Edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within enclosure.
6. Sections of switchboard shall be front- and rear-aligned with depth as shown on the Drawings. Devices shall be front-removable and load connections shall be front-accessible.
7. Provide assembly with adequate lifting means so that assembly is capable of being moved to its installation position.
8. Conduit entry and exit shall be bottom entry and coordinated by Contractor.

F. Wiring/Terminations:
1. Provide small wiring, necessary fuse blocks, and terminal blocks in switchboard as required. Control components mounted in assembly, such as fuse blocks, relays, pushbuttons, switches, and other components, shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
2. Provide mechanical-type terminals for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of size indicated on the Drawings.
3. Provide lugs in incoming line section for connection of main grounding conductor. Provide additional lugs for connection of other grounding conductors as indicated on Drawings.
4. Control wire shall be Type SIS, bundled and secured with nylon ties. Provide insulated locking spade terminals for all control connections, except where saddle type terminals are provided integral to a device. Current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to another device. Provide groups of control wires leaving switchboard with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

G. Miscellaneous Devices:
1. Provide control power transformers with primary and secondary protection, as indicated on the Drawings or as required for proper operation of equipment.

2.3 SWITCHBOARDS SOURCE QUALITY CONTROL

A. Tests:
1. Factory-test switchboards in accordance with NEMA PB2 and UL 891
2. Perform factory tests on equipment prior to shipment. Tests shall consist of the manufacturer's standard tests, and shall include:
a. Physical inspection and checking of all components.

b. Operation and device function tests under simulated service conditions to verify accuracy of wiring and functioning of all equipment.
c. Primary, control, and secondary wiring hi-pot tests.

2.4 SWITCHBOARD CIRCUIT BREAKERS MATERIALS

A. Circuit breakers shall be molded case type with quantity of poles, voltage, and current ratings shown.

B. Circuit breakers shall be manually-operated thermal magnetic type, including inverse-time overload and instantaneous short-circuit protection. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by arc chutes.

C. Circuit breakers shall be operated by a toggle-type handle and shall have quick-make/quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of circuit breakers shall be clearly indicated by handle position.

D. Where shown or required due to capacity, circuit breakers shall be insulated case type. Insulated case circuit breakers shall be manually-operated with stored energy mechanisms. Circuit breakers shall include open-close pushbuttons, five-cycle close time, and rotary operated stored energy handle mechanism providing quick make/quick-break protection.

E. Circuit breakers shall have 100-amp frames, minimum. Provide overload protection on all poles, with trip settings as shown. Circuit breakers with frame sizes 250 amps and below shall have thermal-magnetic trip units and inverse time-current characteristics, or equal.

F. Provide circuit breakers 400-amp frame and larger with an electronic solid state programmable trip unit. For four-wire power systems and circuits, provide a neutral current transformer, and trip unit shall be suitable to accept neutral input. Provide push-to-trip button on front of circuit breaker to provide local manual means of exercising trip mechanism. Electronic trip system shall include:
   1. Plug-in protection programmer, flux shift trip device, and current sensor package. Construct programmer, sensor, and flux-shifting trip device as integral elements of circuit breaker, requiring no externally mounted assemblies for proper operation.
   2. Solid state, microprocessor-based, nine-function programmer shall provide true RMS current sensing and include adjustable continuous and instantaneous current elements with adjustable long time, short time, zero sequence ground fault pickup and delay and zone selective interlocking. Main, tie and feeder circuit breakers shall be connected for zone selective interlocking to allow instantaneous bus protection.

G. Where shown, provide circuit breakers with shunt trips, bell alarms, and auxiliary devices.

2.5 MAIN METER DEVICE MATERIALS

A. Provide main meter device as shown on the Drawings, and in accordance with the following.

1. Type 1 Microprocessor-based Monitoring Device:
   a. Device shall provide complete electrical metering in one package. Device shall include self-contained potential transformers and self-protected internal fuses.
   b. Mount device on compartment door to allow personnel access to meter menu and display.
   c. Device shall include trend analysis, event logging, and recording. Device shall include the following direct reading metered values:

1)	Volts:	0.2 percent accuracy
2)	Amperes:	0.2 percent accuracy
3)	Watts, Vars, and VA:	0.5 percent accuracy
4)	Power Factor:	1.0 percent accuracy
5)	Frequency:	0.05 percent accuracy
6)	Watts, and VA Hours:	0.5 percent accuracy
7)	Var Hours:	1.0 percent accuracy
8)	Watts, Var, and VA Demand:	0.4 percent accuracy
9)	THD-Voltage:	50th harmonic
10)	THD-Current:	50th harmonic
11)	Individual Ampere Harmonics:	50th harmonic
12)	Individual Voltage Harmonics:	50th harmonic

   d. Metering device shall have the following additional features:
      1) Trend analysis that shall display minimum and maximum values for each metered parameter with date and time of each occurrence.
      2) Input range of device shall accommodate external current transformers with ranges from 100/5 to 5000/5 and potential transformers from a ratio of 120:120 to 500,000:120. Three current transformers suitably rated shall be included.
      3) Alarm contacts rated five amps at 120 vac.
      4) Three analog outputs programmable to reflect the metered parameters, except kilowatt hours and kilovar hours.
      5) Communication capability, using RS-485, Modbus RTU Protocol or Ethernet as indicated on the Drawings

2.6 PANELBOARD MATERIALS

A. Panelboards:
   1. Manufacturers: Provide products of one of the following:
      a. General Electric Company.
      b. Eaton/Cutler-Hammer.
      c. Schneider Electric/Square D Company.
      d. Or equal.
   2. Rating: Voltage rating, current rating, number of phases, number of wires and number of poles as shown or indicated on the Drawings.
   3. Bus Bars: Bus bars shall be 98 percent conductivity copper. Four-wire panelboards shall have solid neutral bar. Each panel shall have ground bus bar.
   4. Main: Panelboards shall have main circuit breaker unless the Drawings specifically indicate main lugs only.
   5. Connect branch circuit breakers for sequence phasing.
   6. Enclosures:
      a. Indoors in prefabricated FRP enclosures: NEMA 4X, 316 stainless steel.

b. Indoors in prefabricated, precast concrete enclosures: NEMA 1 when HVAC is provided for the enclosure and approved by CFPUA and recommended by the Engineer. Otherwise, enclosure shall be NEMA 4X, 316 stainless steel.
c. Outdoors: NEMA 4X, 316 stainless steel.

7. Construction: Code-grade steel, ample gutter space, flush door, flush snap latch and lock. Panelboards shall comply with NEMA PB 1 and UL 67.
8. Trim: Surface.
9. Directory: Typed or computer-printed card, with transparent protective cover in frame on back of door giving circuit numbers and area or equipment served.
10. Identification: Identify panelboards in accordance with Section 26 05 02 - Basic Electrical Work. Identification shall indicate panel number and voltage.
11. Directory of Existing Panelboards: When adding or removing circuit breakers or loads from existing panelboards, provide a new typed or computer-generated directory card, indicating the circuit numbers and equipment served.

B. Panelboard Circuit Breakers
1. Circuit Breakers: Molded case, bolt-in thermal magnetic type with number of poles and trip ratings as shown or indicated. Where indicated on the Drawings, circuit breakers shall be ground fault circuit interrupting type equipped with solid state sensing and five-milliamp sensitivity.
2. Circuit breakers for 480-volt panelboards shall have minimum interrupting rating of 14,000 ampere RMS symmetrical, unless otherwise indicated on the Drawings. Circuit breakers for other panelboards shall have minimum interrupting rating of 10,000 ampere RMS symmetrical, unless otherwise indicated on the Drawings.

C. Integrated Panelboard and Transformer:
1. Products and Manufacturers: Provide products of one of the following:
a. Mini-Power Zone by Schneider Electric/Square D Company.
b. Mini-Power Center by Eaton/Cutler-Hammer.
c. Panel Tran by Acme Electric Corporation.
d. Or equal.
2. General: Unit shall consist of encapsulated dry-type transformer, primary and secondary main circuit breakers, and secondary panelboard all in one enclosure.
3. Transformer Rating: Transformer portion shall comply with this Section, Dry-type Low-Voltage Distribution Transformers. KVA, primary voltage, secondary voltage, frequency and number of phases shall be as shown or indicated on the Drawings.
4. Branch Circuits: Molded case circuit breakers, plug-in thermal magnetic type with number of poles and trip ratings as shown or indicated on the Drawings.
5. Enclosure: Enclosures shall be as required for the area classifications indicated in This Section, Dry-Type Low-Voltage Distribution Transformers Materials, unless otherwise indicated on the Drawings.

2.7 LOW-VOLTAGE RECEPTACLES MATERIALS

A. Receptacles:
1. Grounding receptacle, two-pole, three-wire, NEMA 5-20R configuration, brown color.
a. Single:
1) Products and Manufacturers: Provide one of the following:
a) HBL5361I by Hubbell, Inc.

b) 5361-I by Pass & Seymour.
c) Or equal.

b. Duplex:
1) Products and Manufacturers: Provide one of the following:
a) HBL5362I by Hubbell, Inc.
b) PS5362-I by Pass & Seymour.
c) Or equal.

c. Weather-resistant Duplex:
1) UL-listed as weather-resistant.
2) Products and Manufacturers: Provide one of the following:
a) HBL5362IWR by Hubbell, Inc.
b) WR5362-I by Pass & Seymour.
c) Or equal.

2. Grounding receptacle, two-pole, three-wire, 250-volt, 20 ampere, NEMA 6-20 configuration, brown color.
a. Single:
1) Products and Manufacturers: Provide one of the following:
a) HBL5461 by Hubbell, Inc.
b) 5871 by Pass & Seymour.
c) Or equal.

b. Duplex:
1) Products and Manufacturers: Provide one of the following:
a) HBL5462 by Hubbell, Inc.
b) 5862 by Pass & Seymour.
c) Or equal.

3. Provide Type 302 stainless steel cover-plate conforming to UL 514D. Provide cast metal weatherproof-while-in-use cover where shown on the Drawings as “WP” or “WPU” and provide where receptacles are located in wet or corrosive location.
4. Receptacles shall comply with UL 498.

B. Ground Fault Interrupting Receptacles:
1. Duplex grounding receptacle, two-pole, three-wire, NEMA 5-20R configuration, 125-volt AC, 20 amperes, gray color with ground fault circuit interrupting (GFCI) protection.
2. Ground fault interrupting receptacles shall comply with UL 943.
3. Provide Type 302 stainless steel cover-plate conforming to UL 514D. Provide cast metal weatherproof-while-in-use cover where shown on the Drawings as “WP” or “WPU”, and provide where located in wet or corrosive location.
4. Products and Manufacturers: Provide one of the following:
a. GFR5362SGY by Hubbell, Inc.
b. 2091-GRY by Pass & Seymour.
c. Or equal.
5. Weather-resistant Ground Fault Interrupting Receptacles
a. Products and Manufacturers: Provide one of the following:
1) 2095TRWRGRY by Pass & Seymour.
2) Or equal.

C. Weatherproof-While-in-Use Covers:
1. Where receptacles are shown on the Drawings as “WP” or “WPU”, and where receptacles are installed in wet locations as defined in area classification portion

of Section 26 05 02 - Basic Electrical Work, provide receptacles as specified in this Section, as applicable, with weatherproof-while-in-use covers as specified below.
2. Provide covers that are UL-listed, weatherproof while receptacle is in use, and are of ultraviolet-resistant construction suitable for outdoor use in accordance with NEC 406.
3. Material:
   a. Cast aluminum box with cast aluminum cover.
   b. Stainless steel screws and hardware.
   c. Color: Gray finish
4. Products and Manufacturers: Provide one of the following:
   a. TayMac Corporation.
   b. Red Dot
   c. Or equal.

D. Power and Special Receptacles: Provide receptacles with number of poles and voltage and current rating as shown or indicated. Coordinate with equipment plugs. Provide matching plug for each receptacle.

2.8 SNAP SWITCHES MATERIALS

A. Switches for Non-Hazardous Locations:
1. Single pole AC toggle switch, quiet type, 120/277-volt AC, 20 amperes, Brown, specification grade.
   a. Products and Manufacturers: Provide one of the following:
      1) Catalog No. 1221-I, by Harvey Hubbel, Inc.
      2) Catalog No. 1991-I, by Arrow-Hart, Inc.
      3) Catalog No. 20AC1-I, by Pass & Seymour.
      4) Or equal.
2. Single pole, three-way AC toggle switch, quiet type, 120/277-volt AC, 20 amperes, Brown, specification grade.
   a. Products and Manufacturers: Provide one of the following:
      1) Catalog No. 1223-I, by Harvey Hubbell, Inc.
      2) Catalog No. 1993-I, by Arrow-Hart, Inc.
      3) Catalog No. 20AC3-I, by Pass & Seymour.
      4) Or equal.
3. Two-pole AC toggle switch, quiet type, 120/277-volt AC, 20 amperes, Brown, specification grade.
   a. Products and Manufacturers: Provide one of the following:
      1) Catalog No. 1222-I, by Harvey Hubbel, Inc.
      2) Catalog No. 1992-I, by Arrow-Hart, Inc.
      3) Catalog No. 20AC2-I, by Pass & Seymour.
      4) Or equal.
4. Switches in non-hazardous areas shall be UL-listed in accordance with UL 20.

B. Switch Covers:
1. Indoor covers shall be Type 304 stainless steel.
2. Outdoor, wet, or corrosive location covers shall be weatherproof and corrosion resistant cast aluminum.

C. Key Operated On-Off Switches:

1. Key operated switches shall be complete with legend plate and NEMA 4 enclosure and two keys for each switch.

2.9 DISCONNECT SWITCHES MATERIALS

A. Manufacturers: Provide products of one of the following:
   1. Square-D Company.
   2. Cutler-Hammer.
   3. General Electric Company.
   4. Siemens.
   5. Or equal.

B. Service Disconnect Switches:
   1. Type: Fused, heavy-duty, single throw, quick-make, quick-break mechanism, visible blades in “OFF” position and safety handle.
   2. Rating: Voltage, current and short circuit ratings and number of poles as shown or indicated on the Drawings. Switch shall bear UL label indicating suitability for use as service equipment and shall comply with UL 98, NEMA KS 1, and NEMA 250.

C. Single Throw, Circuit Disconnect Switches:
   1. Type: Fused or unfused, horsepower rated, heavy-duty, single throw, quick- make, quick-break mechanism, visible blades in the "OFF" position and safety handle.
   2. Rating: Voltage and current ratings and number of poles as required for motor or equipment circuits being disconnected. Switches shall bear a UL label and shall comply with the requirements of UL 98, NEMA KS 1 and NEMA 250.

D. Double Throw Safety Switches:
   1. Type: Unfused, double throw with center “OFF” position, quick-make, quick-break mechanism, visible blades in the “OFF” position, and safety handle.
   2. Rating: Voltage and current ratings and number of poles as required for circuits being disconnected. Switches shall bear UL label and shall comply with UL 98, NEMA KS 1, and NEMA 250.

E. Disconnect Switches for 120-volt, Single-phase Circuits:
   1. Refer to this Section, Snap Switches.

F. Enclosures: NEMA rating shall be as required for area classifications specified in Section 26 05 02 – Basic Electrical Work, General Provisions for Electrical Systems.

G. Identification:
   1. Identify enclosures in accordance with Section 26 05 02 - Basic Electrical Work, Identification for Electrical Systems.
   2. Provide nameplate to identify the equipment served by disconnect switch and associated source of power.

2.10 ENCLOSED CIRCUIT BREAKER MATERIALS

A. Manufacturer: Provide equipment by one of the following:
   1. Eaton Cutler Hammer
   2. General Electric

3. Siemens
4. Square-D
5. Or equal

B. Type:
1. Breakers shall be molded-case with inverse time and instantaneous tripping characteristics.
2. Circuit breakers shall be operated by toggle-type handle and shall have a quick-make, quick-break, over-center switching mechanism that is mechanically trip-free. Automatic tripping of circuit breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy with arc-extinction chutes.
3. For frame sizes 225-ampere and above, provide with interchangeable trip unit.
4. For frame sizes 150-ampere and below, provide with non-interchangeable trip.
5. Terminations: Provide terminals for accommodating two normal-range copper cables per phase.
6. Enclosed circuit breakers shall be UL-listed and bear the UL label, and shall comply with UL 489 and NEMA AB 1.

C. Interrupting Capacities:
1. 400-ampere Frame and Above: Minimum 35,000 amperes RMS symmetrical at 480-volt, three-phase, 60 Hertz, or as shown.
2. 100-ampere, 150-ampere, and 225-ampere Frame: Minimum 22,000 amperes RMS symmetrical at 480-volt, three-phase, 60 Hertz, or as shown.

D. Enclosure:
1. Indoors in prefabricated FRP enclosures: NEMA 4X, 316 stainless steel.
2. Indoors in prefabricated, precast concrete enclosures: NEMA 1 when HVAC is provided for the enclosure, and approved by CFPUA and recommended by the Engineer. Otherwise, enclosure shall be NEMA 4X, 316 stainless steel.
3. Outdoors: NEMA 4X, 316 stainless steel.
4. Access Door Interlock: Provide disconnect device to prevent unintentional opening of door while circuit breaker is energized and unintentional application of load power while door is open, with provisions for releasing interlock for intentional access or application of power by authorized personnel.
5. External operating handle shall be integral part of the associated box, not the door. Operating handle shall have provisions for padlocking in the “OFF” position with door open or closed, and shall include prominent trip indication.
6. Identification: Provide nameplate identification of circuit breaker in accordance with Section 26 05 02 - Basic Electrical Work, Identification for Electrical Systems. Identify load side equipment controlled and line side source.
7. Enclosures shall be UL-listed and comply with UL 50 and UL 50E.

2.11 ENCLOSED CIRCUIT BREAKER SOURCE QUALITY CONTROL

A. Tests:
1. Perform standard factory tests on equipment furnished under this Section. Tests shall be in accordance with applicable NEMA and UL standards.

2.12 SURGE PROTECTIVE DEVICES MATERIALS

A. Manufacturers: Provide equipment of one of the following:
   1. General Electric.
   2. Schneider Electric/Square-D Company.
   3. Eaton/Cutler-Hammer.
   4. Or equal.

B. General:
   1. SPD shall be modular, high-energy, parallel design with fast-acting transient voltage suppression using metal oxide varistors. Equipment shall provide noise attenuation with electromagnetic interference filter.
   2. SPD shall comply with requirements of the following:
      a. ANSI/UL 1449.
      b. UL 1283.
      c. IEEE C62.11, IEEE C62.41 and IEEE C62.45.
   3. SPD shall be suitable for operation under the following environmental conditions:
      a. Relative Humidity: Zero to 95 percent, non-condensing.
      b. Frequency: 47 to 63 Hertz.
      c. Temperature: Zero to 149 degrees F.
   4. SPD operating voltage and IEEE C62.41 and IEEE C62.45 Category A, B, and C application environments shall be suitable for the associated SPD location(s) shown or indicated on the Drawings.

C. SPD shall include a surge suppression path for each mode as required for the system configuration shown on the Drawings. Each mode shall be individually fused and equipped with thermal cutouts. SPD short-circuit rating shall be 200 kA. Protection modes shall include, to the extent applicable, the following:
   1. Line-to-line.
   2. Line-to-neutral.
   3. Line-to-ground.
   4. Neutral-to-ground.

D. SPD shall include electromagnetic interference/radio frequency interference (EMI/RFI) noise rejection filter with attenuation up to 30 dB from 10 kHz to 100 MHz.

E. SPDs and components in the operating path shall have maximum continuous operating voltage greater than 115 percent of nominal system operating voltage.

F. ANSI/UL 1449 minimum withstand rating shall be 20 kA per pole, and ANSI/UL 1449 voltage protection rating for SPD shall not exceed the following:

Modes	208Y/120	480Y/277
L-N,L-G, N-G	800	1200
L-L	1200	2000

G. SPD surge capacity based upon IEEE C62.41 location category shall, as a minimum, be the following:

Category	Application	Per Phase	Per Mode
C	Service entrance	240 kA	120 kA

B	High exposure locations (distribution equipment)	160 kA	80 kA
A	Branch locations	120 kA	60 kA

2.13 SURGE PROTECTIVE DEVICES ACCESSORIES

A. Provide SPD equipped with the following accessories:
   1. Surge counter with display for indicating the number of surges detected.
   2. LED indicators for monitoring device status.
   3. Dry contacts, “Form C”, for remote annunciation of unit status.
   4. Indicators, counter, alarm, and silence switch shall be visible and accessible from front of the SPD.
   5. Enclosure for each externally-mounted SPD: NEMA rating shall be as required for area classifications specified in Section 26 05 02 - Basic Electrical Work, General Provisions for Electrical Systems.

2.14 SURGE PROTECTIVE DEVICES SOURCE QUALITY CONTROL

A. Perform manufacturer’s standard factory tests on equipment. Tests shall be in accordance with IEEE C62.45 and ANSI/UL 1449.

PART 3 EXECUTION

3.1 INSPECTION

A. Dry-Type Low-Voltage Distribution Transformers Inspection, Switchboards Inspection, Panelboards Inspection, Low-Voltage Receptacles Inspection, Snap Switches Inspection, Disconnect Switches Inspection, Enclosed Circuit Breaker Inspection and Surge Protective Devices Inspection: Examine the conditions under which the equipment is to be installed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Dry-Type Low-Voltage Distribution Transformers Installation:
   1. Install transformers on walls, rack or floors at locations shown. Install floor mounted transformers on raised concrete bases. Provide sufficient access and working space for convenient and safe operation and maintenance.
   2. Mount transformers so that vibrations are not transmitted to the building structural parts and other equipment. Make connections to transformers with flexible conduit.
   3. Adjust tap settings to provide proper voltage at panelboards.
   4. Install dry type transformers in conformance with governing codes and manufacturer’s instructions and recommendations, and the Contract Documents.

B. Switchboards Installation:
   1. Install equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.

2. Install equipment on concrete pad, as shown. Coordinate pad dimensions to fit equipment furnished.
3. Install in accordance with Laws and Regulations, manufacturer's recommendations, and the Contract Documents. Do not energize equipment without permission of Owner.

C. Panelboards Installation:
1. Mounting: Install panelboards at locations shown or indicated. Set cabinets so that top branch circuit breaker is not over six feet above the floor.
2. Directory: Complete typewritten or computer-printed directory indicating items controlled by each circuit breaker and the size of feeder serving the panel.
3. Identify panelboards in accordance with Section 26 05 02 - Basic Electrical Work, Identification for Electrical Systems.
4. Install in accordance with Laws and Regulations, manufacturer's recommendations, and the Contract Documents. Verify proper installation prior to energizing panelboards.

D. Low-Voltage Receptacles Installation:
1. Install receptacles at locations shown, in outlet or device boxes in accordance with Section 26 05 02 – Basic Electrical Work, Outlet Boxes.
2. Install receptacles with ground pole in the down position.
3. Install in conformance with Laws and Regulations.
4. Identification:
   a. Identify each conductor with circuit number and lighting panel number in accordance with Section 26 05 02 - Basic Electrical Work, Identification for Electrical Systems.
   b. Identify each receptacle with permanent phenolic tag. Tags shall include circuit number and panelboard designation.

E. Snap Switches Installation:
1. Install switches at locations as shown or indicated in the Contract Documents in outlet or device boxes, in accordance with Section 26 05 02 - Basic Electrical Work, Outlet Boxes.
2. Mount wall switches 4.0 feet above finished floor, in accordance with the Americans with Disability Act, unless otherwise noted.
3. Identify each conductor with circuit number and lighting panel number. Identification shall be in accordance with Section 26 05 02 - Basic Electrical Work, Identification for Electrical Systems.

F. Disconnect Switches Installation:
1. Install equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.
2. Securely fasten equipment to walls or other structural supports on which they are mounted. Provide independent stainless steel supports where no wall or other structural surface exists. Mount disconnect enclosures at a height not exceeding six feet.
3. Provide suitable ¼-inch spacers to prevent mounting enclosure directly against walls.

G. Enclosed Circuit Breaker Installation:

1. Install in accordance with NFPA 70, and Laws and Regulations.
2. Mounting and Installation:
    a. Install equipment to provide sufficient access and working space for ready and safe operation and maintenance. Equipment centerline shall not be less than four feet above finished floor.
    b. Securely fasten equipment to walls or other surfaces on which equipment is mounted. Provide independent supports complying with Section 26 05 02 - Basic Electrical, Hangers and Supports, where there is no wall or other surface capable of supporting the equipment.
    c. Provide suitable ¼-inch spacers to prevent mounting enclosure directly against walls.
3. Adjustments: Perform field adjustments of circuit breakers as required to place equipment in operating condition. Adjustable breaker settings shall be in accordance with the accepted power distribution coordination study prepared under Section 26 05 02 – Basic Electrical Work, Electrical Power Distribution System Studies, or as directed by Engineer.

H. Surge Protective Devices Installation:
1. Install SPD at locations shown on the Drawings in accordance with equipment manufacturer’s recommendations, Laws, and Regulations, and the Contract Documents.
2. Conductor length between suppressor and connection point shall be as short and as straight as possible.

3.3 SWITCHBOARDS FIELD QUALITY CONTROL

A. Site Tests:
1. After installation, inspect and perform field testing of each switchboard. Testing and inspections shall by Supplier's factory-trained representative, in accordance with manufacturer’s recommendations. Inform Owner and Engineer when Supplier's representative indicates that equipment is correctly installed.
2. Perform the following tests and checks before energizing equipment:
    a. Verify proper installation.
    b. Inspect all mechanical and electrical devices for proper operation.
    c. Check tightness of bolted connections.
    d. Measure insulation resistance of each bus section, phase-to-phase and phase-to-ground.
    e. Measure insulation resistance of each circuit breaker, pole-to-pole and from pole-to-ground.
    f. Check for proper anchorage, required area clearances, physical damage, and proper alignment.
    g. Clean and lubricate as required.
    h. Perform other tests and adjustments recommended by equipment manufacturer.

B. Manufacturer’s Services: Provide services of qualified, factory-trained serviceman to perform the following:
1. Instruct Contractor in installing equipment.
2. Inspect and adjust equipment after installation and ensure proper operation.

3. Instruct operations and maintenance personnel in operation and maintenance of the equipment.
4. Manufacturer's technician shall make visits to the Site as follows:
    a. For instructing Contractor in proper equipment installation and assisting in installing equipment.
    b. For checking completed installation, start-up of system; and performing field quality control testing.
    c. To instruct operations and maintenance personnel.
        1) Furnish services of manufacturer's qualified, factory-trained specialists to instruct Owner's operations and maintenance personnel in recommended operation and maintenance of equipment.
    d. Technician shall revisit the Site as often as necessary until installation is acceptable.
5. All costs, including expenses for travel, lodging, meals and incidentals, and cost of travel time, for visits to the Site shall be included in the Contract Price.

3.4 SWITCHBOARDS ADJUSTING

A. Calibrate, set and program protective devices. Coordinate the protective devices furnished under this Section and provide proper settings of devices per the results of the study specified in Section 26 05 02 - Basic Electrical Work, Electrical Power Distribution System Studies.

3.5 ENCLOSED CIRCUIT BREAKER FIELD QUALITY CONTROL

A. Field Tests and Inspections:
    1. All test equipment and material shall be by Contractor.
    2. Perform visual and mechanical inspection including:
        a. Inspect for physical, electrical, and mechanical condition.
        b. Check for proper installation, required area clearances, physical damage and proper alignment.
        c. Check electrical and mechanical interlock systems for proper operation.
        d. Clean and lubricate as required.
        e. Other testing and inspections recommended by manufacturer.

B. Manufacturer's Services:
    1. Provide services of qualified, factory-trained manufacturer's representative to advise Contractor on installation of the equipment and to check the installed equipment prior to start-up.
    2. Qualified factory-trained manufacturer's representative shall certify in writing that equipment has been installed, adjusted, and tested in accordance with manufacturer's recommendations.
    3. Furnish services of qualified trained specialist, with minimum of five years' experience, from manufacturer to instruct Owner's operations and maintenance personnel in recommended operation and maintenance of the equipment.

END OF SECTION

SECTION 26 29 15

PUMP CONTROL PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and provisions of the General Conditions, Special Conditions, and the Sections included under General Requirements are included as part of this Section as though bound herein.

1.2 SUMMARY

A. This section gives the requirements for installation of a pump control panel and components for control and monitoring operating status of the pump station.

1.3 CERTIFICATIONS

A. The instrumentation panel and individual components shall be 3rd part listed; UL, ETL, CSA, etc.

B. The control panel shall be listed to UL 698A, Industrial Control Panels Relating to Hazardous (Classified) Locations.

1.4 RELATED SECTIONS

A. Section 40 78 00 - Panel Mounted Instruments and Devices.

1.5 DESCRIPTION OF OPERATION

A. The control panel shall control the operation of two pumps, unless indicated otherwise.

B. Manual mode, selector switches in “HAND” position:
   1. Selected motor operates until the wetwell is pumped down to the Off level.
   2. Selected motor stops under overload or overtemperature conditions.
   3. “Pump Down” pushbutton will allow operation of motors below the low level shutoff level.

C. Automatic mode, selector switches in “AUTO” position:
   1. Level Sensing:
      a. For pump stations with pump motors rated less than 50 HP, float switches shall be used for level sensing.
      b. For pump stations with pump motors rated 50 HP and higher, an analog level control system with a submersible level transducer, or alternatively ultrasonic or radar systems, shall be used for level sensing and control. In addition, float switches shall be used for backup High Alarm level, High/High Alarm Level, and low Off level.

2. One pump operates upon reaching the Lead level.
3. A second pump shall operate upon reaching the Lag level.
4. Upon pumping down to the Off level, both pumps will shut down.
5. The lead pump shall alternate for each pumping cycle.
6. A time delay shall be introduced for the lag pump to prevent simultaneous starting after power failure or similar incidents.

D. Relays, circuitry, etc. for monitoring and indication of the following shall be provided:
   1. Motor RUN status.
   2. Pump leak detection / seal failure. A leak detection / seal failure condition shall not stop motors from operating.
   3. Motor overtemperature. A motor over-temperature condition shall prevent the motor from operating until the condition is cleared.
   4. Motor starter overload. A motor overload condition shall prevent the motor from operating until the condition is cleared by manual reset.
   5. Pump control panel power loss / phase failure.
   6. High wet well level and high/high wet well level.
   7. High/high wet well level
   8. Low wet well level. A low wet well level condition shall prevent motors from operating, unless manually bypassed by the momentary position “Pump Down” pushbutton.

E. Alarm horns and lights:
   1. Activated by:
      a. High/high wet well level.
   2. Alarm functions shall operate when power is lost by utilizing an uninterruptible power supply (UPS).
      a. Include a duplex receptacle for 120v power connection to the UPS input.
      b. Circuitry to be supplied from the UPS output includes, but is not limited to: power loss relay, float switches, overtemperature sensors, seal failure sensors, alarm horn, and alarm light.
      c. Include a manual Bypass/UPS selector switch in the UPS output circuitry to accommodate bypassing the UPS. Circuitry shall be configured utilizing the power loss relay to automatically transfer to UPS power if the selector switch is in Bypass position and power is lost.
      d. UPS Ratings: 120V input / output, 1500 VA / 865 W (minimum), extended run battery pack. Design Basis: APC #BR1500G + (1) BR24BPG.
      e. See Section 40 78 00 - Panel Mounted Instruments and Devices for UPS systems.
   3. Auxiliary signal, dry contacts shall be provided with circuitry wired to terminal blocks for connection to an external SCADA unit for the following:
      a. Pump Run status.
      b. High wet well level.
      c. High/high wet well level
      d. Motor overtemperature.
      e. Motor starter overload.
      f. Pump HOA not in Auto
      g. Pump control panel power loss / phase failure.

F. See pump control panel detail on drawings for additional information.

1.6 SUBMITTALS

A. General: Unless noted otherwise in the project manual, the Contractor shall submit PDF files of shop drawings, certified prints, literature, and cuts sheets for all control panels and accessory materials.

B. Shop drawings adequate for control panel fabrication, installation and maintenance shall be submitted and approved prior to manufacture. The adequacy of shop drawings shall be determined solely by the Owner's Representative. Drawings shall include:
   1. Elementary control (ladder) diagram.
   2. Interconnection wiring (schematic) diagram.
   3. Interior and exterior panel component layout drawings.
   4. Dimensioned outline drawing of the enclosure with mounting supports.
   5. Component catalog cuts and Contractor's installation drawings.

C. Post fabrication submittals shall include:
   1. Device nameplate list.
   2. Written certification of the UL serialized label for the pump control panel.

D. Post installation submittals shall include four copies of operation and maintenance manuals.

PART 2 PRODUCTS

2.1 CONTROL PANEL

A. General: Control panel shall consist of a main circuit breaker, phase monitor, surge protector, control power transformer, selector switches, pushbutton operators, auxiliary relays, timers, alternator, indicator lights, elapsed time meters, circuit breakers, motor starters with overloads, strip heater with thermostat, duplex GFCI receptacle, alarm strobe and horn, circuitry, battery backup for alarm circuitry, and terminal blocks with all components mounted in one common enclosure. The controls assembly shall provide means to operate each motor manually or automatically. Power supply shall be as indicated on the drawings. Control power shall be 120 volts.

B. Short Circuit Current Rating (SCCR): The control panel shall be rated for minimum short circuit current as indicated in the project drawings. The control panel shall be marked with this SCCR rating. The control panel short circuit rating shall match that of the distribution panel or circuit breaker that supplies the pump control panel.

C. Enclosure:
   1. Located indoors in prefabricated FRP shelters: NEMA 4X, 316 stainless steel.
   2. Located indoors in prefabricated, precast concrete enclosures:
      a. When HVAC is provided for the enclosure and where approved of by CFPUA and recommended by the Engineer: NEMA 12. Exterior and interior steel surfaces of switchboard shall be properly cleaned and provided with rust-

inhibiting phosphatized coating by switchboard manufacturer. Color and finish of switchboard shall be light gray.

b. Otherwise, enclosure shall be NEMA 4X, 316 stainless steel.

3. Located outdoors: NEMA 4X, 316 stainless steel.
4. For NEMA 4X stainless steel enclosures; external hardware, hinges, etc., shall be 300 series stainless steel.
5. Weatherdoor: Gasketed, continuously hinged with doorstop, three-point latch, quick release latches and a hasp assembly for padlocking.
6. Deadfront / interior swing panel for mounting selector switches, pushbutton operators, and LED indicators: Continuously hinged deadfront held closed with two slotted nickel plated brass captive panel screws with knurled edges to allow for finger or screwdriver tightening.
7. Control compartment shall incorporate a fixed, rigid back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar PHASE studs. The back panel shall be 12-gauge galvanized steel, painted with heavy-duty epoxy enamel after fabrication. Back panel shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.
8. Mounting provisions: Mounting lugs shall be provided for rack mounted panels. Mounting feet shall be provided for self-supported panels.

D. Components:

1. A control panel main disconnect switch shall be circuit breaker type. The switch shall be lockable in either the ON or OFF position.
2. A phase monitor shall be connected to the main power input terminals to prevent motor operation upon phase loss, phase reversal, under-voltage, and phase imbalance conditions. Upon restoration of satisfactory input voltage, the unit shall automatically reset after a user programmable time delay. Phase monitor leads shall be fused in accordance with the manufacturer’s requirements.
3. A surge protection device for the control panel shall be connected to the main power input terminals.
4. A 120V control power transformer shall be provided, sized in accordance with the loads to be supplied, plus 20% additional capacity.
5. Float switch circuitry from wastewater wet wells shall be connected to intrinsically safe relays / barriers.
6. Selector switches: See Section 40 78 00 - Panel Mounted Instruments and Devices.
7. Motor operator selector switches shall be three position Hand-Off-Automatic type, shall permit over-ride of automatic control, and allow manual operation or shutdown of each motor.
8. Pushbutton operators: See Section 40 78 00 - Panel Mounted Instruments and Devices.
9. Auxiliary and control relays: See Section 40 78 00 - Panel Mounted Instruments and Devices.
10. Timer delay relays: See Section 40 78 00 - Panel Mounted Instruments and Devices.
11. Alternator relays shall be enclosed, general purpose duplex alternating relays with plug-in bases and transparent polycarbonate dust cover.
    a. Continuous rated coils with AC pickup voltages of 85% of nominal. Coil voltage as required.

b. Contacts rated at 120 VAC, 80 percent P.F., 10 amperes continuous, 30 amps make, 3 amps break.
c. Solid-state alternating circuit driving electro-mechanical relay coil.
d. Relays shall feature state indicating LEDs in the cover.
e. Provided for alternation of the lead pump for each run cycle.

12. Indicator lights: See Section 40 78 00 - Panel Mounted Instruments and Devices.
13. Running time meters for each motor shall be provided. See Section 40 78 00 - Panel Mounted Instruments and Devices.
14. Individual magnetic, instantaneous trip circuit breakers shall be provided for each motor. Breakers shall be lockable in the OFF position. Breakers shall be sized in accordance with the nameplate rating of the motor provided.
15. Starters:
    a. For motors less than 20 HP: Individual full voltage across the line type.
    b. For motors 20 HP and greater: Individual solid state soft start type.
    c. For some project applications as coordinated with CFPUA, variable frequency drives may be required. See specification 262923.
    d. Size starters in accordance with the nameplate rating of the motor provided.
    e. Starters shall meet NEMA IC1, NEMA IC2, UL 508, & NEC requirements.
    f. Replacement of coil and contacts shall not require removal of the starter or power wiring from the control panel.
    g. Electronic Overloads: Relays shall be electronic type. Electronic relays shall be multi-function, adjustable, current sensing type, and include overload, phase-unbalance, phase-loss, and equipment type ground fault in one package.
    h. Starters shall feature auxiliary contacts for run indication and overload shutdown.
16. A strip heater with thermostat shall be provided to prevent the formation of condensation within the control panel interior.
17. An LED light, switched when the panel door is opened shall be provided for the control panel interior.
18. A ground fault circuit interrupter receptacle shall be provided as a convenience outlet.
19. Alarm strobes / beacons:
    a. One mounted such that it can viewed from the road right of way.
    b. Red LED; 120,000 hour light source life.
    c. Exterior device: NEMA 4X; mount to junction box in a waterproof matter with closed cell neoprene gasket.
    d. The strobes shall flash at approximately 65 flashes per minute.
    e. Design basis: Edwards 109R-N5, or equivalent by Federal Signal or Maxi-Signal.
20. Alarm horn shall be provided on the control panel exterior, with waterproof connections to the control panel. Design basis: Edwards 876-N5, or equivalent by Federal Signal or Maxi-Signal.
21. Alarm horns / beacon:
    a. Combination audible / visual signal for mounting external to the pump control panel.
    b. Independent horn and beacon control.
    c. Red Fresnel lens/dome; 60,000 hour LED light source.
    d. Horn output for 85 dBA at 10'.
    e. 120 VAC.

f. Design Basis: Federal Signal #AV1-LED-120R, or approved equivalent.

22. Terminal blocks shall be provided for connection of both internal connections and connections for external circuitry.
    a. Channel mounted, sectional type.
    b. Rated 600 volts, 20 amps minimum.
23. Labeling:
    a. All switches, pilot lights, control devices, major components, etc., shall be clearly labeled according to function with engraved plastic plates, black with white core. Minimum letter size shall be 1/8-inch.
    b. All conductors and terminal strips shall be labeled, matching schematic, and wiring diagrams.
    c. Identification labeling shall match the bill of materials, schematic diagram, and wiring diagram.
    d. Schematic and wiring diagrams shall be displayed via a placard mounted to the inside surface of the panel door.
24. All other components necessary for a completely operable system performing the functions required shall be supplied.

E. Operating Controls and Instruments: In cases where specialized equipment is required to interface with or modify the operation, function, or settings of Variable Frequency Drives (VFDs) or any other related equipment, the Contractor shall provide CFPUA with all necessary licensing, hardware, software, firmware, and any other required accessories. This provision shall ensure that CFPUA can effectively operate, interface with, and implement necessary changes for optimal station operation.

F. Wiring:
1. All wiring workmanship and schematic wiring diagrams shall be in compliance with applicable standards and specifications for industrial controls set forth by the Joint Industrial Council (JIC), National Machine Tool Builders Association (NMTBA), National Electrical Code (NEC), Division 16 of these specifications and other pertinent electrical codes and standards.
2. All control circuit wiring shall be, stranded copper, color coded and clearly marked at each end to match schematic wiring diagrams, and of adequate size to safely carry required electrical loads. All control wires shall be marked using T&B Shur-code sleeve markers. All wires on the back panel shall be contained in wire troughs with removable covers to facilitate field repairs and addition of optional/additional components. Splices shall not be used.

2.2 ACCESSORIES

A. Float-Tilt Type Level Switches
1. Materials:
    a. Float material: Polypropylene with internal polyurethane foam or Teflon coated 316 stainless steel, not less than 5” in diameter.
    b. Cable jacket: CPE, PVC, Synthetic rubber jacket; provide 1/8” thick neoprene sleeve over the cable jacket from 5” above mounting assembly to 5” below cable hinge point; provide 1/8” thick neoprene sleeve over the cable jacket from 5” above float to the top of the float switch body.
    c. Cable clamp mounting assembly: 316 stainless steel, flanged & flared on both sides providing hinge point stress relief to both sides of the cable.

2. Design and Fabrication:
    a. Provide switch complete with flexible electrical cable.
    b. Sealed & potted mercury-free switch in float.
    c. Cable: 2-conductor plus ground, #16-gauge minimum stranded copper conductors, of sufficient length to reach the control panel without splices along the route as detailed in the project drawings.
    d. SPST contact rated 100 VA minimum up to 250 VAC.
    e. Direct acting float switch:
        1) Switch actuates on rising level.
        2) Switch de-actuates when liquid falls 1” below actuation level.
3. A corrosion resistant weight shall be attached to a stainless-steel support cable below the lowest float to hold the switches in place.

B. Submersible Level Transducer
1. Material: 316 stainless steel
2. Output Signal: 4-20 mA.
3. Cable shall be continuous without splices from device to control panel along the route as detailed in the project drawings.
4. Surge protection.
5. Suitable for installation in Class I, Division 1, Group D hazardous locations.
6. In addition to electrical conductors, the sensor support cable shall contain a tube which is vented to atmosphere to offset changes in barometric pressure.

C. Non Submersible (Mounted above water line) ultrasonic or radar level sensor
1. Material: 316 stainless steel
2. Output Signal: 4-20 mA.
3. Cable shall be continuous without splices from device to control panel along the route as detailed in the project drawings.
4. Surge protection.
5. Suitable for installation in Class I, Division 1, Group D hazardous locations.
6. In addition to electrical conductors, the sensor support cable shall contain a tube which is vented to atmosphere to offset changes in barometric pressure.

2.3 OPERATIONS AND MAINTENANCE MANUALS

A. Prepare an operation and maintenance manual for the duplex pump panel and control equipment. Manuals shall be made up with hard cover post type binders. Include index, tabbed section dividers, all approved shop drawings, installation, and maintenance instructions packed with equipment, and parts lists.

B. Provide a written description of equipment operation, special features and maintenance requirements.

C. Provide instructions for setting all adjustable components. Record the final field settings of all adjustable components in a comprehensive table.

D. Large sheets shall be neatly folded and installed with post hole reinforcements such that sheets will unfold without need to open binder posts.

2.4 SPARE PARTS

A. One complete set of fuses.

B. One operating coil for each size of AC contactor provided.

C. One set of overload relays for each type and rating provided.

D. One pilot light with lens for each type provided.

E. One Spare Pump or one Spare Motor and Rotating Assembly shall be provided. Spare motor and rotating assembly is subject to prior approval from CFPUA.

PART 3 EXECUTION

3.1 COORDINATION

A. Verify motor nameplate data prior to sizing components and preparing submittal information for this project.

B. Make changes to the electrical design at no additional cost if the motors supplied have electrical ratings and characteristics different from the motor specified or shown. Provide calculations used to make revised component selections. Revised selections shall comply with the specifications. Verify that final field adjustments comply with factory recommendations.

3.2 SHIPMENT AND STORAGE

A. Wrap pump panel enclosure surfaces in a protective plastic wrap before crating and shipment. Crate the pump control panel to protect it from damage during shipment and storage.

B. Store all electrical materials and equipment at the site in trailers or temporary buildings that provide protection from the effects of weather.

3.3 INSTALLATION

A. General: The Contractor shall receive, handle, and store all equipment and materials to be installed, being careful to prevent any damage during transport and storage. All equipment stored shall be protected from weather in a manner recommended by the manufacturer.
   1. All equipment shall be handled and installed in accordance with written instructions and approved shop drawing details of the manufacturer and as required by the drawings.
   2. If the Contractor determines that existing conditions do not permit proper installation, he shall immediately notify the Owner’s Representative.
   3. All control transformers to be mounted outside of pump control panel.

B. The installation of the pump control panel and accessory equipment must adhere strictly to the manufacturer's instructions and follow industry best practices to ensure quality workmanship. For dry-pit stations, an electric hoist shall be provided within the

building to assist with the maintenance, removal, or installation of pumps, valves, and fittings.

C. The submersible level sensor shall be housed within a PVC pipe to mitigate any potential movement caused by turbulence and surges from pump operation. In cases where the station is designed with pumps situated in a dry pit below ground level, pumps must be of the dry-pit submersible type.

3.4 START-UP TESTING

A. Test instrumentation system for proper function and sequencing of all motors, indication, and remote notification capabilities.

B. Conduct a test for observation by the Owner's representative to demonstrate operation in accordance with the drawings and specifications.

END OF SECTION

SECTION 26 32 13

STANDBY GENERATOR

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes packaged engine-generator sets for optional standby power supply. This specification is primarily intended for pump station and well site applications for units rated 1000 kW and less. Contact Cape Fear Public Utility Authority (CFPUA) for clarification if project conditions indicate otherwise. Include the following features:
   1. Diesel engine.
      a. Natural gas may be applicable only if directed so in advance by CFPUA.
   2. Unit-mounted cooling system.
   3. Unit-mounted control and monitoring.
   4. Performance requirements for sensitive loads.
   5. Fuel system.
   6. Outdoor enclosure.

B. Related Requirements:
   1. Section 26 36 23 - Automatic Transfer Switches for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

A. ATL: Across the Line

B. ECM: Engine Control Module

C. FLA: Full Load Amps

D. HP: Horsepower

E. kVA: kilo-Volt-Amps

F. NEMA National Electrical Manufacturers Association

G. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

H. Optional Standby Power Supply: NEC 702, optional standby.

I. RVAT: Reduced Voltage Autotransformer

J. SSSS3: Solid State Soft Starter @ 300%

1.4 SUBMITTALS

A. Six sets of submittal data shall be provided, with the exception of Closeout Submittals. Four sets of Closeout Submittals are acceptable.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product, standard accessories, and optional accessories.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
   2. Include motor starting performance curve(s) indicating voltage drop for motor starting conditions.
   3. Include thermal damage curve for generator.
   4. Include time-current characteristic curves for generator protective devices.
   5. Include fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
      a. Provide fuel consumption in cubic feet per hour if natural gas unit has been selected by CFPUA. Natural gas may be applicable only if directed so in advance by CFPUA.
   6. Include generator efficiency at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
   7. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor and rated load. Testing shall be performed per ISO3046 standards. Provide drawings showing requirements and limitations for location of air intake and exhausts.
   8. Include generator characteristics, including, but not limited to kw rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:
   1. Include plans and elevations for engine-generator set, subbase fuel tank, enclosure, and other components specified and/or provided. Indicate recommended equipment pad dimensions. Indicate access requirements affected by height of subbase fuel tank.
   2. Include details of equipment assemblies. Indicate dimensions, weights, center of gravity of full assembly, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Identify fluid drain ports and clearance requirements for proper fluid drain.
   4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
   5. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment, automatic transfer switch, and functional relationship between all electrical components.

6. Plans, elevations, and details for maintenance platform.

1.6 INFORMATIONAL SUBMITTALS

A. Specification Compliance Markup: Submit a mark-up copy of this specification with notations and explanations comprehensively showing all deviations and / or exceptions to these Specifications.

B. Voltage Drop Calculations: Submit calculations based on loading criteria indicated below to limit voltage drop to 25% maximum with full recovery of unit to steady state operation.
   1. Step 1 Loads:
      a. 5 kW miscellaneous load.
      b. Motor Nameplate Data:

HP	VOLTS	NEMA Code	FLA	Start Amps	Run kVA	Start kVA	Starter

   2. Step 2 Load, Motor Nameplate Data:

HP	VOLTS	NEMA Code	FLA	Start Amps	Run kVA	Start kVA	Starter

C. Qualification Data: For supplier / installer.
   1. Statement from supplier / installer detailing local service capability, factory-trained service personnel, and details of service response required in accordance with this specification. Reference section 1.9B.3 for service response guarantee.

D. Qualification Data: For manufacturer.
   1. Statement of quality from manufacturer detailing acceptance as an ISO9001 manufacturer.

E. Source quality-control reports, including, but not limited to the following:
   1. Certified summary of prototype-unit test report.
   2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
   3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria.
   4. Report of factory test on units for this Project, showing evidence of compliance with specified requirements. Report shall be submitted when units ship.
   5. Report of exhaust emissions showing compliance with applicable regulations.

F. Field quality-control reports.

G. Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Initial Manual Submittal for Review: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Owner and/or Engineer will comment on whether scope and content of manual are acceptable.
   1. Correct or revise each manual to comply with Owner and/or Engineer comments. Submit copies of each corrected manual as the Final Manual Submittal.

B. 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.
   1. Format: Submit operations and maintenance manuals in the following formats.
      a. PDF electronic file. Assemble each manual into a composite electronically indexed file. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory Submit electronic file on both digital disc and USB drive.
      b. Two paper copies in heavy-duty, three-ring, loose-leaf binders. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. Data shall be provided and identified that is specific to the site where equipment is installed.
   1. 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.
   2. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
      a. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents.
      b. Product information.
      c. Maintenance procedures.
      d. Maintenance and service schedules.
      e. 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.
      f. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
      g. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
      h. Warranties: Include copies of warranties and lists of circumstances and conditions that would affect validity of warranties. Include procedures to follow and required notifications for warranty claims.
   3. Operation Manuals: Assemble a complete set of operation data indicating operation of each system, subsystem, and piece of equipment not part of a system.
      a. System, subsystem, and equipment descriptions.
      b. Operating procedures.
      c. Wiring diagrams.
      d. Control diagrams.

e. Piped system diagrams.

4. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, 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.
5. Additionally, include the following:
   a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
   b. Operating instructions laminated and mounted adjacent to generator location.
   c. Training plan.
   d. Software for unit controller with diagnostic, troubleshooting, and maintenance functionality.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: One for every 10 of each type and rating but no fewer than one of each.
   2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
   3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
   4. Paint: Two spray cans of each color.
   5. Keys: Four keys for enclosure access doors.
   6. Special Tools: Tools unique to the product for standard maintenance, listed by part number in operations and maintenance manual.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer accepted as an ISO9001 manufacturer.

B. Supplier / Installer Qualifications:
   1. Manufacturer and factory authorized representative who is trained and approved by manufacturer.
   2. Maintain, within 125 miles or two hours of Wilmington, North Carolina; a factory certified service center capable of providing training, parts, and emergency maintenance repairs.
   3. Response for emergency repairs shall be guaranteed to be four hours or less upon receipt of service call notification.
   4. Manufacturer's authorized representative shall employ factory-trained and certified service personnel and shall carry single-source responsibility for warranty, parts, and service.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period at no additional cost to the Owner.

1. Warranty Period: 5 year or 2500 hours, whichever occurs first, from date of start-up and Substantial Completion.

1.11 SERVICE CONTRACT

A. Manufacturer's service representative shall provide a service contract at no additional cost to the Owner for a period of 5 years from date of start-up and Substantial Completion of the generator set installation.

B. The service contract shall be to semi-annually inspect, and test run the engines and to perform manufacturers recommended preventative maintenance service on the equipment furnished. The service contract shall include operation of the equipment under simulated power failure conditions, adjustment of generator, transfer switch and switchgear controls as required and certification in the Owner's maintenance log of repairs made and proper functioning of all engines and auxiliary systems.

C. At the Owner's option, the service agreement shall be renewable on a year-to-year basis, thereafter, with costs being paid by the Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Caterpillar.
   2. Cummins.
   3. MTU.

B. Manufacturers shall agree to make factory training available for Owner personnel. No costs associated with training are expected to be covered by the manufacturer. The intent of the training is for Owner personnel to be trained and capable of make repairs in the same manner as a manufacturer's factory trained technician after the warranty period has expired.

C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer. Generator set shall be standard offering from manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Compliance:
   1. Comply with NFPA 30.
   2. Comply with NFPA 37.
   3. Comply with NFPA 54. Natural gas may be applicable only if directed so in advance by CFPUA.
   4. Comply with NFPA 70.
   5. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

B. UL Compliance: Comply with UL 2200/CSA.

C. Engine Exhaust Emissions: Comply with current EPA requirements and applicable state and local government requirements.

D. Noise Emission:
   1. At a minimum, sound level measured at a distance of 23 feet from the unit after installation is complete shall be 75 dBA or less.
   2. Verify with the Owner and/or Engineer if more restrictive noise emission is required due to a generator unit being located near a property line. New Hanover County, Wilmington, and Wrightsville Beach have noise ordinances that may restrict noise to a level less than what is indicated above.
   3. Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

E. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
   1. Ambient Temperature: Minus 15 to plus 50 deg C.
   2. Altitude: Sea level to 100 feet.

F. Unusual Service Conditions: Engine-generator equipment and installation are required to operate under the following conditions:
   1. High salt-dust content in the air due to sea-spray evaporation.

2.3 ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. EPSS Class: Engine-generator set shall be classified as a Class 72 in accordance with NFPA 110.

D. Governor: Adjustable isochronous, with speed sensing, capable of maintaining frequency within 0.2 Hertz of normal.

E. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
   1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

F. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated on the drawings at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
2. Output Connections: As indicated on the drawings.
3. Voltage: As indicated on the drawings.
4. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component. Nameplate shall be in accordance with NFPA70.

G. Generator-Set Performance:
   1. Oversizing alternator compared with the rated power output of the engine is permissible to meet specified performance.
      a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
   2. Steady-State Voltage Operational Bandwidth: 2 percent of rated output voltage from no load to full load.
   3. Transient Voltage Performance:
      a. Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 3 seconds.
      b. Not more than 25 percent dip under worst case motor starting conditions. See Informational Submittals, Voltage Drop Calculations for specific step loading criteria.
   4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
   5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
   6. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds.
   7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
   8. Block Load Performance: per NFPA110, the unit shall be able to fully recover from a 100% block load.
   9. Excitation System: Performance shall be unaffected by 10% total voltage distortion (THD) caused by nonlinear load.
      a. Provide permanent magnet excitation (PMG) for power source to voltage regulator.
   10. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.4 ENGINE

A. Fuel: Diesel Fuel oil, Grade DF-2.
   1. Natural gas may be applicable only if directed so in advance by CFPUA.

B. Engine Rating: Prime mover shall have adequate horsepower to meet the specified kW at the specified site altitude and temperatures. Products that de-rate below specified kW for temperature or altitude shall not be accepted.

C. Rated Engine Speed: 1800 rpm.

D. Cylinders: For units 300 kW and larger, cylinders shall be cast iron, sleeved.

E. Lubrication System: The following items shall be mounted on engine or skid:
   1. Positive displacement, full pressure lubrication oil pump.
   2. Filter and Strainer: Per manufacturer recommendations.
   3. Dipstick to check oil level.
   4. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

F. Jacket Coolant Heater:
   1. Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity. Heater(s) shall be 3rd party listed.
   2. 1500-watts, 120-volt minimum. Provide higher capacity heater as required based on manufacturer requirements for engine size.
   3. Thermostatically controlled to maintain engine coolant at not less than 90 deg F in 32 deg F ambient.
   4. Shut-off valve to simplify replacement of the heater.

G. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
   1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
   2. Cooling System Sizing: Sized to adequately cool the generator set, including aftercooler, without de-rate to an ambient temperature of 122 deg F (50 deg C) for diesel. Maximum external restriction shall be no greater than 0.5 inch of water column.
   3. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
   4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
   5. Blower fan, water pump, thermostat, and radiator duct flange shall properly cool the engines in 105 deg F ambient with up to 0.5 inches H20 static pressure on the fan. Radiator shall include a duct flange adapter for connection to the discharge air vent.
   6. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
      a. Rating: 50-psig maximum working pressure with coolant at 180 deg F (82 deg C), and non-collapsible under vacuum.
      b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

H. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

I. Starting System: 12 or 24-V electric, with negative ground.
   1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
   2. Cranking/Starting Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
      a. Speed sensing and a second independent starter motor disengagement systems shall protect against starter engagement with a moving flywheel.
   3. Cranking Cycle: As required by NFPA 110 for system level specified.
      a. Cranking cycler with 15 second ON and OFF cranking periods.
      b. Overcrank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.
      c. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.
   4. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.
   5. Battery: Lead acid, certified to meet NFPA 110, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
   6. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
   7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
   8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and continuous rating adequate for batteries provided, 35-A minimum.
   9. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with and be listed to UL 1236 and include the following features:
      a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
      b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
      c. Automatic Voltage Regulation: Maintain +/- 1% constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
      d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates. Fuse protection. Reverse polarity and transient protected.
      e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet with adequate vibration isolation if mounted within the generator set.

2.5 DIESEL FUEL-OIL SYSTEM

A. Comply with NFPA 30.

B. Flexible fuel lines rated 300 deg F and 100 psi ending in pipe thread.

C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions. Engine-driven or electric fuel transfer pump capable of lifting fuel 4.7 feet minimum.

D. Fuel Filtering: Primary fuel filter to remove water and contaminants larger than 10 micron. Secondary filter to remove contaminants larger than 2 micron.

E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:
   1. Fuel-Tank Capacity: Fuel for 72 hours' continuous operation at 100 percent rated power output (200 gallons minimum). Tanks larger than the minimum capacity specified are acceptable
   2. Tank level indicator gauge.
   3. Low Fuel Sensing Switch: shall be provided, in accordance with NFPA110, to indicate when less than the minimum fuel necessary for full load running, as required by the specified EPSS class.
   4. Leak detection in interstitial space.
   5. Vandal-resistant fill cap.
   6. Spill containment box for filling location.
   7. Normal vent shall extend to 12’ above grade. Adequately brace extended vent so that attachment of the vent to the tank is not the sole means of support.
   8. Containment Provisions: Comply with requirements of authorities having jurisdiction.
   9. Tank shall be production tested to 2 psi.
   10. Tank shall be equipped with overfill protection, fuel line check valve, fuel level gauge, low fuel level alarm contact, low fuel level shutdown contact, and fittings for fuel supply, return, fill and vent.
   11. Top of tank shall be a minimum of 30" above slab and/or grade to aid in preventing flood damage to engine.
   12. The tank shall feature all welded construction and have the structural integrity to support the genset, accessories, and the weather-protective enclosure.

2.6 GASEOUS FUEL SYSTEM

A. As noted previously, natural gas is to be used only if directed so in advance by CFPUA.

B. Natural-Gas Piping: Comply with requirements of NFPA 37 and 54.

1. Gas piping and first stage gas regulator shall be the responsibility of the installing contractor.
2. Gas piping shall be sized to provide adequate fuel to the engine while allowing for no greater than 1-inch water column pressure drop from no load to full load.
3. Gas piping shall supply pressure to the generator set inlet per manufacturer's recommendations, nominally 11 to 14 inches of water column.
4. Gas regulator shall be sized to provide 125 percent of full-load generator set capacity.

C. Gas Train: Comply with NFPA 37.

D. Engine Fuel System:
   1. Natural-Gas, Vapor-Withdrawal System:
      a. Carburetor.
      b. Secondary Gas Regulator.
      c. Fuel-Shutoff Solenoid Valves: NRTL-listed, normally closed, safety shutoff valves; one for each fuel source.
      d. Fuel Filters: One for each fuel type.
      e. Manual Fuel Shutoff Valves: One for each fuel type.
      f. Flexible Fuel Connectors: Minimum one for each fuel connection.

2.7 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown with a programmed 5-minute cooldown period. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Activation of a remote emergency-stop switch also shuts down generator set. When mode-selector switch is in the OFF position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault shall also be accomplished by putting the switch to the OFF position.

B. Provide minimum run time control set for 15 minutes with override only by switching the model-selector switch to Off or by operation of a remote emergency-stop switch. Provide engine cooldown timer, factory set at 5 minutes, to permit unloaded running of the standby set after transfer of the load to normal.

C. Comply with UL 508A.

D. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration. Panel shall be powered from the engine-generator set battery.
   1. Engine and generator control wiring shall be multi-stranded annealed copper conductors encased by cross-linked polyethylene insulation resistant to heat, abrasion, oil, water, diesel fuel, and antifreeze. Wiring shall be suitable for continuous

use at 250 deg F (121 deg C) with insulation not brittle at minus 60 deg F (minus 51 deg C). Cables shall be enclosed in nylon flexible conduit, which is slotted to allow easy access and moisture to escape.

a. Engines that are equipped with an electronic engine control module (ECM) shall monitor and control engine functionality and seamlessly integrate with the generator set controller through digital communications. ECM monitored parameters shall be integrated into the genset controllers NFPA 110 alarm and warning requirements.

2. Construction: All circuitry within the control panel shall be individually environmentally sealed to prevent corrosion. Encapsulated circuit boards with surface mounted components and sealed, automotive-style connectors for sensors and circuit board connectors.

E. Indicating Devices: As required by NFPA 110 for Level 1 system. All ECM fault codes shall be displayed at the generator set controller in standard language; fault code numbers are not acceptable. Utilizing a digital display, including the following:
1. AC voltage: True three-phase sensing.
2. AC current.
3. Frequency.
4. EPS supplying load indicator.
5. DC voltage (alternator battery charging).
6. Engine-coolant temperature.
7. Engine lubricating-oil pressure.
8. Running-time meter.
9. Current and Potential Transformers: Instrument accuracy class.

F. Protective Devices and Controls in Local Control Panel: Shutdown devices and common visual alarm indication as required by NFPA 110 for Level 1 system, including the following:
1. Start-stop switch.
2. Overcrank shutdown device.
3. Overspeed shutdown device.
4. Coolant high-temperature shutdown device.
5. Coolant low-level shutdown device.
6. Low lube oil pressure shutdown device.
7. Overcrank alarm.
8. Overspeed alarm.
9. Coolant high-temperature alarm.
10. Coolant low-temperature alarm.
11. Coolant low-level alarm.
12. Low lube oil pressure alarm.
13. Lamp test.
14. Contacts for local and remote common alarm.
15. Coolant high temperature prealarm.
16. Generator-voltage; digitally adjustable via controller, password protected.
17. Fuel tank low-level alarm.
18. Run-Off-Auto switch.
19. Control switch not in automatic position alarm.
20. Low cranking voltage alarm.
21. Battery-charger malfunction alarm.

22. Battery low-voltage alarm.
23. Battery high-voltage alarm.

G. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

H. Data Connection: Provide an RS-485 ModBus port.

I. The control system shall provide pre-wired customer use dry contact outputs (4 minimum). Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality. For the initial installation, configure:
   1. One relay output shall be configured for a summary indication of pre-alarm/alarm/shutdown conditions.
   2. One relay output shall be configured for RUN indication of the generator.

J. Programmable Cycle Timer: To start and run the generator for a predetermined time. The timer shall use 14 user-programmable sequences that are repeated in a 7-day cycle. Each sequence shall have the following programmable set points:
   1. Day of the week.
   2. Time of the day start.
   3. Duration of cycle.
   4. Option to exercise at reduced speed for quiet test mode.

2.8 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
   1. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with UL 489.
   1. Tripping Characteristic: Designed specifically for generator protection.
   2. Trip Rating: Matched to generator output rating.
   3. Trip Settings:
      a. Selected to coordinate with generator thermal damage curve.
      b. Selected to coordinate with magnetic only, motor circuit protector breaker at a fire pump controller, as applicable.
      c. The instantaneous trip setting shall not exceed the calculated short circuit fault current available from the generator.
   4. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
   5. Mounting: Each circuit breaker installed in separate box in accordance with NEC700 separation of circuits.

2.9 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1 and UL2200, sized for 248 deg F (120 deg C) temperature rise above ambient at rated load.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H, vacuum impregnated with epoxy varnish in accordance with MILSPEC 1-24092 for improved fungus and salt spray resistance.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide twelve lead alternator.

E. Range: Provide broad range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rated speed, and heat during operation at 110 percent of rated capacity.

G. Enclosure: Drip-proof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type on a sealed circuit board, separate from exciter, providing performance as specified and as required by NFPA 110. Must be 3-phase sensing.
   1. Voltage Adjustment on Control and Monitoring Panel: Provide plus or minus 10 percent adjustment of output-voltage operating band.
   2. Provide anti-hunt provision to stabilize voltage.
   3. Isolated to prevent tracking when connected to SCR loads.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12 percent, maximum for sites with motor load supplied from VFDs or solid-state soft starters.

L. Excitation: Permanent magnet (PMG) type providing 300 percent current output for up to 10 seconds to a downstream breaker for selective coordination and improved motor starting.

2.10 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, sound-attenuating, weatherproof housing, wind resistant up to 130 mph. Roof shall be peaked or sloped for water runoff. Access doors shall be positioned to provide adequate access to components requiring maintenance. Instruments and controls shall be mounted within enclosure.
   1. Structural Design and Anchorage: Comply with North Carolina Building Code for wind loads up to 150 mph. Enclosure shall be mounted to the subbase fuel tank.
   2. Aluminum alloy, 0.063” thick minimum (14-gauge equivalent).
   3. Enclosure exterior shall be primed and finish coated with machinery gray, powder baked manufacturer standard paint.

4. Hinged Doors:
    a. Provide a minimum of two doors per side for operator and service access. A rear door or removable access panel shall provide access to generator end of unit.
    b. Door Panels: With integral stiffeners, and capable of being removed by one person without tools. In lieu of being removed, hardware that retains doors in fully open position are acceptable.
    c. Slip-pin hinges and latches stainless steel with nylon spacers.
    d. Gasketed for weather and rodent protection.
    e. Handles to have padlocking provisions.
    f. Door locks, hardware, and fasteners shall be stainless steel. Locks shall be keyed alike to match the existing Owner standard, manufacturer A.L. Hansen, Key #1250.
5. Silencer:
    a. Located within enclosure.
    b. Super critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. At a minimum, sound level measured at a distance of 23 feet from exhaust discharge after installation is complete shall be 75 dBA or less. Reference section 2.2D for coordination required to determine if more restrictive noise emissions are necessary.
    c. Coated to be temperature and rust resistant.
    d. Integral condensate drain.
    e. Gas proof, stainless steel, flexible exhaust bellows with threaded NPT or flanged connections.
    f. All exhaust piping shall be wrapped for personnel protection and to eliminate excessive heat build-up during generator operation.
6. Assembly Hardware (Nuts and Bolts): Use stainless steel hardware and nylon washers to prevent paint deterioration.

B. Sound Attenuation: Factory or third-party enclosure, designed to meet the following design criteria:
    1. Sound attenuated enclosure designed to match the criteria for the silencer. Reference section A.5.b. Enclosure shall have intake and discharge hoods, as needed to reduce the mechanical and exhaust noise to an acceptable level.
    2. Sound attenuation materials shall be securely supported, attached, and mechanically held in place; preferably with aluminum perforated metal sheeting.

C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
    1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow. Screened openings to prevent rodent entry.

D. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.11 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel

baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

2.12 MAINTENANCE PLATFORM

A. A prefabricated maintenance platform shall be provided around three sides of the generator. The radiator discharge end of the unit does not require a platform.

B. Materials: Aluminum.

C. Grating: Extend 48 inches around the perimeter of the genset enclosure on three sides.

D. Access steps.

E. Safety handrails shall extend around the platform perimeter and up both sides of the steps.

F. Platform height shall match the top of the sub-base fuel tank.

G. A variance for the maintenance platform may be granted upon written request for small generators where the control panel is less than 60 inches above the generator slab.

2.13 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
   1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
   2. Additionally, test and document the following:
      a. Maximum power (kW).
      b. Maximum motor starting (kVA) at 35% instantaneous voltage dip.
      c. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1 -22.40.
      d. Governor speed regulation under steady-state and transient conditions.
      e. Voltage regulation and generator transient response.
      f. Fuel consumption at 1/4, 1/2, 3/4, and full load.
      g. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
      h. Three-phase short circuit tests.
      i. Alternator cooling air flow.
      j. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
      k. Endurance testing.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
   1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
   2. Test generator, exciter, and voltage regulator as a unit.

3. Full load run.
4. Maximum power.
5. Voltage regulation.
6. Transient and steady-state governing.
7. Single-step load pickup.
8. Safety shutdown.
9. Report factory test results within 5 days of completion of test.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DELIVERY

A. Generator equipment shall be shipped to the site as a “single-source” item for which responsibility for overall installation, maintenance, spare parts, and service is through the local factory representative.

B. Delivery of the generator shall include off-loading and setting the generator in place on a concrete slab. Installation shall include mounting of all accessories specified elsewhere in this specification along with external power and control connections of the unit.

3.3 PREPARATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
   1. Notify Owner no fewer than two weeks in advance of proposed interruption of electrical service.
   2. Do not proceed with interruption of electrical service without Engineer / Owner’s written permission and without the presence of an Owner representative on site.

3.4 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Equipment Mounting:
   1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified and/or as detailed in the drawings.
   2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases.

C. Install packaged engine-generator to provide access, without removing connections or accessories, for periodic maintenance.

D. Install engine-generator in enclosure with elastomeric isolator pads on concrete base. Secure set as required by the manufacturer.

E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

F. Provide fuel as required for startup, testing, and demonstration.

3.5 CONNECTIONS

A. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine-generator to allow service and maintenance.

B. Connect engine exhaust pipe to engine with flexible connector.

C. Where natural gas unit has been designated in advance by CFPUA, connect fuel piping to engines with a gate valve, regulator, union, and flexible connector. Install manual shutoff valve in a remote location to isolate natural-gas supply to the generator enclosure. If corrosion resistant piping is not installed, paint piping to prevent corrosion.

D. Ground equipment according to Section "Grounding."

E. Connect wiring according to Section "Wire and Cable." Provide a minimum of one 90-degree bend in flexible conduit routed to the generator set from a stationary element.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:
   1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs as specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
      a. Visual and Mechanical Inspection
         1) Compare equipment nameplate data with drawings and specifications.
         2) Inspect physical and mechanical condition.
         3) Inspect anchorage, alignment, and grounding.

4) Verify the unit is clean.
5) Provide fluids and check levels of fuel, lubricating oil, and antifreeze for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
6) Accessories that normally function while each set is standing by shall be checked prior to cranking the engines. These shall include block heaters, battery chargers, etc.

b. Electrical and Mechanical Tests
1) Test protective relay devices per manufacturer recommendations.
2) Verify phase rotation, phasing, and synchronized operation as required by the application.
3) Start-up test mode to check for exhaust leaks, path of exhaust gases outside buildings, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage, and phase rotation.
4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
5) Conduct performance test in accordance with NFPA 110.
6) Verify correct functioning of the governor and regulator.
7) Seven hour load bank test with an external load bank as follows: 1 hour @ 50% load, 1 hour @ 75% load, 4 hours @ 100% load and 1 hour @ 50% load, monitor and record the following data in 15 minute intervals: engine coolant temperature, oil pressure, battery charge level, generator output voltage, amperes, and frequency.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
   a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
   b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
   c. Verify acceptance of charge for each element of the battery after discharge.
   d. Verify that measurements are within manufacturer's specifications.
4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks. Repair leaks and retest until no leaks exist.
6. Voltage and Frequency Transient Stability Tests:
   a. Use data capture from manufacturer control panel and software for measurements.
   b. Measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases and verify that performance is as specified.
   c. Measure voltage and frequency transients for actual site loads, similar to the steps indicated for voltage drop calculation requirements.

7. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge.
    a. Make measurements at four locations, 90 degrees apart and 23 feet from the exhaust discharge.
    b. Make measurements at 4 locations on the property line, nearest to the generator unit.
    c. Compare measured levels with required values.

C. Coordinate tests with tests for transfer switches and run them concurrently. Perform automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown.

D. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

E. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Remove and replace malfunctioning units and retest as specified.

G. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

H. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.7 MAINTENANCE SERVICE

A. After the seven-hour load bank test has been completed:
    1. Change the lubrication oil, lubrication oil filters, and fuel filters.
    2. Fill fuel tank.

B. Under the service contract, provide full service and maintenance by certified employees of manufacturer's designated service organization.
    1. Semi-Annually: Include inspection, testing, exercising, and adjustments to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation.
    2. Yearly: Along with quarterly activities, include a load bank test for a minimum of 3 hours at 100% load.
    3. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
    4. Include certification in the Owner’s maintenance log of repairs made and proper functioning of all engine and auxiliary systems.

3.8 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation, maintenance, and repair of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner. Time permitting, training will be tentatively scheduled after start-up.

END OF SECTION

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCHES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install automatic transfer switches.

B. Related Sections:
   1. Section 26 05 02 - Basic Electrical Work, Identification for Electrical Systems.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. IEEE 472, Guide for Surge Withstand Capability Tests.
   2. IEEE 446, Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications.
   3. IEEE C62.41, Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits.
   4. NEMA ICS1 109, Tests and Procedures.
   5. NEMA ICS10, AC Automatic Transfer Switches.
   6. UL 1008, Transfer Switch Equipment.
   7. UL 508, Industrial Control Equipment
   8. UL 61010B-1 (previously UL 3111-1), Electrical Measuring and Test Equipment; Part 1: General Requirements.
   9. ANSI C37.90a, Surge Withstand Capability Test (formerly IEEE Standard 472-1974) – Ring Wave Test.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. NEC Article 702, Optional Standby Systems.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Listing of transfer switches to be provided, including ratings and location of each.
      b. Equipment dimensions, and construction details of enclosures with conduit entry locations.
   2. Product Data:
      a. Manufacturer’s technical information for products proposed, including catalog cut sheets.

B. Informational Submittals:
   1. Field Quality Control Submittals:
      a. Submit reports of completed field tests, including test results and procedures used for testing.
   2. Supplier Instructions:
      a. Manufacturer's written instructions for transporting, handling, storing, and installing the products.
   3. Supplier Reports:
      a. Written report of each visit to Site by supplier's service representative.

C. Closeout Submittals
   1. Operation and Maintenance Data:
      a. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation, and spare parts information.
      b. Manuals shall include record drawings of control schematics, including point-to-point wiring diagrams.
      c. Furnish operation and maintenance manuals.

D. Maintenance Material Submittals: Furnish the following:
   1. Spare Parts and Extra Stock Materials: Provide as specified in this Section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices to be embedded in cast-in-place concrete in time to prevent delay of the Work.

B. Shipping sections shall be designed to be shipped by truck, rail, and ship. Indoor sections shall be bolted to skids.

C. Equipment shall be equipped to be handled by crane. Where cranes are not available equipment shall be suitable for skidding in place on rollers using jacks to raise and lower the sections.

1.6 MAINTENANCE

A. Spare Parts and Extra Stock Materials:
   1. Furnish, tag, and box for shipment and long-term storage the following spare parts for each switch:

Item	**Quantity (per Switch)**
a. Control relay	Two of each type used
b. Pilot light	Two per ten of each type used
c. Fuses	Two set of each type and size used

   2. Furnish a list of additional recommended spare parts for an operating period of one year. Describe each part, quantity recommended, and current unit price of each.

3. Package spare parts in suitable containers bearing labels clearly indicating contents and equipment with which they are to be used. Deliver spare parts at same time as switchgear.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Owner Acceptance.

PART 2 PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Provide automatic transfer switches as specified for transferring loads from one power source to another.

2.2 MANUFACTURERS

A. Manufacturers: Provide products of one of the following:
   1. ASCO Power Technologies.
   2. G.E. / Zenith.
   3. Russelectric.
   4. Or pre-approved equal.

2.3 SWITCH

A. Ratings:
   1. Switches shall be capable of switching all classes of loads and rated for continuous duty when installed in a non-ventilated enclosure.
   2. Switches shall be rated with continuous ampere rating, number of poles and voltage as shown on Drawings.
   3. Switches shall be rated to withstand the magnitude of fault current available without welding of contacts in compliance with ANSI C37.90a and IEEE C62.41.

B. Standards and Performance:
   1. Switches shall comply with UL Standard 1008, NEMA Standard ICS10, and applicable requirements of NEC Article 700, IEEE 446, IEEE C62.41, UL 508, and UL 61010B-1. Switches shall be UL labeled with performance meeting or exceed the following:
      a. Temperature Rise: Measurements shall be made after overload and endurance tests.
      b. Withstand: UL listed to withstand magnitude of fault current available at switch terminals when coordinated with respective protective devices shown on Drawings at an X/R ratio of 6.6 or less. Main contacts shall not trip open or weld when subjected to fault currents.

1) As a condition for approval, manufacturer of automatic transfer switches shall verify that switches are listed by Underwriters Laboratories, Inc., Standard UL-1008 with three-cycle short circuit closing and withstand as follows:

RMS Symmetrical Amperes		
Amperes	**3 Cycle Closing & Withstand**	
	240 VAC Max	480 VAC Max
100 to 400	65,000	42,000
600 to 800	65,000	65,000
1000 to 1200	85,000	85,000
1600 to 4000	100,000	100,000

2) During three-cycle closing and withstand tests, there shall be no contact welding or damage. Three-cycle tests shall be performed without using current limiting fuses, and oscillograph traces across main contacts shall be furnished to verify that contact separation has not occurred, and there is contact continuity across all phases after completion of testing. Test procedures shall be in accordance with UL-1008, and testing shall be certified by UL.
3) When conducting temperature rise tests to UL-1008, Supplier shall include post-endurance temperature rise tests to verify ability of transfer switch to carry full rated current after completing overload and endurance tests.

c. Dielectric: Measurements shall be made at 1960 VAC RMS minimum following the withstand current rating test.
d. Transient Withstand: Control panel shall pass the voltage surge withstand test per IEEE Standard 472 and voltage impulse withstand test per NEMA ICS1 109.

C. Construction:
1. Switch shall be double throw actuated by non-fused, momentarily energized operating mechanism(s).
2. Accomplish mechanical locking of main contacts in each direction without aid of latching solenoids, toggle mechanisms, or gear arrangements.
3. An overload or short-circuit shall not cause switch to go to a neutral position.
4. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.
5. Switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
6. Main contacts shall be silver-tungsten composition. Switches shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
7. Inspection of contacts shall be possible from front of switch without disassembly of operating linkages and without disconnecting power conductors. Switches rated 600 amps and higher shall have front-removable and replaceable contacts.

All stationary and moveable contacts shall be replaceable without removing power conductors or bus bars.

8. Transfer switch shall be equipped with a safe manual operator designed to prevent injury to operating personnel. Manual operator shall provide same contact-to-contact transfer speed as electrical operator to prevent a flash-over from switching main contacts slowly. Manual operation shall be safe even if electrical operator becomes energized and shall not require prior disconnection of operators or control wiring. Safe manual transfer shall be possible under all load conditions, energized or non-energized. Manual operator shall be an external type, operable through door of transfer switch enclosure. Operating personnel shall not be required to open transfer switch door to facilitate manual transfer. Manual operator shall be functional at all times, regardless of switch position or status. Manually initiated electrical operation does not meet intent of this requirement. Manual operator is not required on closed transition type switches.
9. Neutral Connections:
    a. Provide switch with fully rated neutral transfer contacts.
10. Dual lug configuration shall be provided at the Load terminals for connection of the output feeder conductors and for connection of conductors to a surge protection device. See drawings for conductor sizes.

D. Enclosure:
    1. Indoors in prefabricated FRP enclosures: NEMA 4X, 316 stainless steel.
    2. Indoors in prefabricated, precast concrete enclosures: NEMA 1 when HVAC is provided for the enclosure and approved by CFPUA and recommended by the Engineer. Otherwise, enclosure shall be NEMA 4X, 316 stainless steel.
    3. Outdoors: NEMA 4X, 316 stainless steel.

E. Identification: Identify switches per Section 26 05 02 - Basic Electrical Work, Identification for Electrical Systems.

2.4 TRANSFER SWITCHING FEATURES

A. Delay Transition (Open): Provide automatic delayed open transition transfer for each switch. Switch shall transfer load in delayed transition (break-before-make) mode. Transfer shall be accomplished with a user-defined interruption period in both directions adjustable from one second to five minutes in at least 15 increments.

2.5 SEQUENCE OF OPERATION

A. When voltage on any phase of normal source is outside of specified parameters and after a programmable time delay period to allow for momentary dips, engine starting contacts shall close to start generating supply.

B. Transfer switch shall transfer to emergency source when generating supply has reached specified voltage and frequency on all phases.

C. After restoration of normal power on all phases to within specified parameters, an adjustable time delay shall delay retransfer to normal to assure stabilization of normal supply. After expiration of the time delay period, transfer switch shall retransfer too

normal. Retransfer to normal shall be prevented until two power supplies approach synchronization. Should emergency power source fail during the time delay period, switch shall bypass time delay and automatically return to normal source.

D. After retransfer to normal, engine generator shall be allowed to operate at no load for a programmable period to cool down.

E. Should transfer to emergency source be initiated by test switch rather than an actual source failure, transfer from normal to emergency shall be as described above.

2.6 MICROPROCESSOR CONTROLLER

A. Each switch shall include a microprocessor controller for operation of the switch. Equip controller with the following:
   1. Provide controller's sensing and logic by a built-in microprocessor with ability to communicate serially through an optional serial communication module.
   2. Controller shall provide a minimum of five selectable nominal voltages. Voltage sensing shall be true RMS type and be accurate to plus/minus one percent of nominal voltage. Frequency sensing shall be accurate to plus/minus 0.2 percent. Controller shall be capable of operating over a temperature range of -20 to +60 degrees C and storage from -55 to +85 degrees C.
   3. Connect controller to transfer switch by an interconnecting wiring harness that shall include a keyed disconnect plug to enable controller to be disconnected from transfer switch for routine maintenance. Interfacing relays shall be industrial grade plug-in type with dust covers. Enclose controller with a protective cover. Mount controller internally but separately from transfer switch.
   4. Customer connections shall be wired to a common terminal block.

B. Controller Display and Keypad:
   1. Display and keypad shall be an integral part of controller for viewing available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through serial communications input port. The following parameters shall be adjustable:
      a. Nominal line voltage and frequency
      b. Single- or three-phase sensing
      c. Operating parameter protection
      d. Transfer operating mode configuration: Open transition, closed transition, or delayed transition
   2. Instructions and controller settings shall be easily accessible, readable, and accomplished without using codes, calculations, or instruction manuals.

C. Controller Voltage, Frequency and Phase Rotation Sensing:
   1. Voltage and frequency on both the normal and emergency sources shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities values shown as a percent nominal unless otherwise specified:

Parameter	Sources	Dropout/Trip	Pickup/Reset
Under-voltage	Normal and Emergency, three-phase	70 to 98%	85 to 100%
Over-voltage	Normal and Emergency,	102 to 115%	2% below trip

	three-phase		
Under-frequency	Normal and Emergency	85 to 98%	90 to 100%
Over-frequency	Normal and Emergency	102 to 110%	2% below trip
Voltage Unbalance	Normal and Emergency	5 to 20%	1% below dropout

2. Repetitive accuracy of all settings shall be within plus/minus 0.5 percent over an operating temperature range of -20 degrees C to +60 degrees C.
3. Voltage and frequency settings shall be field adjustable in one percent increments, either locally with the display and keypad or remotely via serial communications port access.
4. When activated by keypad or through serial port, controller shall be capable of sensing phase rotation of both normal and emergency sources. Source will be unacceptable if phase rotation is not preferred rotation selected (ABC or CBA).
5. Source status screens shall be provided for both normal and emergency to provide digital readout of voltage on all three phases, frequency, and phase rotation.

D. Controller Time Delays:
   1. Provide controller with time delays below. Time delay settings shall be adjustable over a range of zero to 9999 seconds (factory set at three seconds) unless specified otherwise.
      a. Normal source failure, for engine starting.
      b. Transfer to emergency on availability of emergency source.
      c. Emergency source failure, retransfer on availability of normal source.
      d. Engine cool down following retransfer to normal.
      e. Time delay to control contact transition time during open transition transfer to either source.
      f. All timers can be bypassed via operation on processor’s keypad.
   2. Provide adjustable time-delay on retransfer to normal. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
   3. Time delay and sensing functions shall be field adjustable and operate with drift that does not exceed plus/minus one percent of set frequency, plus/minus two percent of set voltage, and plus/minus ten percent of set time delay, over the temperature range of -20 degrees C to +70 degrees C.
   4. Time delays shall be adjustable in one-second increments, except extended parallel time, that shall be adjustable in 0.01-second increments.
   5. Time delays shall be adjustable by using display and keypad or with a remote device connected to serial communications port. Time delay value displayed shall be time remaining until next event occurs.
   6. For (open) delay transition transfer switches, controller shall include the following built-in time delays for delayed transition operation:
      a. Zero to five-minute time delay for load disconnect position for delayed transition operation.
   7. For closed transition transfer switches, controller shall include the following built-in time delays
      a. One to five-minute time delay on failure to synchronize normal and emergency sources prior to closed transition transfer.

b. 0.1 to 9.99 second time delay on an extended parallel condition of both power sources during closed transition operation.

2.7 ACCESSORY FEATURES:

A. Provide each switch with the following:
   1. A two-position maintained-type test switch for test/automatic/ modes. Test position shall simulate a normal source failure.
   2. A SPDT silver-tungsten contact, rated five amps at 30 VDC, for a low-voltage engine start signal. Start signal shall prevent dry cranking of engine by requiring generator set to reach proper output and run for duration of cool down setting regardless of whether normal source restores before load is transferred.
   3. Auxiliary contacts, rated ten amps at 250 VAC, consisting of one contact, closed when switch is connected to normal source and one contact closed when switch is connected to emergency source.
   4. LED indicating lights (30.5 mm, industrial heavy duty, oil-tight, NEMA rated to match automatic transfer switch enclosure). One shall indicate when switch is connected to normal source (green) and one to indicate when the switch is connected to standby source (red).
   5. Provide the following built-in to controller, capable of being activated through keypad programming or serial port only when required by user:
      a. Provide ability to select “commit/no commit to transfer” to determine whether load should be transferred to standby generator if normal source restores before generator is ready to accept load.
      b. Provide terminals for a remote contact that opens to signal switch to transfer to emergency, and for remote contacts that open to inhibit transfer to emergency or retransfer to normal. Provide ability to activate both inhibit signals through keypad or serial port.
      c. Engine Exerciser: Controller shall provide an internal engine exerciser that allows user to program up to seven different exercise routines. For each routine, user shall be able to:
         1) Enable or disable routine.
         2) Enable or disable transfer of load during routine.
         3) Set start time.
         4) Time of day
         5) Day of week
         6) Week of month (first, second, third, fourth, last, alternate, and every)
         7) Set duration of run.
         8) At end of specified duration, switch shall transfer load back to normal and run generator for specified cool down period. A ten-year life battery that supplies power to real time clock in event of a power loss shall maintain time and date information.
   6. System Status: Controller display shall include a “System Status” screen that shall be readily accessible from all points in the menu by a maximum of two key strokes. System status screen shall display a clear description of active operating sequence and switch position.
   7. Self-Diagnostics: Controller shall contain a diagnostic screen for detecting system errors. Screen shall provide information on status input signals to controller that may be preventing completion of load transfer commands.

8. Communications Interface: Controller shall be capable of interfacing, through an optional full-duplex RS 485 serial communication module, with a network of transfer switches, within 4,000 feet (locally) and remotely through modem serial communications. Standard software specific for transfer switch applications shall be available from transfer switch manufacturer. Software shall include monitoring, control, and setup of parameters.
9. Data Logging: Controller shall have ability to log data and to maintain last 99 events, even during total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:
    a. Event Logging
        1) Date and time and reason for transfer normal to emergency.
        2) Date and time and reason for transfer emergency to normal.
        3) Date and time emergency source available.
    b. Statistical Data
        1) Total number of transfers.
        2) Last ten numbers of transfers due to source failure.
        3) Total number of hours both normal and emergency sources are available.
10. Terminate control wires with crimp lugs and identify with sleeve type markers. Provide suitable copper connector lugs for each service and load connections.
11. Additional Accessories:
    a. Automatic synchronizing check function to prevent transfer from normal to emergency or retransfer from emergency to normal until both sources are within acceptable limits of synchronism.
    b. Pushbutton to reset Fail to Transfer.

2.8 SOURCE QUALITY CONTROL

A. Perform manufacturer's standard factory tests that shall include:
    1. Physical inspection and checking of components.
    2. Mechanical operation and device functional tests.
    3. Control operation and functionality tests.
    4. Primary, control, and secondary wiring hi-pot tests.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which Work is to be performed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.

B. Install equipment in accordance with Contract Documents and manufacturer recommendations.

C. Securely fasten equipment to floors, walls, or other surfaces on which equipment will be mounted. Install freestanding switches on raised concrete pad at locations shown on Drawings. Install in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

A. Perform field testing and inspection of each automatic transfer switch. Testing and inspection shall be in accordance with manufacturer's recommendations and be performed by manufacturer's factory-trained representative, who shall inform Owner and Engineer when equipment has been correctly installed. Do not energize equipment without permission of Owner.

3.4 MANUFACTURER SERVICES

A. Manufacturer Services:
   1. Manufacturer's factory-trained representative shall test the system as specified in Article 3.3 of this Section. Representative shall operate and test system in the presence of Engineer and verify that equipment conforms to requirements.
   2. Manufacturer's factory-trained representative shall adjust the system to initial settings specified in Article 2.6 of this Section.
   3. Representative shall revisit the Site as often as necessary until all deficiencies are corrected, prior to readiness for final payment.
   4. Provide services of manufacturer's factory-trained representatives to correct defective Work within 72 hours of notification by Owner during the Correction Period specified in the General Conditions as amended by the Supplementary Conditions.
   5. Replacement parts or equipment installed during the Correction Period shall be equal to or better than the original.

B. Training: Furnish services of qualified factory trained specialists from manufacturer to instruct Owner's operations and maintenance personnel in recommended operation and maintenance of the products.

END OF SECTION

SECTION 26 50 01

LED LIGHTING

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install LED lighting fixtures and associated controls.

B. Coordination:
   1. Coordinate location of fixtures with piping, ductwork, openings, and other systems and equipment and locate clear of interferences.

C. Related Sections:
   1. Section 26 05 02 - Basic Electrical Work

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. UL 1598, Safety of Luminaires.
   2. Design Lights Consortium (DLC) SSL Technical Requirements, V4.3, effective March 26, 2018.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the following:
   1. NEC Article 410, Luminaires, Lampholders, and Lamps.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Product Data:
      a. Manufacturer’s technical information, specifications, standard wiring diagrams, and catalog cuts for lighting fixtures proposed.
      b. Fixture construction details.
      c. ETL photometric and isocandle curves for each fixture proposed.
      d. Verification that recessed fixtures to be mounted in hung ceilings are compatible with ceiling suspension system proposed.

B. Informational Submittals: Submit the following:
   1. Manufacturer’s Instructions:
      a. Instructions and recommendations for handling, storing, and protecting the equipment.
      b. Installation instructions for the equipment, including setting drawings, templates, and directions and tolerances for installing anchorage devices.

C. Maintenance Material Submittals: Submit the following:
   1. Spare Parts and Extra Stock Materials: Furnish spare parts for each type of unit required as indicated in Part 2 of this Section.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Upon delivery, inspect equipment for evidence of water that may have entered equipment during transit.

B. Storage:
   1. Store lighting fixtures, controls, related materials, and equipment in clean, dry location. Protect materials and equipment with coverings.
   2. Store materials and equipment for easy access for inspection and identification. Keep materials and equipment off ground, using pallets, platforms, or other supports. Protect materials and equipment from corrosion and deterioration.

PART 2 PRODUCTS

2.1 MATERIALS

A. Type: Lighting fixtures required shall be in accordance with the Lighting Fixture Schedule or Legend on the Drawings. Fixtures shall be complete with supports, lamps, and incidentals, as required.

B. Fixtures in hazardous locations shall be listed in accordance with UL 1598 and UL 844.

C. Lamps:
   1. LED lamps are intended to meet the requirements of DLC Technical Requirements V4.3. Provide minimum lamp efficacy (lm/W) per DLC. Provide correlated color temperature (CCT) and Color Rendering Index (CRI) requirements per DLC. Provide lumen maintenance data with product submittals. Provide rated life warranty per DLC. All LED lamps shall have a power factor ≥ 0.9 and a THD < 20%. All LED lamps shall be capable of continuous dimming, flicker and noise free, from 10-100 percent. All LED lamps shall be free of noise over the full range of operation from 10%-100% output.

D. Fixtures located in area identified as hazardous in Section 26 05 02 - Basic Electrical Work, General Provisions for Electrical Systems, shall each be approved as a complete assembly, shall be clearly marked to indicate maximum wattage of lamps for which they are approved, and be protected against physical damage by suitable guards.

E. Hardware: Provide necessary hangers, supports, conduit adaptors, reducers, hooks, brackets, and other hardware required for safe fixture mounting. Hardware shall have protective, non-corrosive finish.

F. Outdoor Fixtures: Provide each fixture to be installed outdoors with cut-off lens to reduce the fixture’s light pollution emissions.

G. Photocell:
   1. Products and Manufacturers: Provide one of the following:
      a. 2100 Series by Tork Time Controls, Inc.
      b. Or equal.
   2. Cadmium sulfide hermetically-sealed cell, fully temperature compensated, with time delay of not less than 15 seconds to prevent false switching.
   3. Built-in fail safe light level selector, adjustable within limits of two to 50 foot-candles and factory set at 25 foot-candles.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine conditions under which the Work will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:
   1. Fixture mounting heights and locations indicated on the Drawings are approximate and are subject to revision in the field where necessary to clear conflicts and obstructions.
   2. Mounting Heights: Mounting heights or elevations are to bottom of fixture or to centerline of device.
   3. Install fixtures in accordance with Laws and Regulations, the Contract Documents, and manufacturer instructions and recommendations.
   4. Mount fixtures so that sufficient access is available for ready and safe maintenance.
   5. Securely fasten equipment to walls or other surfaces on which equipment is mounted.

B. Surface Mounted Fixtures:
   1. Attach to appropriate outlet box.
   2. Attach to surface using fasteners and sealing washers when mounting fixture in damp or wet locations.

C. Boxes and Fixtures:
   1. For units mounted against masonry or concrete walls, provide suitable 1/4-inch spacers to prevent mounting back of box directly against wall.
   2. Bolt units rigidly to building with expansion anchors, toggle bolts, hangers, or Unistrut.
   3. Do not install boxes with open conduit holes.
   4. Cable each circuit and identify with tag.

D. Mount photocells as shown and adjust foot-candle setting for proper dusk and dawn photo-control. Provide wiring in conduit from photocell to controls.

END OF SECTION

SECTION 31 23 34.01

EXCAVATING, TRENCHING, DEWATERING AND BACKFILLING FOR UTILITY WORK

PART 1 GENERAL

1.1 SUMMARY

A. Furnish all labor, equipment, supplies and materials, and perform all operations in connection with the following:
   1. Clearing, grubbing, and preparation of the site; removal and disposal of all debris.
   2. Pipeline and utility structure excavations including trenching, subgrade preparation, embedment, backfilling, pumping, and dewatering
   3. Tunneled (trenchless construction) crossings.
   4. Sheeting, shoring, and protection of work.
   5. Borrow, transportation, handling, storage, and disposal of suitable and unsuitable materials for pipelines, utility structures, site fills, curb and gutters, sidewalks, driveways, and pavements
   6. Subgrade preparation, grading, wetting, rolling, surfacing and other operations pertaining to the site work
   7. Protection of adjacent property.

B. No classification of excavated materials will be made. Excavation includes all materials regardless of type, character, composition, moisture, or condition thereof.

C. Related Requirements:
   1. Section 03 05 00 - Concrete
   2. Section 32 92 01 - Seeding and Sodding
   3. Section 33 14 13 - Water Distribution Piping, Valves, Hydrants, and Appurtenances
   4. Section 31 31 11 - Sanitary Sewer Gravity Mains
   5. Section 33 31 23 - Sanitary Sewer Force Mains, Valves, and Appurtenances
   6. Section 33 32 11 - Wastewater Pumping Stations

1.2 REFERENCES

A. Definitions:
   1. "Subgrade" is the uppermost surface of native soil material unmoved from cuts, the bottom of excavation.

B. Reference Standards:
   1. OSHA - Safety and Health Regulations for Construction, Chapter XVII of Title 29, CFR, Part 126
   2. NCDOT Positive Shoring Plan - issued with Right-of-Way Encroachment Agreement
   3. AASHTO T99/T180 - Standard Method of Test for Moisture-Density Relations of Soils.
   4. ASTM C136 - Sieve analysis of fine and coarse aggregates.
   5. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

6. ASTM D698 - Tests for moisture-density relations of soils and soil-aggregate mixture using 5.5 lb (2.49 kg) rammer and 12 inch (305 mm) drop.
7. ASTM D2321 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
8. ASTM D2487 - Classification of Soils for Engineering Purposes.
9. ASTM D4253 - Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
10. ASTM D4254 - Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
11. ASTM D4318 - Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
12. ASTM D4832 - Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
13. ASTM D6023 - Test Method for Density (Unit Weight), Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low-Strength Material (CLSM).
14. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Contractor Excavation Protection Plans or NCDOT Positive Shoring Plans:
   1. Provide sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property.
   2. At least 30 days before starting construction on sheeting and shoring, and in accordance with the OSHA and NCDOT requirements, the Contractor shall ensure the sheeting and shoring design engineer complete and submit the Protective System Design Certificate(s) for the sheeting and shoring systems that the Contractor will install.
   3. If required by the OSHA regulations to protect existing facilities, the Contractor shall submit separate certificates for each unique design. The certificate(s) shall be signed and sealed by the registered professional engineer that designed the protection system.

B. Geotextile Fabrics: Samples, manufacturer’s product data, installation instructions

C. Embedment and Backfills Materials:
   1. Name and location of proposed material suppliers.
   2. Standard test results for materials proposed by independent materials testing firm.

D. Trench Shields: Fabricator/manufacturer certifications

1.4 QUALITY ASSURANCE

A. Contractor to provide experienced on-site Safety Officer and Superintendent to comply with OSHA regulations for site excavations and engineered shoring plans.

B. Safety Officer and Superintendent shall hold OSHA 30-Hour Construction Certifications and classified as the competent person.

1.5 EXISTING SITE CONDITIONS

A. Every reasonable effort has been made to provide accurate information on existing site conditions. The Contractor should become familiar with the site and satisfy himself as to the scope of the work involved and the materials to be encountered. Any significant change in conditions should be immediately brought to the attention of the Engineer.

PART 2 PRODUCTS

2.1 MATERIALS

A. Geotextile Fabric. The fabric shall be provided in rolls wrapped with covering for protection from mud, dirt, dust, and debris.

1. Geotextile Fabric Type A. Geotextile fabric Type A shall be provided for installation at locations indicated on the Drawings and as specified herein. Geotextile Fabric Type A shall be a nonwoven fabric consisting of only continuous chains of polymeric filaments or yarns of polyester formed into a stable network by needle punching. The fabric shall be inert to commonly encountered chemicals; shall be resistant to mildew, rot, ultraviolet light, insects, and rodents; and shall have the indicated properties:

Property	Test Method	Unit	Minimum Average Roll Value *
Fabric Weight	ASTM D3776	oz/yd2	5.7
Grab Strength	ASTM D4632	lb	155
Grab Elongation	ASTM D4632	percent	50
Mullen Burst Strength	ASTM D3786	psi	190
Apparent Opening Size	CW-02215	U.S. Std. Sieve Size	70

* Minimum average roll value in weakest principal direction.

B. Polyethylene Film: Polyethylene film beneath concrete slabs or slab base course material shall be Product Standard PS17, 6 mil minimum thickness.

C. Granular Materials and Soils: Five classes defined according to properties and characteristics as follows.

a. **Class I** - Angular, 25 mm (1-in.) to No.4 (3/16 in.) in size, #57 or #67 graded stone or equivalent regional material from crushed rock, slag, and/or coral.

b. **Class II** - Coarse sands and gravels with maximum size of 25 mm (1-in.), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class.

c. **Class III** - Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil Types GM, GC, SM, and SC are included in this class.

d. **Class IV** - Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH, and CL are included in this class. These materials are not acceptable for bedding, haunching, or initial backfill.
e. **Class V** - This class includes the organic soil, OL, OH, PT as well as soils containing frozen earth, debris, rocks, larger than 37.5 mm (1-1/2 in.) in diameter, and other foreign materials. These materials are not acceptable for bedding, haunching, initial backfill, or final backfill.

D. General Fill:
1. Use soils free of organic matter, refuse, rocks and lumps greater than 4 inches in diameter and other deleterious matter.
2. Fill shall have a liquid limit not greater than 45, and plasticity index not greater than 25.
3. Previously excavated materials complying with the Contract Documents requirements for general fill may be used for general fill.
4. When on-site materials are found unsuitable for use as general fill, provide approved off-site general fill materials. Prior to using off-site material as general fill, furnish submittal for and obtain Engineer's approval of the material proposed for use.
5. General fill material not otherwise specified shall be Class II or III.

E. Granular Fill: Granular fill under floor slabs shall be Class I material.

F. Structural Fill: Fill material placed inside the line of the building foundation or slab shall be Class I or II.

G. Fill Under Pavement: Fill material used beneath pavement and for road shoulders shall be Class II or III.

H. Topsoil: Natural, friable soil free of subsoil, stumps, rocks larger than 2 inches in diameter, weeds, and other material detrimental to plant growth.

I. Concrete: Concrete placed for cradles, thrust blocks, or encasement shall be Class B concrete as specified in Section 03 05 00 - Concrete.

J. Subbase Material:
1. Material shall be naturally- or artificially graded mixture of natural or crushed gravel, crushed stone, or natural or crushed sand. Crushed slag is unacceptable.

K. Drainage Fill:
1. Material shall be washed, uniformly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing 1-1/2-inch sieve and not more than 10 percent passing a No. 4 sieve (#57 or #67 stone).

L. Controlled Low Strength Material (CLSM):
1. CLSM shall be self-leveling and self-compacting cementitious material.
a. Cement: Type I or Type II Portland cement complying with ASTM C150/C150M.
b. Fly Ash Mineral Admixture: Comply with ASTM C618, Class F.

c. Water: Clean, potable.
d. Admixtures: Provide admixtures in accordance with product manufacturer's published instructions. Admixtures shall be compatible with each other. Do not use calcium chloride or admixtures containing chloride ions. Use only admixtures that have been tested and approved in the mix designs.
e. Fine Aggregates: ASTM C33/C33M.

2. CLSM Mix:
   a. Cement Content: 50 pounds per cubic yard.
   b. Fly Ash Mineral Admixture: 250 pounds per cubic yard.
   c. Fine Aggregate Content: 2910 pounds per cubic yard.
   d. Water Content: 500 pounds per cubic yard.
   e. Admixtures shall comply with manufacturer's recommendations for use with CLSM.
   f. Unconfined compressive strength shall be not more than 100 psi.
   g. Adjustment of Mixes.
      1) Mix design adjustments may be requested by Contractor when warranted by characteristics of materials, Site conditions, weather, test results, or other, similar circumstances.
      2) Submit for Engineer's approval laboratory test data for adjusted mix designs, including compressive strength test results.
      3) Implement adjusted mix designs only after Engineer's approval.
      4) Adjustments to mix designs shall not result in additional costs to Owner.

2.2 SOURCE QUALITY CONTROL

A. Perform quality assurance testing, and submit results to Engineer, in accordance with the 'Submittals" Article in Part 1 of this Section.

PART 3 EXECUTION

3.1 INSPECTION

A. Familiarization: Prior to commencement of the Work, become thoroughly familiar with the site, the site conditions, and all portions of the work specified in this Section.

B. Provide Engineer with sufficient notice and with means to examine areas and conditions under which excavating, filling, and grading will be performed. Do not proceed with the Work until unsatisfactory conditions are corrected.

C. Approvals: Backfilling and grading operations near foundations, walls, pipes and other portions of the work to be covered shall not commence until the Engineer has completed all required inspections, tests and approvals. Work covered prior to inspection shall be uncovered for inspection purposes and backfilled.

3.2 SUBSURFACE UTILITY LOCATION AND EXPLORATION

A. Existing Utilities Location:

1. Prior to excavation, Contractor shall contact local underground alert hotlines, “North Carolina 811” and/or individual utility owners for marking underground utilities. A survey shall be made of the utility size, material, location, and elevation prior to trench excavation and information shall be recorded on the record Drawings maintained by the Contractor.
2. Once utilities are marked and recorded, Contractor shall excavate to expose the existing utilities in advance of the construction.
3. Perform all work required in connection with excavating, stockpiling, maintaining, sheeting, shoring, filling, and replacing pavement for utility location pits.
4. Contractor shall be responsible for the definite location of each existing underground utility involved within the area of excavation for the Work and exercise care during such location work to avoid damaging and disrupting the affected underground facilities or structures. Contractor shall be responsible for repairing, at his expense, damage to underground facility or structures caused during exploratory Work.

3.3 PREPARATION

A. Surface Preparation
   1. Clearing: Areas designated for clearing and required for construction operations shall be cleared of trees, brush, structures and other materials within the defined rights-of-way, easements, and limits of disturbance indicated. Trees which are to remain shall be protected during clearing operations and subsequent work.
   2. Grubbing: Roots, stumps and other materials shall be grubbed from the cleared areas to a depth of at least 18 inches. Tree stumps shall be grubbed in their entirety, including tap roots where applicable.
   3. Topsoil: Strip existing topsoil to a depth of 4 inches from areas to be excavated or graded. Stockpile the topsoil in a suitable area for use during final grading operations. Protect the topsoil from excessive erosion.
   4. Unsuitable Material: Remove sod, muck, or other unsuitable material to firm subsoil in areas designated for filling or grading operations.
   5. Disposal: Trees, stumps, roots, rubbish, unsuitable soil, or other material resulting from surface preparation shall be remove from the site by the Contractor and disposed of.

B. Prohibited Work:
   1. Burning or blasting and use of explosives is not allowed.

C. Dust Control:
   1. Control objectionable dust caused by Contractor’s operation of vehicles and equipment, clearing and other actions. To minimize airborne dust, apply water or use methods subject to approval of authorities having jurisdiction.

3.4 EXCESS WATER CONTROL

A. General Dewatering:
   1. Grade and maintain all areas of the site to preclude surface runoff into excavations and prevent ponding of water.
   2. Remove all soil softened or eroded by the presence of water and replace with suitable backfill material.

3. Provide and maintain drainage and dewatering equipment to remove and dispose of all surface water and ground water entering excavations, or other parts of the Work areas. Keep excavations dry during execution of Work, subgrade preparation, and continually thereafter until the pipeline or structure to be built therein is acceptable to Engineer and backfilling operations are completed and acceptable to Engineer.
4. Provide temporary drainage ditches and temporary dikes and provide required temporary pumping and other work necessary for diverting or removing rainfall and all other accumulations of surface water from excavations and fill areas. Perform diversion and removal of surface water in manner that prevents accumulation of water behind permanent or temporary structures and at any other locations in the construction area where such accumulations may be detrimental.
5. Water used for working or processing, resulting from dewatering operations, or containing oils or sediments that will reduce the quality of the surface water or groundwater downstream of the point of discharge, shall not be directly discharged. Divert such waters through temporary settling basin or filter before discharging to surface water, groundwater, or drainage routes.
6. Contractor shall be responsible for condition of piping, conduits, and channels used for drainage and such piping, conduits, and channels shall be clean and free of sediment.

B. Temporary Dewatering Systems:
1. Contractor shall design, provide, and operate dewatering system to include sufficient trenches, sumps, pumps, hose, piping, well points, deep wells, and similar facilities, necessary to depress and maintain groundwater level below the base of each excavation during all stages of construction operations.
2. Design and operate dewatering system to avoid settlement and damage to existing structures and underground facilities.
3. Groundwater table shall be lowered in advance of excavation for a sufficient period of time to allow dewatering of fine grain soils.
4. Maintain groundwater level at excavations 2-feet below lowest subgrade excavation until the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural groundwater.
5. Operate dewatering system continuously, 24-hours per day, 7-days per week. Provide standby pumping facilities and personnel to maintain the continued effectiveness of the system. Do not discontinue dewatering operations without first obtaining Engineer's acceptance for such discontinuation.
6. Locate elements of temporary dewatering system to allow continuous dewatering operation without interfering with the Work to the extent practicable.
7. Where portions of dewatering system are located in the area of permanent construction, submit to and obtain Engineer's acceptance of details of proposed methods of constructing the Work at such location. Control of ground water shall continue until the permanent construction provides sufficient dead load to withstand hydrostatic uplift of the normal groundwater, until concrete has attained sufficient strength to withstand earth and hydrostatic loads, and until waterproofing Work is completed.
8. Perform pumping of water from excavations in a manner that prevents carrying away of unsolidified concrete materials, and that avoids damaging the subgrade.

C. Disposal of Water Removed by Dewatering System:

1. Contractor's dewatering system shall discharge to in accordance with the NC Sedimentation Pollution Control Act, NCDEQ Erosion Control Permit, and NC Stormwater Permit for Construction Activities.
2. Convey water from excavations in closed conduits. Do not use trench excavations as temporary drainage ditches.
3. Dispose of water removed from excavations in a manner that does not endanger health and safety, property, the Work, and other portions of the Project.
4. Dispose of water in manner that causes no inconvenience to Owner, others involved in the Project, and adjacent and downstream properties.

3.5 SHEETING, SHORING AND BRACING

A. General:
   1. Design and provide sheeting, shoring, bracing, cofferdams, and similar excavation supports as shown, specified, and required for the Work. Where sheeting, shoring, bracing, or trench boxes are used, they must be designed and sealed by a professional engineer licensed to practice in the State of North Carolina.
   2. Clearances and types of temporary sheeting, shoring, bracing, and similar excavation supports, insofar as they may affect the finished character of the Work and the design of sheeting to be left in place, will be subject to the Engineer's approval; but Contractor is responsible for adequacy of all sheeting, shoring, bracing, cofferdams, and similar excavation supports.
   3. Materials:
      a. Previously used materials shall be in good condition and shall not be damaged or excessively pitted. All steel or wood sheeting designated to remain in place shall be new. New or used sheeting may be used for temporary sheeting, shoring, and bracing.
      b. All steel work for sheeting, shoring, bracing, cofferdams, and other excavation supports, shall be in accordance with ANSI/AISC 360, except that field welding will be allowed.
      c. When required, provide permanent steel sheet piling or treated timber sheet piling where subsequent removal of sheet piling might allow lateral movement of soil under adjacent structures
   4. As excavation progresses, carry down shoring, bracing, cofferdams, and similar excavation supports to required elevation at bottom of excavation.
   5. Maintain sheeting, shoring, bracing, bracing, and other excavation supports in excavations regardless of time-period excavations will be open.
   6. Unless otherwise shown, specified, or directed, remove materials used for temporary construction when the Work is completed. Perform such removal in manner not injurious to the structures and underground facilities, their appearance, and adjacent construction.

B. Removal of Shoring, Sheeting and Bracing:
   1. Remove sheeting and bracing from excavations, unless otherwise directed by Engineer in writing. Perform removal to avoid damaging the Work and adjacent construction. Removal shall be equal on both sides of excavation to ensure no unequal loads on structures and underground facilities.
   2. Defer removal of sheeting and bracing, where removal may cause soil to come into contact with concrete, until the following conditions are satisfied:
      a. Concrete has cured for not less than 7 days.

b. Wall and floor framing, up to and including grade level floors, is in place.

3. When shoring is installed that does not extend below the invert of the underground structure, the shoring shall be removed. Backfill and compaction shall be executed in conformance with the specifications.

C. Shoring Left in Place:
   1. Only shoring authorized by the Engineer and approved by the Engineer shall be left in place.
   2. When shoring is installed to extend below the underground structure, the shoring shall remain with the top edge 4-feet below the finished grade.

D. Sheeting Left in Place:
   1. Materials: Steel sheeting shown or indicated to be left in place shall consist of rolled sections of continuous interlocking type. Steel sheeting material designated to be left in place shall be new. Type and design of the sheeting and bracing shall comply with the above requirements for steel work for all sheeting and bracing.
   2. Installation:
      a. Steel sheeting to be left in place shall be driven straight to lines and grades as shown, indicated, or directed. Piles shall penetrate into firm materials with secure interlocking throughout pile's entire length. Damaged piling having faulty alignment shall be pulled and replaced by new piling.
      b. Type of guide structure used and method of driving steel sheeting to be left in place shall be determined by Contractor's professional engineer.
   3. Cut off at elevations shown, indicated, or directed by Engineer sheeting left in place and remove cut off pilings from the Site.
   4. Clean wales, braces, and all other items to be embedded in the permanent structure and ensure that concrete surrounding the embedded element is sound and free of air pockets and harmful inclusions. Provisions shall include the cutting of holes in the webs and flanges of wale and bracing members, and welding of steel diaphragm water stops perpendicular to the centerline of brace ends that are to be embedded.

3.6 TRENCH EXCAVATION

A. Cutting Existing Surface Pavements.
   1. Cuts in concrete pavement and concrete base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances.
   2. Cutting shall be started with a concrete saw in a manner which will provide a clean groove at least 1-½ inches deep along each side of the trench and along the perimeter of cuts for structures.
   3. Concrete pavement and concrete base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 12-inches in width at any point is left between the cut edge of the pavement and the top edge of the trench.
   4. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the center line of the trench.
   5. Pavement removal for connections to existing lines or structures shall not exceed the extent necessary for the installation.

6. Where the trench parallels the length of concrete walks, and the trench location is all or partially under the walk, the entire walk shall be removed and replaced.
7. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and subsequently replaced between existing joints or between saw cuts as specified for pavement.

B. Trench Width: Trenches shall be excavated to a width which will provide adequate working space and sidewall clearance for proper installation, jointing, and embedment haunching. Trench banks from the top of the pipe to trench bottom shall be as vertical as practicable.

C. Over-Excavation: Over-depth excavation carried below required grade, unless authorized by the Engineer, shall be backfilled with Class I material, and compacted as embedment at no additional cost to Owner.

D. Alignment and Depth: Trench to the lines and grades shown on the drawings. Where elevations are not shown, trench to a depth sufficient to provide at least 36-inches of cover above the top of pipe, unless otherwise specified. Grade trenches to provide a constant slope free of sags and high spots.

E. Dewatering: Keep trenches free of water.

F. Trench Bracing: Properly brace, sheet and support trench walls as soil conditions indicate and in conformance OSHA regulations. Provide adequate bracing and shoring to protect adjacent improvements according to contractor submitted excavation plan or NCDOT positive shoring plan. Contractor shall provide certification for all premanufactured trench bracing devices prior to any excavation activities.

G. Bedding, Haunching and Backfill: Tamp to provide firm, even bedding. Excavate bedding material to match the shape of the bottom of the pipe and bell, as detailed in the drawings. Shovel slice haunching material to provide full bearing around the bottom of the pipe.

H. Method of Compaction Density Testing: ASTM D698 Standard Proctor

I. Pipe Trench Construction: (Depth measured from top of pipe to final grade)
1. Bedding requirements for sewer force mains and water mains listed in Section 3.6.I below shall be followed, if it has been determined that unsuitable soils exist within the excavated trench. Otherwise bedding for sewer force mains and water mains may be Class I or Class II. All other backfill for sewer force mains and water mains shall be as shown below.
2. <u>Type A – Sewer mains 12-feet and deeper</u>
   a. Bedding, Haunching, and Initial Backfill – Class I bedding material, 4-inch minimum depth or 1/8 pipe diameter from stable subgrade to pipe invert; Class I haunching and initial backfill from invert to 6-inces above top of pipe; compact all zones to 95% standard density.
   b. Final Backfill – Class II material from top of initial backfill to ground surface; compact to 95% standard density.
3. Type B – <u>Sewer mains between 6-feet and 12-feet deep (occasional water and sewer force mains)</u>

a. Bedding and Haunching – Class I bedding material, 4-inch minimum depth or 1/8 pipe diameter from stable subgrade to pipe invert; Class I haunching to spring-line of pipe; compact both zones to 95% standard density.
b. Initial Backfill – Class II material from spring-line of pipe to 6-inches above top of pipe; compact to 95% standard density.
c. Final Backfill – Class II or III material from top of initial backfill to ground surface; compact to 95% standard density.

4. Type C – Sewer, water, and sewer force mains 3-feet to 6-feet deep
   a. Bedding and Haunching – Class I material 4-inch minimum depth or 1/8 pipe diameter from stable subgrade to 1/6 pipe outside diameter above invert; compact to 95% standard density.
   b. Initial Backfill – Class II or III material from top of pipe to a minimum of 6-inches above top of pipe; compact to 95 standard density.
   c. Final Backfill – Class II or III material from top of initial backfill to ground surface; compact to 95% standard density.
5. Type S – Water and sewer service lines 3-feet to 6-feet deep
   a. Bedding, Haunching, and Initial Backfill – Class I or II material 3-inch minimum depth from stable subgrade to 3-inch minimum above top of pipe; compact to 95% standard density.
   b. Final Backfill – Class II or III material from top of initial backfill to ground surface; compact to 95 percent standard density.

J. Trench Compaction Lifts:
   1. Embedment and initial backfill zones – 6-inch lifts
   2. Final backfill zone – 8-inch lifts

K. Subgrade Stabilization: Wet, yielding, and mucky trench bottoms shall be stabilized by removal of the material and replacement with sufficient Class I embedment material to correct the instability.

L. Backfilling Under NCDOT or City Pavements
   1. As indicated on standard detail drawings
      a. Top 12-inches of final backfill for road or street subbase shall be compacted to 98% standard density.
      b. CLSM trench embedment and backfill.

M. Trench Shields:
   1. When using a shield for installing pipe, bottom of the shield shall not extend below pipe spring-line and haunching embedment.
   2. When using a shield for installing structures, bottom of the shield shall not extend below the top of the bedding for the structures.
   3. When removing the shield or moving the shield ahead, exercise extreme care to prevent moving piping, structures, and other underground facilities, and prevent disturbance of bedding material for piping, structures, and other underground facilities. When piping, structures, or underground facilities are disturbed, remove, and reinstall the disturbed items.

3.7 SITE AND STRUCTURE EXCAVATION

A. Perform all excavation required to complete the Work as shown, specified, and required. Excavation shall include the removal and replacement of all asphalt, concrete, curb, rock, earth, fences, trees, shrubs, and other materials as applicable within the defined rights-of-way, easements, and limits of disturbance indicated.

B. Excavation Protection:
   1. Under all other conditions, excavations shall be sloped and benched, shielded, or shored and braced.
   2. Provide and maintain excavation protection system(s) in accordance with submittals accepted by Engineer.

C. All areas of the site shall be graded and maintained at all times to prevent surface runoff from draining into the excavations, and to prevent ponding of water therein.

D. Excavation shall be accomplished in accordance with the grades and lines as established by the Engineer and as required by the work to be performed. Exercise care to prevent undercutting lower than the required subgrades. When excavations are made below required grades without written order of Engineer, fill such excavations with compacted select fill material, as directed by Engineer, at Contractor's expense.

E. Extend excavations sufficiently on each side of foundation slabs, wet wells, manholes, valve vaults, and similar construction to allow setting of forms, installation of shoring and bracing, and the safe sloping of banks, as necessary.

F. General Site Subgrades:
   1. Subgrades shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud, muck, and other soft or unsuitable materials; and shall remain firm and intact under all construction operations. Subgrades that are otherwise solid but become soft or mucky on top due to construction operations shall be reinforced with select fill. Finished elevation of stabilized subgrades shall not be above subgrade elevations shown.
   2. If, in Engineer's opinion, subgrade becomes softened or mucky because of construction delays, failure to dewater properly, or other cause within Contractor's control, subgrade shall be excavated to firm material, trimmed, and backfilled with select fill material at Contractor's expense.
   3. Upon completion of site preparation and excavation, scarify to a depth of 12-inches and compact as specified. For areas to receive fill, the compacted subgrade shall be scarified to a depth of 4-inches prior to placing the fill.

G. Proof-rolling Subgrades:
   1. Prior to placing fill or constructing pavements or slabs-on-grade, proof-roll the subgrade surface with sufficient proof-rolling apparatus. Before starting proof-rolling, submit to and obtain acceptance from Engineer of proof-rolling apparatus and procedure to be used.
   2. Proof-rolling operations shall be made in the presence of Engineer. Notify Engineer in advance of start of proof-rolling operations.
   3. Subgrades displaying pronounced elasticity or deformation, deflection, cracking, or rutting shall be stabilized as directed by Engineer. Unsuitable materials shall be undercut to the depth directed by Engineer and replaced with select fill material. Other suitable stabilization methods may be directed by Engineer.

H. Excavated Materials to be Used as Fill:
   1. All materials from excavation, considered as suitable by the Engineer, shall be used as fill wherever required, and the Contractor shall arrange his work so that this usage of excavated materials will be possible.
   2. Stockpile excavated materials that are acceptable for use as fill.
   3. As excavation proceeds, keep stockpiles of excavated materials suitable for use as fill separate from unsuitable materials and waste materials.
   4. Place, grade, and shape stockpiles for proper drainage.
   5. Locate and retain soil materials away from edge of excavations.
   6. Dispose of excess soil material and waste materials.
   7. Stockpiled excavated soils for use as select fill or general fill shall be tested and classified by laboratory as on-Site select fill or on-Site general fill. Perform required quality assurance testing for material verification on stockpiled materials as soon as possible to demonstrate compliance of excavated materials.

3.8 SITE AND STRUCTURE FILL AND COMPACTION

A. Provide and compact all fill required for the finished grades as shown on the drawings.

B. Place fill in excavations as promptly as progress of the Work allows, but not until completing the following:
   1. Engineer's authorization after observation of construction below finish grade, including damp-proofing, waterproofing, perimeter insulation, and similar Work.
   2. Inspection, testing, approval and recording of locations of underground facilities.
   3. Removal of concrete formwork.
   4. Removal of shoring and bracing, and filling of voids with satisfactory materials.
   5. Removal of trash and debris.
   6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
   7. Field testing of tanks, underground facilities including piping and conduits, and water-retaining structures.

C. Fill that includes organic materials, debris, roots, trash, stones, or other unacceptable material shall be removed and replaced with approved fill material.

D. Borrow: The Contractor will supply all borrow necessary and will provide all labor and equipment necessary to dig and haul such borrow.

E. Placement:
   1. Place fill to the grades shown or indicated. Bring up evenly on all sides fill around structures and underground facilities.
   2. Fill shall be spread in successive layers of loose material not more than 8 inches in depth. Each layer shall be spread uniformly by motor grader or other approved device and rolled with an approved tamping or 3-wheeled power roller until thoroughly compacted to 90 percent of maximum density obtained at optimum moisture content, as determined by the AASHTO Standard Method T-180.
   3. Fill areas shall be undercut, and proof rolled as directed by Engineer.
   4. Place fill materials at moisture content and density as specified in Table 31 23 34-A of this Section and this Article's requirements on compaction density. Furnish and use equipment capable of adding measured amounts of water to the fill

materials to bring fill materials to a condition within required moisture content range. Furnish and use equipment capable of disking, aerating, and mixing the fill materials to ensure reasonable uniformity of moisture content throughout the fill materials, and to reduce moisture content of borrow materials by air drying, when necessary. When subgrade or lift of fill materials requires moisture-conditioning before compaction, fill material shall be sufficiently mixed or worked on the subgrade to ensure uniform moisture content throughout the lift of material to be compacted. Materials at moisture content in excess of specified limit shall be dried by aeration or stockpiled for drying.

5. Perform compaction with equipment suitable for the type of fill material placed. Select and use equipment capable of providing the minimum density required. Use lightweight or hand operated compaction equipment within horizontal distance of 10 feet from the wall of completed, below-grade structures. Furnish and use equipment capable of compacting in restricted areas next to structures and around piping and underground facilities. Effectiveness of the equipment selected by Contractor shall be tested at start of compacted fill Work by constructing a small section of fill within the area where fill will be placed. If tests on the test section of fill indicate that required compaction is not obtained, do one or more of the following: increase the amount of coverage, decrease the lift thicknesses, or use different compactor equipment.
6. Place fill materials in horizontal, loose lifts, not exceeding specified uncompacted thickness. Place fill in a manner ensuring uniform lift thickness after placing. Mechanically compact each lift, by not less than two complete coverages of the compactor. One coverage is defined as the conditions reached when all portions of the fill lift have been subjected to the direct contact of compactor's compacting surface. Compaction of fill materials by inundation with water is unacceptable.
7. Do not place fill materials when standing water is present on surface of the area where fill will be placed. Do not compact fill when standing water is present on the fill to be compacted. Do not place or compact fill in a frozen condition or on top of frozen material. Fill containing organic materials or other unacceptable material previously described shall be removed and replaced prior to compaction.
8. If required densities are not obtained because of improper control of placement or compaction procedures, or because of inadequate or improperly-functioning compaction equipment, Contractor shall perform all work required to provide the required densities. Such work shall include, at no additional cost to Owner, complete removal of unacceptable fill areas and replacement and re-compaction until acceptable fill is provided.
9. Repair, at Contractor's expense, observed or measured settlement. Make repairs and replacements as required within 30 days after being so advised by Engineer.
10. When any portion of the fill is constructed on an old roadbed, the existing surfaces shall be scarified and manipulated as directed by the Engineer in order that, when compacted, it shall have a uniform density. Fills shall be shaped and maintained at all times during their construction to prevent an accumulation of standing water in the event of rain.

F. Fill Against Concrete:
   1. Placing fill against concrete below finished grade is not allowed until the concrete has attained its specified strength, as determined by duration of concrete curing and testing of field-cured concrete cylinders. Requirements for strength and curing time are in Section 03 05 00 – Concrete.

2. Backfill structural foundation units as soon as practicable, after concrete has gained sufficient strength to avoid damage, to avoid ponding of surface water and accumulation of debris.
3. Where fill is placed against waterproofed surface, exercise care that waterproofing material is not damaged.

G. Fill in Electrical Ductbank Trenches:
1. Provide general fill for full depth of electrical ductbank trench, below and above electrical ductbank.
2. Where one ductbank passes beneath another pipe or ductbank, provide select fill to the elevation of the bottom of upper ductbank or pipe, as applicable.
3. Placing and compacting fill in electrical ductbank trenches shall comply with Type S trench construction requirements.

H. Pavement:
1. Compact the subgrade and fill material beneath paved areas and shoulders to a minimum 98 percent ASTM D698 maximum density at optimum moisture content.
2. Place 1-½ inches of temporary asphalt concrete pavement immediately after filling excavations in paved roadways and other paved areas that will remain for permanent use.
3. Maintain surface of paved area over the fill in good and safe condition during progress of the Work, and promptly fill depressions over and adjacent to the fill area caused by settlement of fill.
4. Permanent replacement pavement shall be equal to that of the existing roadways, unless otherwise shown or specified.

I. Subbase Placement:
1. Provide subbase material where shown to the limits shown or indicated.
2. Place subbase material in compacted lifts not exceeding depth of 6-inches each.

J. Drainage Fill Placement:
1. Provide drainage fill material where shown to the limits shown or indicated.
2. Place drainage fill material in compacted layers of uniform thickness not exceeding depth of 6-inches each. Compact lifts of drainage fill using suitable compaction equipment.

K. Granular Fill Placement
1. Place granular fill on compacted subgrade.

L. Compaction Density Requirements:
1. Compaction required for all types of fills shall be in accordance with Table 31 23 34-A of this Section. Moisten material or aerate the material as necessary to provide the moisture content that will facilitate obtaining the required compaction.
2. Fill shall be wetted and thoroughly mixed to achieve optimum moisture content plus-or-minus 3-percent, with the following exceptions:
   a. On-site clayey soils: Optimum to plus 3-percent.
3. Replace natural, undisturbed soils or compacted soil subsequently disturbed or removed by construction operations with materials compacted as indicated in Table 31 23 34-A.

TABLE 31 23 34-A

REQUIRED MINIMUM DENSITY

Material	Percent Compaction (ASTM D698)	Uncompacted Lift (inches)
General Fill		
More than 5-feet below final grade	100	8
Less than 5-feet below final grade	95	8
Select Fill		
Below concrete slabs or mats	100	8
Below pavement and sidewalks	100	12
Behind concrete walls	95	8
Subbase Material		
Below pavement and sidewalks	100	12
All other locations	100	8
Drainage Fill	N/A	6
Structural Fill	98	-
Granular Fill	100	-
Landscaped Areas		
Subgrade	98	-
Topsoil	85	

4. Field quality control testing for density; to verify that specified density was obtained, will be performed during each day of compaction Work. Responsibility for field quality control testing is specified in the "Field Quality Control" Article in Part 3.
5. When field quality control testing indicates unsatisfactory compaction, provide additional compaction necessary to obtain the specified compaction. Perform additional compaction Work at no additional cost to Owner until specified compaction is obtained. Such work includes complete removal of unacceptable (as determined by Engineer) fill areas and replacement and re-compaction until acceptable fill is provided in accordance with the Contract Documents.

M. Replacement of Unacceptable Excavated Materials: In cases where over-excavation to replace unacceptable soil materials is required, backfill the excavation to required subgrade with select fill material and thoroughly compact in accordance with Table 31 23 34-A and the associated "Compaction Density Requirements" in this Article. Slope the sides of excavation in accordance with the maximum inclinations specified for each structure location

3.9 SITE GRADING

A. General:
1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas. Finished grades should be smooth and provide positive drainage.
   a. Rough Grade Plus or minus 0.1 foot
   b. Finish Grade Plus or minus 0.1 foot

2. Smooth subgrade surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Topsoil: The top 4-inches of soil in landscaped areas shall be topsoil.

C. Protection: Protect areas which have been graded from equipment traffic.

D. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free of irregular surface changes, and shall comply with the following:

E. Grassed Areas or Areas Covered with Gravel, Stone, Wood Chips, or Other Special Cover: Finish areas to receive topsoil or special cover to within not more than one inch above or below the required subgrade elevations.

F. Sidewalks: Shape surface of areas under sidewalks to line, grade, and cross section, with finish surface not more than 1-inch above or below the required subgrade elevation.

G. Pavements: Shape surface of areas under pavement to line, grade, and cross section, with finish surface not more than ½-inch above or below the required subgrade elevation.

H. Grading Surface of Fill Under Concrete Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of ½-inch when tested with a 10-foot straight edge.

I. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.10 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. Controlled Low Strength Materials Placement:
   1. Discharge CLSM from the mixer by reasonable means into the space to be filled.
   2. Bring the fill material uniformly up to the fill line indicated on drawings.
   3. Placement of fill over the CLSM may proceed after a curing period of not less than 3-days.

3.11 SITE PAVEMENT SUBBASE COURSE

A. General:
   1. Place subbase material, in layers of specified thickness, over ground surface to support pavement base course.
   2. After completing filling and grading, shape, and compact pavement subgrade to an even, firm foundation in accordance with this Section. Remove unsuitable subgrade materials, including soft materials, boulders, vegetation, and loose stones, and replace with compacted fill material as directed by Engineer.

B. Undercutting: Undercutting, unless authorized by the Engineer, shall be replaced, and compacted at the Contractor's expense. If the material, after excavation to subgrade, is found to be soft, spongy, or unfit for use as subgrade, such unsuitable material shall be removed to a depth as directed by the Engineer and the subgrade shall be brought to proper elevation by filling with suitable material from excavation or from an approved borrow site.

C. Grade Control:
   1. During construction, maintain lines and grades including crown and cross-slope of subbase course.

D. Placing of Pavement Subbase Course:
   1. Place subbase course material on prepared subgrade in layers of uniform thickness, in accordance with indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placing operations.
   2. When indicated on the drawings, provide geotextile separation fabric over the prepared subgrade

E. Compaction and Grade Control: Comply with compaction requirements for excavation and fill in this Section, and the following requirements:
   a. Compaction with roller shall begin at the sides of the area to be paved and continue toward the center. Continue compaction until there is no movement of the course ahead of the roller.
   b. After compaction of top lift of pavement subbase, provide and uniformly spread pipe bedding material and screenings compacted, on the surface, and sweep using gang-dragged broom, followed by compaction.
   c. After rolling, check for grade with a line not less than 40-feet in length; depression over ½-inch deep shall be filled to satisfaction of Engineer.
   d. After completing compaction, other than that necessary for bringing material for the next course, do not haul or drive over the compacted subbase.
   e. Do not install pavement subbase in excess of 500-feet in length without compacting to prevent softening of the subgrade.
   f. If subgrade material becomes churned up into or mixed with the subbase material, remove the mixed material, and replace with clean, compacted subbase material.

3.12 DISPOSAL OF EXCAVATED MATERIALS

A. Unsuitable materials encountered in an excavation shall be removed by the Contractor and backfilled with suitable material and compacted. Unsuitable materials include organic soils, muck, soft and compressible silts, and clays and running sands.

B. Excavated materials not required for topsoil, fill, or backfill shall be removed from the site of the work by the Contractor, but none shall be deposited on private property without written consent of the property owner.

3.13 TEMPORARY BARRIERS

A. Provide temporary barrier surrounding excavations and excavation work areas to provide temporary protection to persons and property. Barrier shall have openings only at vehicular, equipment, and worker access points.

B. Minimum Material Requirements for Temporary Barriers:
   1. Temporary barrier shall not be less snow fence-type fencing, 4-feet high.
   2. Fence shall be constructed of vertical hardwood slats measuring not less than 1-1/2 inches by 1/4 inch interwoven with strands of horizontal wire or shall be of equivalent plastic construction.
   3. Posts:
      a. Posts shall be steel, either “U”-, “Y”-, “T”-shaped, or channel section.
      b. Posts shall have a nominal weight of not less than 0.33-pound per linear foot, exclusive of the anchor.
      c. Posts shall have tapered anchors weighing not less than 0.67 pounds, each firmly attached by means of welding, riveting, or clamping.
      d. Posts shall have corrugations, knobs, notches, or studs placed and constructed to engage a substantial number of fence line wire in the proper position.
      e. Provide each post with sufficient quantity of galvanized wire fasteners or clamps, of not less than 0.120-inch diameter, for attaching fence wire to post.

3.14 FIELD QUALITY CONTROL

A. Field inspection, sampling and testing shall be performed.

B. Site Tests: Owner will employ an independent testing laboratory to perform field quality control testing.
   1. Testing Laboratory Scope:
      a. Perform field moisture content and density tests to ensure that the specified compaction of embedment and fill materials has been obtained.
      b. Perform tests of actual unconfined compressive strength or bearing tests on structure subgrades.
      c. Report results of each test to CFPUA, Engineer, and Contractor.
   2. Authority and Duties of Testing Laboratory:
      a. Technicians representing the testing laboratory shall inspect the materials in the field, perform testing, and report findings. When materials furnished or the Work performed does not comply, technician will direct attention of CFPUA, Engineer, and Contractor to such failure.
      b. Technician will not act as foreman or perform other duties for Contractor. Work will be checked as it progresses, but failure to detect defective Work or non-complying materials shall not in any way prevent later rejection when defect is discovered. Technicians are not authorized to revoke, alter, relax, enlarge, or release requirements, or to approve any portion of the Work.
   3. Responsibilities and Duties of Contractor:
      a. To facilitate testing laboratory, Contractor shall advise testing laboratory at least 2-days in advance of excavating filling operations to allow for assignment of personnel for field quality control testing.

b. It shall be Contractor's responsibility to control construction operations to accomplish the specified compaction for fill and trench construction and confirm tests verify that Contractor has complied and is complying relative to compaction control.
c. Contractor shall demonstrate adequacy of compaction equipment and procedures before exceeding one or more of the following quantities of earthwork:
    1) 200 linear feet of trench embedment and backfill.
    2) 10 cubic yards of select fill.
    3) 100 cubic yards of general fill.
    4) 50 cubic yards of subbase material.
d. Each test location shall include tests for each layer, type, or class of fill to finish grade.

4. Testing laboratory will inspect and indicate acceptable subgrades and fill layers using the interval/units listed below as a guide. Actual inspection and testing interval/units will vary based on specific project conditions.
    a. Trenches for pipelines and underground facilities (including buried ductbanks):
        1) In Open Fields: Two locations every 1,000 linear feet.
        2) Along Dirt or Gravel Roads or Off Traveled Right-of-Way: Two locations every 500 linear feet.
        3) Crossing Paved Roads: Two locations along each crossing.
        4) Under Pavement Cuts or Within Two Feet of Pavement Edges: One location every 400 linear feet.
    b. Footing Subgrade: For each stratum of soil on which footings will be placed, perform not less than one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Engineer.
    c. For Select Fill: On 30-foot intervals on all sides of the structure for every compacted lift, but not less than one per lift on each side of the structure for structures less than 60 feet long on a side.
    d. For General Fill: One per 1,000 square feet on every compacted lift.
    e. Subbase Material: One per 1,000 square feet on every compacted lift.
5. Test reports shall be provided to Owner, Engineer and Contractor.
6. If testing laboratory reports or inspections indicate subgrade, fills, or bedding compaction below specified density, Contractor shall remove unacceptable materials as necessary and replace with specified materials and provide additional compaction at Contractor's expense until subgrades, bedding, and fill are acceptable.

END OF SECTION

TABLE 1 Classes of Embedment and Backfill Materials

Class	Type	Soil Group Symbol D 2487	Description	Percentage Passing Sieve Sizes			Atterberg Limits		Coefficients	
				1½ in. (40 mm)	No. 4 (4.75 mm)	No. 200 (0.075 mm)	LL	PI	Uniformity C_U	Curvature C_C
IA	Manufactured Aggregates; open-graded, clean.	None	Angular, crushed stone or rock, crushed gravel, broken coral, crushed slag, cinders or shells; large void content, contain little or no fines.	100 %	≤10 %	<5 %	Non Plastic			
IB	Manufactured, Processed Aggregates; dense-graded, clean.	None	Angular, crushed stone (or other Class 1A materials) and stone/sand mixtures with gradations selected to minimize migration of adjacent soils; contain little or no fines (see X1.8).	100 %	≤50 %	<5 %	Non Plastic			
II	Coarse-Grained Soils, clean	GW	Well-graded gravels and gravel-sand mixtures; little or no fines.	100 %	<50 % of "Coarse Fraction"	<5 %	Non Plastic		>4	1 to 3
		GP	Poorly-graded gravels and gravel-sand mixtures; little or no fines.						<4	<1 or >3
		SW	Well-graded sands and gravelly sands; little or no fines.		>50 % of "Coarse Fraction"				>6	1 to 3
		SP	Poorly-graded sands and gravelly sands; little or no fines.						<6	<1 or >3
	Coarse-Grained Soils, borderline clean to w/fines	e.g. GW-GC, SP-SM.	Sands and gravels which are borderline between clean and with fines.	100 %	Varies	5 % to 12 %	Non Plastic		Same as for GW, GP, SW and SP	
III	Coarse-Grained Soils With Fines	GM	Silty gravels, gravel-sand-silt mixtures.	100 %	<50 % of "Coarse Fraction"	12 % to 50 %		<4 or <"A" Line		
		GC	Clayey gravels, gravel-sand-clay mixtures.					<7 and >"A" Line		
		SM	Silty sands, sand-silt mixtures.		>50 % of "Coarse Fraction"			>4 or <"A" Line		
		SC	Clayey sands, sand-clay mixtures.					>7 and >"A" Line		
IVA[A]	Fine-Grained Soils (inorganic)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, silts with slight plasticity.	100 %	100 %	>50 %	<50	<4 or <"A" Line		
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.					>7 and >"A" Line		
IVB	Fine-Grained Soils (inorganic)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	100 %	100 %	>50 %	>50	<"A" Line		
		CH	Inorganic clays of high plasticity, fat clays.					>"A" Line		
V	Organic Soils	OL	Organic silts and organic silty clays of low plasticity.	100 %	100 %	>50 %	<50	<4 or <"A" Line		
		OH	Organic clays of medium to high plasticity, organic silts.				>50	<"A" Line		
	Highly Organic	PT	Peat and other high organic soils.							

[A] Includes Test Method D 2487 borderline classifications and dual symbols depending on plasticity index and liquid limits.

Note—"Coarse Fraction" as used in this table is defined as material retained on a No. 200 sieve.

SECTION 32 13 01

CONCRETE SIDEWALKS, DRIVEWAYS AND GUTTERS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Contractor shall furnish all labor and materials required to restore and construct concrete sidewalks, driveways and gutters as specified herein.

B. Related Sections:
   1. Section 03 05 00 – Concrete

PART 2 PRODUCTS

2.1 MATERIALS

A. Sidewalk shall be 3,000 psi concrete, and shall meet the dimensions and thickness indicated in the Drawings.

B. Replacement of concrete driveways shall be in accordance with NCDOT Standard Specifications as stated by the Engineer.

C. Curb and curb and gutter shall consist of 3,000 psi/28-day concrete.

D. Expansion joints shall be installed between the back-of-curb and concrete driveways, and between concrete driveways and sidewalks, where new concrete abuts old concrete.

PART 3 EXECUTION

3.1 CURB AND GUTTER

A. Curb or curb and gutter removal, where required in the construction of this work, shall be held to a minimum. Curb and gutter material to be removed shall be carefully separated from the trench excavation material and shall be disposed of as directed. The Contractor shall replace all curb or curb and gutter which has been removed. Curb and gutter shall be removed up to the nearest regular joint on each side of the trench.

B. Curb or curb and gutter shall be replaced as soon as possible after the backfill is placed and compacted and shall duplicate in all respects the original construction. Workmanship shall be in accordance with the best standard practices for this type of work. Curb and curb and gutter shall be the same dimensions, spacing, and number as the section of curb or curb and gutter it replaces.

3.2 SIDEWALKS

A. Sidewalk removal, where required in the construction of this work, shall be held to a minimum. Sidewalk material removed shall be carefully separated from the trench excavation material and shall be disposed of as directed. Sidewalk shall be cut at the nearest regular joint on each side of the trench.

B. The Contractor shall replace all sidewalks which are removed. Sidewalks shall be replaced as soon as practicable after the backfill is placed and compacted and shall duplicate, in all respects, the original sidewalk.

C. The Contractor shall replace all sidewalks which are damaged by the construction operation or by the heavy equipment traveling over them and shall replace them at their own expense.

D. The top surface of all sidewalks shall be given a light broom finish.

3.3 DRIVEWAYS

A. Concrete driveways that are crossed or traversed by the trenches shall be restored to the conditions existing prior to the excavation.

B. Removal shall be held to a minimum, but when necessary removal shall be made in neat sawcut lines or to the nearest joint if approved by the Engineer.

C. Reinforcement of concrete driveways is not required.

3.4 TESTS

A. The quality of the concrete as to conformance to the specifications is the entire responsibility of the Contractor until it is accepted in place. When required by NCDOT, City, or the Engineer, the Contractor shall arrange for field testing. Field testing shall include, but may not be limited to, the following:
   1. Compressive Strength Test: Perform the 1, 3, 7, 14, and 28-day strengths of the average of two 6” x 6” x 20” beams and the average of two 6” x 12” cylinders for each age made and tested in accordance with AASHTO R 39, T22, and T97. Design the mix to produce an average strength sufficient to indicate that a minimum strength of 650 psi in flexure and 3,000 psi in compression will be achieved in the field within 28 days.
   2. Air Entrainment: Entrain air in the concrete by the use of an approved air entraining agent dispensed with the mixing water, unless prohibited. Provide an air content of 5.0% $\pm$ 1.5% in the freshly mixed concrete. The air content will be determined in accordance with AASHTO T 121, T152, or T196.
   3. Slump Test: Slump test shall be a maximum of 1.5-inches where placed by a fully mechanized paving train and no more than 3-inches where placed by hand methods. Slump test shall be made on each load of concrete unless directed differently by CFPUA or Engineer.
   4. Reports: Proper reports of all tests performed by the laboratory shall be prepared by the laboratory and submitted promptly to CFPUA and Engineer. Such reports shall be properly labeled so as to identify the portions of the Project into which the

materials are being placed, and the results of the test indicating whether or not the test met the requirements of these specifications.

3.5 CAUSE FOR REJECTION

A. Should the concrete fail to conform to all the requirements of this Section, the Engineer or CFPUA may require the Contractor to remove the defective concrete and reconstruct the work as directed.

END OF SECTION

SECTION 32 31 19

DECORATIVE FENCING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fence, Framework, and Accessories.
   2. Manual Gates and Related Hardware.

B. Requirements:
   1. Furnish all materials, labor, and equipment required to provide fence for project area.

C. Related Requirements:
   1. Section 03 05 00 – Concrete.

1.2 REFERENCE STANDARDS

A. Standard References in this Section are:
   1. ASTM B221 – Standard Specification for Aluminum and Aluminum – Allow Extruded Bars, Rods, Wires, Profiles and Tubes.
   2. ASTM B633 - 11 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   3. ASTM D6577 - 00 Standard Guide for Testing Industrial Protective Coatings
   4. ASTM F2814 - 09 Standard Guide for Design and Construction of Ornamental Steel Picket Fence Systems for Security Purposes
   5. ASTM F2957 - 13 Standard Specification for Ornamental Aluminum Fence Systems.

1.3 SYSTEM DESCRIPTION

A. Aluminum Picket Fence
   1. Basic Uses:
      a. Provides attractive, maintenance free security for residential, commercial, industrial, and recreational applications.
      b. Prevents rusting and corrosion, even when exposed to moisture.
   2. Composition and Materials:
      a. Manufactured from aluminum extrusions, having a minimum tensile strength of 35,000 psi, using 6005 T5 alloy for structural components.
      b. All screws are stainless steel with a plating of zinc and yellow dichromate to ensure corrosion resistance under the harshest conditions.
      c. The screw heads are painted to match the color of the fence, with a polyurethane finish.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Erector/Installer:
      a. Engage a single erector that is skilled and trained, and possesses successful and documented experience installing fencing, and employs only workers with specific skill and successful experience in the type of Work required.
      b. Erector shall be acceptable to fencing manufacturer,

B. Component Supply and Compatibility:
   1. Provide fencing as complete system with all gates, hardware, appurtenances, and other components produced by a single manufacturer, including custom erection accessories, fittings, clamps, and fastenings as required for complete system.

1.5 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

C. Product Data: Submit data on posts, accessories, fittings, and hardware.

D. Manufacturer's Installation Instructions: Submit installation requirements.

E. Closeout Submittals: Submit the following:
   1. Section 01 70 00 – Execution and Closeout Requirements.
   2. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:
   1. Protect materials from damage by storing in a location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Ornamental Aluminum Picket Fence:
   1. Manufactured from aluminum extrusions, having a minimum tensile strength of 35,000 psi, using 6005 T5 alloy for structural components in accordance with ASTM F2957 – 13. Fence shall have exposed pickets.

B. Ornamental Horizontal Rails:
   1. Rails shall be C-Channels or Hollow Square Extrusions.
   2. Square holes shall be punched in the top of the rails to allow the pickets to pass through.
   3. Because aluminum extrusions allow metal to be placed where it is needed most, the top shall be designed for additional strength.

C. Ornamental Posts:
   1. Posts shall be hollow square extrusions with holes pre-punched to allow the rails from the fence sections to slide into them.

D. Ornamental Gates:
   1. Matching gates.

2.2 COMPONENTS

A. Ornamental Fence Dimensions
   1. Fence Height:
      a. Fence height shall be 8’ high.
   2. Pickets:
      a. Pickets shall be ¾” square x .050” thick and shall be exposed at the top.
   3. Horizontal Rails:
      a. The number of rails used in a section varies with the height and strength of the fence.
         1) Rails shall be1-⅜” x 1-¼’’ with .088” sides and .065” top thickness.
   4. Posts:
      a. Line Post Spacing shall be as indicated on the drawings.
         1) Posts shall be 2” square x .125” thick.
   5. Gates:
      a. Gates shall be 14’ wide with a double gate unless otherwise directed.
      b. Gates shall be fabricated with 2” square ends, 1-⅜” x 1’-¼’’ rails and ¾” pickets.
      c. Gates shall fit openings inside-to-inside of the posts.
   6. Or as outlined in Project Drawings.

B. Screws
   1. All screws shall be stainless steel with a plating of zinc and yellow dichromate to ensure corrosion resistance under the harshest conditions.
   2. The screw heads shall be painted to match the color of the fence, with a polyure-thane finish.

2.3 GATES

A. General:

1. Gate Types, Opening Widths and Directions of Operation: As indicated on the drawings.
2. Gates shall be designed for operation by one person.
3. Gates shall be factory assembled prior to delivery.
4. Gates finish shall match fence. The powder coat finish shall be black.
5. Gates shall match fence styles.
6. Gates shall include a stopping mechanism per CFPUA Standard Details.

B. Hinges, Springs, and Latches:
1. Hinges shall be made from aluminum extrusions with a 3/8” stainless steel pin that may be attached to either a post or a wall.
2. Self-closing springs and self-latching latches are available for all gates.

2.4 FINISHES

A. Colors:
1. The powder coat finish shall be black.

B. Styles:
1. Typical rail cross sections:
a. Ornamental rail with exposed pickets.
b. Heavy Industrial Top snaps over bottom closure to conceal screw heads.

C. Pretreatment:
1. A three stage non-chrome pretreatment shall be applied.
a. The first step shall be a chemical cleaning.
b. The second step shall be a water rinse.
c. The final step shall be a dry-in-place activator which produces a uniform chemical conversion coating for superior adhesion.
2. Screws shall be plated with yellow and zinc dichromate to ensure corrosion resistance.

D. Coating:
1. Fence materials shall be coated with a polyester powder-coat finish system.
a. The finish shall have a cured film thickness of at least 2.0 mils.
2. The screw heads shall be painted to match the color of the fence.

E. Finish:
1. The cured finish shall meet the following:
a. Humidity resistance of 1,000 hours using ASTM D2247.
b. Alt spray resistance of 1,000 hours using ASTM B117.
c. Accelerated weathering for 500 hours under Method 6152 of Federal Test Method 141 shall show no adhesion loss, with only slight fading, chalking and water staining.
d. Outdoor weathering shall show no adhesion loss, checking or crazing, with only slight fade and chalk when exposed for one year.
e. Minimum hardness of 2H using ASTM D3363.

2.5 CONCRETE

A. See Section 03 05 00 – Concrete.

2.6 SOURCE QUALITY CONTROL

A. Fabrication Tolerances:
   1. Fabric, posts, rails, and other supports shall be straight or uniformly curved to provide the profiles shown, to dimensional tolerance of 1/16-inch in 10 feet without warp or rack in the finished Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Examine conditions under which the Work will be erected and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:
   1. Do not begin installation and erection of fencing until final grading is completed.

B. Pickets:
   1. The hollow pickets pass through the rails and are attached using stainless steel screws. By using this method of attachment, the pickets are always parallel regardless of the pitch of the terrain.

C. Set intermediate, terminal, gate, and corner posts plumb, in concrete footings 33” depth recommended with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

D. Install fence in accordance with manufacturer’s recommendations.

3.3 WARRANTY

A. Fencing shall be guaranteed for 1 years. This guarantee shall cover, at minimum, defects in workmanship and materials, as well as the powder finish of the fence. The paint shall be guaranteed to not peel, crack, or chip.

3.4 ADJUSTMENT AND CLEANING

A. Repair coatings damaged in the shop or at the Site by recoating with manufacturer’s recommended repair compound, applied in accordance with manufacturer’s directions.

B. Lubricate and clean exposed operating surfaces.

C. Repair and replace broken or bent components.

3.5 ERECTION TOLERANCE

A. Maximum Variation from Plumb: ¼ inch.

B. Maximum Offset from Indicated Position: 1 inch.

C. Minimum distance from property line: 6 inches.

END OF SECTION

SECTION 32 92 01

SEEDING AND SODDING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The area to be grassed and mulched along the work disturbed area shall include all damaged cover over the backfilled trench and area adjacent thereto irrespective of the cause of damage, whether it be from handling of pipe, trenching or driving equipment.

B. Where required by the NCDOT encroachment permit, areas along the work shall be grassed and mulched in accordance with Section 1660, of the latest edition of the State of North Carolina Department of Transportation "Standard Specifications for Roads and Structures".

1.2 QUALITY ASSURANCE

A. Requirements
   1. It is the intent of this Specification that the Contractor is obliged to deliver a satisfactory stand of grass as specified. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering, and seeding or sodding at no additional cost to the Owner until a satisfactory stand is obtained.

B. Satisfactory Stand
   1. For purposes of grassing, a satisfactory stand of grass is herein defined as a full lawn cover over areas to be seeded or sodded, with grass free of weeds, alive and growing, leaving no bare spots larger than ¾ square yard within a radius of ten (10) feet.

1.3 SUBMITTALS

A. Provide technical data as required for shop drawings on all materials or installation procedures required under this Section.

B. When required by the Engineer, submit representative topsoil samples for analysis by a private laboratory to determine nutrient deficiencies and outline a proper fertilization program.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fertilizer

1. Fertilizer shall be 10-10-10 at a rate of 1,000 pounds per acre of uniform, free-flowing granules. Fertilizer shall be a standard product complying with State and Federal fertilizer laws.
2. Percentages of nitrogen, phosphorus and potash shall be 10-10-10 unless required otherwise based on laboratory testing on the actual soils.
3. Fertilizer shall be delivered to the site, mixed as specified, in the original unopened standard size bags showing weight, analysis and name of manufacturer. Containers shall bear the manufacturer's guaranteed statement of analysis, or a manufacturer's certificate of compliance covering analysis shall be furnished to the Engineer. Store fertilizer in a weatherproof place and in such a manner that it will be kept dry and its effectiveness will not be impaired.
4. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than twenty (20) percent available phosphoric acid.

B. Lime
1. Description: Agricultural dolomitic limestone containing a minimum of 85 percent of combined calcium and magnesium carbonates with 60% passing a #60 mesh sieve and 95% passing a #10 mesh sieve.

C. Seed
1. Seed shall have 97% purity and 90% germination guarantee. All seed must meet the requirements of the North Carolina Department of Agriculture. Bags shall be labeled to describe the composition, purity, germination, and the presence of restrictive or prohibited agents. Damp or moldy seed will be rejected.
2. Seed shall be sown during the following dates at the following pound per acre rates. On a calm day and preferably by machine, but if by hand, only by experienced workmen.
    a. For soils with good moisture retention from February 15 to April 30 or September 1 to October 31. Seed with 80 lbs. tall Fescue, 50 lbs. un-hulled Common Bermuda Grass, 40 lbs. Kobe Lespedeza.
    b. For soils with poor moisture retention from April 1 - July 15, seed with 50 lbs. un-hulled Common Bermuda Grass, 5 lbs. Centipede Grass and 10 lbs. German Millet.
    c. Temporarily seeding all other times (to be reseeded at the first available date listed in a or b above), 120 lbs. rye (grain), 50 lbs. Kobe Lespedeza.
3. Hydroseed may be utilized if approved by the Engineer.

D. Organic Fiber Blanket in yard and lawn areas that are not sodded, the areas disturbed shall be re-established by securing straw, excelsior, coconut, or wood fiber blankets over the seed bed to aid moisture retention and seed germination.

E. Sod
1. Sod shall be Bermuda Grass, Centipede Grass, St. Augustine Grass or Zoysia Grass, of firm texture having a compacted growth and good root development as approved.
2. Sod shall be approved by The North Carolina Sod Producers Association and absolutely true to varietal type, and free from weeds or other objectionable vegetation, fungus, insects, and disease of any kind.

3. Before being cut and lifted the sod shall have been mowed three times with the final mowing not more than a week before cutting into uniform dimensions.

F. Mulch
   1. Rate of application specified herein shall correspond to depth not less than one inch or more than three inches according to texture and moisture content of mulch material.
   2. Mulch shall consist of small grain straw or other acceptable material and shall have been approved by the Engineer before being used. All mulch shall be reasonably free from mature seedbearing stalks, roots, or bulblets of Johnson Grass, Nutgrass, Sandbur, Wild Garlic, Wild Onion, Bermuda Grass, Crotalaria, and Witchweed, and free from an excessive amount of restricted noxious weeds as defined by the North Carolina Board of Agriculture at the time of use of the mulch, and there shall be compliance with all applicable State and Federal domestic plant quarantines. Straw mulch that is matted or lumpy shall be loosened and separated before being used.

G. Topsoil
   1. Topsoil shall be a natural, fertile, friable, productive soil from naturally well drained areas in the immediate vicinity with a PH between 5 and 9. It shall not contain any substances that may be harmful to grass growth. Topsoil which has been stockpiled from trenching or excavations may be used provided it meets the above requirements. Topsoil delivered to the site in a frozen or muddy condition shall be rejected.

H. Water
   1. It is the Contractor's responsibility to water the site, as required during seeding and sodding operations and until the work has reached final completion. The Contractor shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. The Contractor shall also furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of lawns and planted areas as may be required.

PART 3 EXECUTION

3.1 SHOULDER STABILIZATION, FERTILIZING, SEEDING, MULCHING, AND SODDING

A. The Contractor shall protect and restore road shoulders, ditch banks and other natural or artificial slopes as directed by the NCDOT encroachment permit or City of Wilmington right of way permit.

B. Shoulder Stabilization, Fertilizing, Seeding, Mulching, and Sodding requirements shall conform in all respects to those specified above.

3.2 GRASS AND SHRUBBERY PLOTS

A. Grass plots and graded areas shall be restored to the condition existing prior to making the excavation. All shrubbery, ornamental trees and other planting shall be fully protected. If it is necessary to remove any shrubbery or planting to accomplish the

work, it shall be satisfactorily replaced before the work will be accepted. A 10-10-10 fertilizer shall be applied to all replaced sod at a rate of 50 pounds per 1,000 square feet.

B. The areas in which the grass plots and shrubbery are to be replaced shall contain sufficient moisture, as determined by the Engineer, for optimum results after being placed. The areas shall be kept in a moist condition for no less than three weeks. The moistened condition shall extend at least to the full depth of the rooting zone.

3.3 NEW SOD PLACEMENT

A. Whenever a suitable area has been graded and requires sodding, the Contractor shall, when directed by the Engineer, proceed at once with the sodding of the available areas. Sodding shall be incorporated into the Project at the earliest practical time in the life of the contract. No sod which has been cut for more than forty-eight (48) hours shall be used unless specifically authorized by the Engineer after his careful inspection thereof. Any sod which is not placed within twenty-four (24) hours after cutting shall be stacked in an approved manner and properly maintained.

B. The sod shall be placed on the prepared surface, with edges in close contact. Stake sod in place by driving stakes flush with the sod, on all slopes 2:1 or steeper, in drainage channels, on other areas shown in the plans, and on any areas that are in such condition that there is danger of sod slipping. Perform staking concurrently with sod placement and before tamping with sound wooden stakes which are approximately one inch square or one inch in diameter and not less than 12" in length. Place enough stakes to prevent slipping or displacement of the sod. Drive stakes perpendicular to the slope. Where backfill is necessary on cut slopes to obtain a uniform sodding area, provide stakes of sufficient length to reach at least 3" into the solid earth underneath the backfill. On all other areas, use metal staples in place of wooden stakes. The metal staples should be 12" long, made of 11-gauge new steel wire so as not to bend when pinned or driven through the sod. Shorter staples may be used with the approval of the Engineer.

C. Place, stake and staple the sod where necessary, then tamp or roll carefully and firmly by acceptable means. If rolled, roller shall weigh 150 lb/ft of roller width. Take extreme care to prevent the installed sod from being torn or displaced.

D. Where sodding is used in drainage ditches, the setting of the pieces shall be staggered, such as to avoid a continuous seam along the line of flow. Along the edges of such staggered areas the offsets of individual strips shall not exceed six inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces of sod shall be tamped so as to produce a feather-edge effect.

E. Any pieces of sod which, after placing, show an appearance of extreme dryness shall be removed and replaced with new sod.

F. Ditch banks disturbed during the construction of ditch and creek crossings shall be sodded when directed by the Engineer or when called for in the permit requirements.

G. Watering and fertilizing requirements shall conform in all respects to those specified above.

END OF SECTION

SECTION 33 01 12

IDENTIFICATION FOR UTILITIES PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Underground Pipeline Detection and Warning.
      a. Tracer wire system
         1) Vinyl/PVC adhesive tape.
         2) Polyethylene adhesive tape.
         3) Direct bury wire splice kits.
      b. Tracer wire system testing
      c. Metal detectable underground warning tape.
      d. Marker posts.
   2. Above Ground Piping and Valve Identification at CFPUA Facility Sites.
      a. Tags
      b. Applied pipe markers.

B. Related Requirements:
   1. Section 09 91 00 - Painting and Protective Coating: Execution requirements for painting specified by this Section.
   2. Section 33 05 07.13 - Horizontal Directional Drilling: Materials and methods for piping and appurtenances.
   3. Section 33 05 07.23 - Jacking and Boring: Materials and methods for carrier pipes and appurtenances.
   4. Section 33 14 13 - Water Distribution Piping and Appurtenances: Materials and methods for piping and appurtenances.
   5. Section 33 14 14 - Public Water Service Connections: Materials and methods for piping, valves, and appurtenances.
   6. Section 33 31 23 - Sanitary Sewer Force Mains, Valves and Appurtenances: Materials and methods for piping, valves, and appurtenances.
   7. Section 40 71 00 - Magnetic Flow Meter
   8. Section 43 21 39.13 - Submersible End Suction Pumps: Materials and methods for piping, valves, pumps, and other station equipment.

1.2 REFERENCE STANDARDS

A. NCGS 87-8A Underground Utility and Damage Prevention Act

B. American Public Works Association: Uniform Color Code

C. American Society of Mechanical Engineers: ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's catalog literature for each product required.

PART 2 PRODUCTS

2.1 UNDERGROUND PIPELINE DETECTION AND WARNING

1. Tracer Wire
   a. Vinyl/PVC adhesive tape.
   b. Polyethylene adhesive tape.
2. Direct bury wire splice kits.
3. Metal detectable underground warning tape.
4. Refer to CFPUA Material Specification Manual (MSM) for the following products:

MSM Section	Material
K-Miscellaneous	Warning Tape
L-Electrical	Wire and splice kits

2.2 ABOVE GROUND PIPING AND VALVE IDENTIFICATION

A. Above Grade Pipe Identification
   1. Color-Coding and Lettering Size: Conform to ASME A13.1.
   2. Applied Pipe Markers
      a. Factory-fabricated, flexible, semi-rigid plastic.
      b. Preformed to fit around pipe or pipe covering.
      c. Larger sizes may have maximum sheet size with spring fastener.
   3. Applied Tape Pipe Markers
      a. Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.
   4. Stencils
      a. Clean-cut symbols.
      b. Letters:
         1) Up to 2-inch Outside Diameter of Insulation or Pipe === ½-inch high letters.
         2) 2-½- to 6-inch Outside Diameter of Insulation or Pipe == 1-inch high letters.
         3) Over 6-inch Outside Diameter of Insulation or Pipe == 1-¾-inch high letters.
         4) Stencil Paint: As specified in Section 099000 - Painting and Coating; semi-gloss enamel.

B. Valves
   1. Plastic Tags
      a. Laminated three-layer plastic with engraved letters on light, contrasting background color.
      b. Minimum Tag Size and Configuration: 1-½ inch.
   2. Metal Tags
      a. Stainless-steel construction; stamped letters.
      b. Minimum Tag Size and Configuration: 1-½ inch with finished edges.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify prescribed materials and color code for each pipeline type to be installed.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Prepare surfaces as specified in Section 09 90 00 - Painting and Protective Coating for stencil painting.

3.2 INSTALLATION

A. Buried Pipeline Detection and Warning
   1. Tracer wire system termination and access.
      a. Tracer wire systems must be installed as a single continuous wire. No looping or coiling of wire is allowed.
      b. All tracer wire termination points must be grade level/in-ground access boxes identified with “sewer” or “water” cast into the cap.
      c. A minimum of 2 ft. of excess/slack wire is required in all tracer wire access boxes after meeting final elevation.
      d. Runs without service laterals or hydrants shall provide intermediate tracer wire access at minimum 1,000-foot intervals and must be provided utilizing a grade level/in-ground access box located at the edge of the road right-of-way and outside the roadway surface.
      e. Termination and access shall be installed as indicated on the Drawings for all pressure piping at the following locations:
         1) Cast iron boxes located at minimum 1,000-foot intervals
         2) All in-line valve boxes on water mains and services and on sewer force mains and services.
         3) At hydrant valve boxes and hydrants
         4) Water meter service boxes
   2. Tracer wire repairs
      a. Any damage occurring during installation of the tracer wire must be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
   3. Tracer wire attachment and connections
      a. Tracer wire shall be installed at the top half (11-1 o’clock position) of the pipe and secured (taped/tied) at 12-foot intervals.
      b. Mainline tracer wire shall not be connected to existing conductive pipes. Treat as a mainline dead end and ground using an anode buried at the same depth as the tracer wire.
      c. All service lateral tracer wires shall be a single wire, connected to the mainline tracer wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline tracer wire.
      d. In occurrences where an existing tracer wire is encountered on an existing utility that is being extended or tied into, the new tracer wire and existing

tracer wire shall be connected using approved splice connectors and shall be properly grounded at the splice location as specified.

e. A mainline tracer wire must be installed, with all service lateral tracer wires properly connected to the mainline tracer wire, to ensure full tracing/locating capabilities from a single connection point.
f. Lay Mainline tracer wire continuously on the North or East side of valves and fittings.
g. Tracer wire on all service laterals must terminate at an approved tracer wire access located directly above the service lateral at the edge of road right of way.
h. Connect tracer wire using direct bury splice kits in accordance with manufacturer's recommendations

4. Tracer wire testing and verification
   a. Provide locating equipment to verify tracer wire locating system in presence of CFPUA or ENGINEER construction observer.
   b. The test will take the following form:
      1) A standard 5-watt generator will be used to provide an AC current on the wire.
      2) The frequency of the signal from the generator will be initially restricted to 33 kHz or less.
      3) A standard hand-held detector will be used to trace the signal.
   c. The installed tracer wire will be deemed to pass the test if using the above set up:
      1) The tracer wire is accessible at all access points.
      2) The tracer wire can be traced from access point to access point.
      3) Widely spaced access points can be traced out in the worst-case from each end to a common meeting point between them.
      4) Depth readings are consistent and accurate to within a 15:1 depth to diameter ratio.
5. Horizontal Directional Drill and Bore/Jack Crossings
   a. Follow special tracer wire procedures identified in those specification sections.

B. Buried Pipeline Metal Detectable Warning Tape
   a. For all diameter potable water mains (excluding 1-inch service lines) and all diameter sewerage force mains
      1) Install 1'-6" deep and directly above pipeline during backfilling operation.

C. Above Ground Piping and Valve Identification at CFPUA Facility Sites:
1. Piping:
   a. Identify with plastic tape pipe markers or stenciled painting.
   b. Apply stencil painting as specified in Section 09 90 00 - Painting and Protective Coating.
   c. Identify service, flow direction, and pressure.
   d. Install in clear view and align with axis of piping.
   e. Locate identification not to exceed 20 feet on straight runs, including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
2. Valves:
   a. Install tags using corrosion-resistant chain.

b. Number tags consecutively by type and location.

END OF SECTION

SECTION 33 05 05.31

HYDROSTATIC TESTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Hydrostatic testing of pressure piping.

B. Related Requirements:
   1. Section 33 31 23 - Sanitary Sewer Force Mains, Valves and Appurtenances: Pipe materials and accessories normally encountered with municipal sanitary sewage force mains.
   2. Section 33 14 13 - Water Distribution Piping: Pipe materials and accessories normally encountered with pressurized water distribution systems.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   2. AWWA C605 - Underground Installation of PVC

1.3 ADMINISTRATIVE REQUIREMENTS

A. The foreman of the contracting crew must speak fluent English.

B. Any event requiring a CFPUA representative to be present will require a minimum of two (2) business day notice to schedule the event.

C. No valves are to be operated unless a CFPUA representative is present. Any valves operated without a CFPUA representative present, or a directive may be subject to penalties in accordance with CFPUA's Ordinance.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittals.

B. Submit following items prior to start of testing upon request:
   1. Testing procedures.
   2. List of test equipment.
   3. Testing sequence schedule.
   4. Provisions for disposal of flushing and test water.
   5. Certification of test gage calibration.

C. Test and Evaluation Reports: Indicate results of piping tests.

D. Qualifications Statement:
   1. Submit qualifications for applicator upon request.

PART 2 PRODUCTS

2.1 HYDROSTATIC TESTING

A. Equipment:
   1. Pressure pump.
   2. Pressure hose.
   3. Water meter.
   4. Test connections.
   5. Pressure relief valve.
   6. Pressure Gage: Calibrated to 0.1 psi.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify that piping and appurtenances are installed and ready for testing.

C. Verify that trenches are backfilled.

D. Verify that pressure piping thrust restraints have been installed. Where any section of piping is provided with concrete thrust blocking, the hydrostatic test shall not be made until at least 5 days after installation of the concrete thrust blocking unless otherwise approved.

3.2 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Testing of Pressure Piping to be performed according to AWWA C600 (DIP), AWWA C605 (PVC) and the following as applicable:
   1. Hydrostatic testing procedure:
      a. Testing shall be performed in the presence of the CFPUA representative. Testing shall be scheduled with CFPUA a minimum of two business days in advance and shall not proceed until granted approval by CFPUA. The contractor will pre-test the lines prior to the CFPUA representative arrival. The contractor is to cancel the test if the lines will not pass the required test, correct all visible leakage, and locate and repair leakage in lines which exceeds the specified amounts. When completed, the contractor will re-schedule the test.
      b. Slowly fill with clean potable water portion of piping to be tested, expelling air from piping. Fill and test mains and services.
      c. Close air vents after air is expelled.

d. Raise pressure to specified test pressure. For purposes of testing, working pressure shall be 100 psi and test pressure shall be 150 psi. The pressure gauge must be liquid filled with 2 psi increments maximum. The gauge must be a minimum of three feet above grade. No more than 3 psi can be lost during the two-hour test. The gauge must return to 0 psi when the test is completed. There will be no allowable leakage. Air testing will not be accepted on mains and services, but will be accepted for tapping sleeves, 40 psi for 15 minutes or hydrostatic testing @150 psi for 15 min with zero pressure loss for both.
e. Observe joints, fittings, and valves undergoing testing.

2. Hydrostatic Testing Requirements for Pipe Burst Installations
   a. Subject pipe burst installations to a pressure test before connecting to direct bury mains. Testing shall be performed in the presence of the CFPUA representative. Testing shall be scheduled with CFPUA a minimum of two business days in advance and shall not proceed until granted approval by CFPUA.
   b. The pipe shall be filled with clean potable water and pressurized to 1.5 times the working pressure at the point of testing with a minimum of 150 psi, for a period of no less than 24 hours and then subjected to the specified test pressure.
   c. Pretest pipe burst installations for a period of 2 hours before notifying CFPUA that the main is ready for a final pressure test. No final pressure test shall begin after 2:00 pm.
   d. Perform testing as follows:
      1) Test pressure shall be at least 1.5 times the working pressure at the point of testing with a minimum of 150 psi. Test pressure shall not be less than 1.25 times the working pressure at the highest point along the test section. Test pressure shall not exceed the pipe or thrust restraint design pressure. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.
      2) The pressure test duration shall be 2 hours.
      3) Ensure that the pipe is full of water and that the air has been removed before testing.
   e. Pressure testing is the responsibility of the Contractor, who shall provide materials, labor, and equipment.
3. If testing of piping and appurtenances indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
4. Correct visible leaks regardless of quantity of leakage.

END OF SECTION

SECTION 33 05 07.23

JACKING AND BORING

PART 1 GENERAL

1.1 SUMMARY

A. SCOPE:

1. Design, furnish and install the proposed piping alignment by jacking and boring construction methods, as shown on the drawings and conform to this specification. The work includes, but not limited to, survey, design, excavation, dewatering, removal of all materials encountered in the jacking and boring operations, disposal of all material not required in the work, grouting bulkheads, testing, cleaning, restoration, and incidentals as shown on the drawings and as specified herein.
2. The jacking and boring construction method shall consist of pushing (jacking) the casing pipe into the earth with a boring auger rotating with the casing/pipe to remove the spoil. The operations are to be completed while simultaneously providing ground stabilization techniques. The method shall include provisions for preventing uncontrolled inflow of loose or saturated soils.
    a. Contractor is responsible for completing any additional geotechnical/subsurface investigations required to establish the appropriate parameters (i.e., limiting pressures, setback distances, depth of cover, etc.) for completing the design of the jacking and alignment, as specified herein.
    b. Owner is responsible for obtaining the required general construction permits, easements and approvals, from the NCDOT or railroad agency. When encasement pipe is installed in the State right-of-ways the entire installation shall be as required by NCDOT. Where encasement pipe is installed in Railroad right-of-ways the entire installation shall be as required by the appropriate railroad agency. Where encasement pipe is installed across rivers, the entire installation shall be as required by USACE/NCDEQ. Where encasement pipe is installed in the City of Wilmington right-of-ways the contractor will pay and be responsible for obtaining the permits.
3. General:
    a. Be responsible for the final design and constructed product, furnishing the design data, obtaining approval from agencies and for the safety of the operations and for personnel engaged in the work.
    b. Be responsible for furnishing the qualified labor and superintendence necessary for this method of construction.
    c. Furnish all items necessary to perform the jack and boring, and construct both the casing and carrier piping to the lines and grade shown on the drawings.
    d. Installation of all jointing and gasketing materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all other Work required to complete the jack and bore, or tunneling installations.
    e. Any modifications, damages or detrimental consequences to the existing ground conditions, structures, facilities, or utilities as a result of the Contractor's Work shall be repaired and restored to its original condition as directed by the Engineer at no additional cost to the owner.

4. Coordination:
    a. Review installation procedures under other Sections and other contracts and coordinate with the Work that is related to this Section.
    b. Be responsible for coordinating construction activities with the respective authorities.
5. Related Sections:
    a. Section 32 92 01 – Seeding and Sodding.
    b. Section 31 23 34 – Excavation, Trenching, Dewatering, and Backfilling.
    c. Cape Fear Materials Specification Manual for the following materials:
        1) Ductile Iron Pipe.
        2) PVC C-900

1.2 COORDINATION

A. Section 01 30 00 – Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with the NCDOT, Cape Fear Public Utility Authority, City of Wilmington (COW), public agencies, and owners of public utilities or other facilities.

1.3 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
    1. American Railway Engineering Association: Specifications, Part 5; Pipeline - Crossings Under Tracks or Located on Railroad Property - For Flammable and Nonflammable Substances.
    2. Steel casing pipe conforming to ASTM A-139 and AWWA C200.
    3. Carrier piping, Ductile Iron Pressure Class 250, ANS/ AWWA C151/A21.51, installation per ANSI/AWWA C600.
    4. Latest edition of ASTM D1248, ASTM D3350, ASTM F-714.

B. All supervisory personnel must be adequately trained and will have at least ten years of experience in jack and boring operations. Contractor will have to submit the names and resumes of all supervisory field personnel prior to the start of construction.

C. Materials and methods of construction used on railroad property shall be subject to the approval of the specific railroad company. Contractor to conduct work operations fully within the railroad company rules, regulations, and requirements.

1.4 SUBMITTALS

A. Engineer will base the review of submitted details and data on the requirements of the completed work, safety of the work in regard to the public, potential for damage to public or private utilities and other existing structures and facilities, and the potential for unnecessary delay in the execution of the work. Such review shall not be construed to relieve the Contractor in any way of his responsibilities under the contract.

B. Contractor shall not proceed with field activities until the required drawings and submittals are reviewed and accepted by the Engineer.

C. Prepare and submit to the Engineer and Owner for review and approval no less than 20 days prior to starting the bore:
   1. Jacking and Boring Plan describing the equipment, methods, operational procedures, construction sequence, contingency plans, and other items of concern to be performed during the jacking and boring construction.
   2. Project Safety Plan.
   3. Submit site layout, equipment arrangement, and entry/exit pits drawings and technical specifications of the machine and equipment (including any modifications) proposed.
   4. Construction drawings, Specifications, and Contingency plans shall be submitted on the following items:
      a. Complete details of the site clearing, excavation, drainage, security, and equipment mobilization including, but not limited to, the methods, procedures, and equipment arrangement to be used during the construction.
      b. Complete details, drawings, and calculations signed and seal by an Engineer licensed in the state of North Carolina, of the significant factors and constraints associated with jacking and boring installations including, but not limited to, fluid pressures, jacking forces, pipe capacities, jacking and receiving pits shoring design, etc.
      c. Provide plan and profile of the proposed jacking and boring alignments, indicating depth, angle of deflection, and radius of all pipe bends along the alignment.
      d. Complete details of the grouting techniques/methods to be utilized for filling grout into the annulus between the adjacent soils and the outside of the casing piping, including but not limited to, fitting procedures, equipment, pumping procedures, fluid pressures, mixtures and plug systems. Also include methods of monitoring and controlling the grouting pressures.
      e. Method of monitoring and controlling the specified line and grade of excavation including, but not limited to, the methods, procedures, reliability, and necessary ancillary equipment to be used during construction operations.
      f. Complete details of the groundwater control, launching seals, muck/spoils containment, dewatering, drying, and removal including, but not limited to, the methods, procedures, equipment, contingency plans, and off-site disposal location.
      g. Complete details of the casing and carrier piping capacities, maximum jacking loads, storage, assembly, and installation including, but not limited to, the methods, procedures, and equipment to be used.

D. Quality Control Methods: At least 10 days prior to the start of the jacking and boring submit a description of his quality control methods he proposes to use during the operations to the Engineer. The submittal shall describe:
   1. Procedures for controlling and checking line and grade.
   2. Field forms for establishing and checking line and grade.

E. Safety: Procedures including, but not limited to, monitoring for gases encountered shall be submitted.

F. Hazardous chemical list as well as all MSDS and technical data sheets.

G. Contractor must demonstrate expertise in "trenchless" methods by providing a list of five (5) utility references for which similar work has been performed in the last two years. The references should include a name and telephone number where contact can be made to verify the Contractor's capability. The Contractor must provide documentation showing successful completion of the projects used for reference. Conventional trenching experience will not be considered applicable.

H. Have completed jacking and boring casing installations of same diameter or larger and have successfully completed lengths equal to the drawings or longer, crossings of railroads, and crossings of major state roads. Provide documentation in qualification submittal.

I. Contractor is required to bring to the attention of the Engineer any known discrepancies with actual jacking and boring methods that the Contractor will be performing. This shall be stated, in writing, to Engineer no later than the pre-construction meeting.

J. As-Built Drawings:
   1. Submit As-built documentation to Engineer and Owner within 7 days of the drill operation.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the Work.

B. Handle all pipe, fittings, specials, and accessories carefully with approved handling devices. Handling devices shall include ropes, fabric, or rubber-protected slings and straps. Chains, cables, or hooks inserted into the pipe ends shall NOT be used. Two slings spread apart shall be used for lifting each length of pipe. Do not drop or roll material off trucks.

C. Store pipes and fittings on heavy wood blocking or platforms so they are not in contact with the ground. Pipe supports shall be spaced suitably and of such widths as not to allow deformation of the pipe at the point of contact with the supports.

D. Stacking of pipe shall be limited to a height that will not cause deformation of the bottom pipes under anticipated temperature conditions.

E. All ends of stored piping shall be securely capped/plugged to prevent entry of soil, debris, and vermin.

PART 2 PRODUCTS

2.1 JACK AND BORING SYSTEM, GENERAL:

A. The jack and boring system shall consist of, but not limited to, the following components:
   1. Jacking system suitable for forcing the casing through the embankment.
   2. Auger Boring and Spoil removal system.

3. Pipe lubrication system.

B. Jacking and Boring over-cut shall not exceed ½-inch on the outside radius of the casing pipe being installed.

C. The excavation equipment and system shall be fully capable of excavating and removing all material that will be encountered during the construction operations.

D. The automated spoil transportation system shall match the excavation rate to the rate of spoil removal, maintaining settlement or heave within tolerances specified herein.
   1. If a slurry spoil transportation system is used, the groundwater pressure may be managed by use of the slurry pumps (which may be variable speed), pressure control valves and a flow meter. A slurry bypass unit shall be included in the system to allow the direction of flow to be changed and isolated, as needed. A solids separation process shall be provided when using slurry transportation systems. The process shall be designed to provide adequate separation of the spoil from the slurry so that the clean slurry can be returned to the cutting head for reuse.
   2. If an Auger spoil transportation system is utilized, the groundwater pressures may be managed by controlling the volume of spoil removal with respect to the advance rate (Earth Pressure Balance Method) and the application of compressed air. In soils with excessive groundwater, approval of the Engineer shall be required for the earth pressure balance auger systems. Approval shall be based on the evaluation of the equipment's ability to balance soil and groundwater pressures at the face, stability of the soils and the significance of the groundwater present.
   3. Contractor to identify and submit for approval the type of separation system to be used.

E. Pipe Jacking Equipment:
   1. The main jacks shall be mounted in a jacking frame and located in the drive (starting) shaft. The jacking frame successively pushes the steel casing pipes toward a receiving shaft. The jacking capacity shall be sufficient to push the auger/boring machine and/or length of casing piping through the ground.
   2. The main jacking equipment installed shall have a capacity greater than the anticipated jacking load. The hydraulic cylinder extension rate shall be synchronized with the excavation rate of the boring, which shall be determined by the specific soils conditions.
   3. Provide intermediate jacking stations when the total anticipated jacking force needed to complete the installation exceeds the designed maximum jacking force of the pipe.

F. Pipe Lubrication System:
   1. A pipe lubrication system may be utilized when anticipated jacking forces on the pipe are expected to exceed the capacity of the main jacks or exceed the pipe design strength with the appropriate safety factor. A prior approved lubricant shall be injected at the rear of the auger, or boring machine and, if necessary, through the casing pipe walls to lower the friction developed on the surface of the pipe during jacking and thereby reduce the jacking forces.

2.2 MATERIALS

A. Refer to the CFPUA Materials Specification Manual for a list of applicable materials including:
   1. Piping used for the conveyance of water, wastewater, and non-potable water.
   2. Casing Pipe
      a. Use only new, welded, or seamless steel pipe per ASTM A-139, Grade B. Casing minimum thickness to be 0.625-inches, or as required by the site-specific regulatory agencies or property owner. The casing wall thickness shall be designed to accommodate the maximum jacking load allowed, as well as the expected earth and live loads. Be fully responsible for the sufficiency of the casing thickness provided.
      b. Joints in steel casing pipe shall be butt-welded joints, conforming to the requirements of AWWA C206. Pipe 36 inches in diameter and larger shall be welded both inside and outside of the pipe/casing.
      c. After welding, the joint and the surrounding damaged or uncoated area shall be coated with the same material and to the same thickness as the shop applied coating.
      d. All steel casing pipe and welds shall meet or exceed either the site-specific regulatory agency's requirement, or the manufacturer's minimum wall thickness to meet or exceed the greater of either: installation (jacking), loading, or carrier load requirements.
      e. The size (diameter) of the steel casing shall be in accordance with the table below. Larger encasement pipe sizes may be substituted upon per-approval or as directed by the Engineer or Owner.

Carrier Pipe OD	Encasement Pipe OD	Roadway Encasement Thickness	Encasement Pipe ID	Railroad Encasement Thickness	Encasement Pipe ID
6”, 8”, 10”	16"	0.250"	15.5”	0.281”	15.438”
12”, 14”, 16”	24"	0.250"	23.5”	0.375”	23.25”
18”, 20”	30"	0.312"	29.376”	0.469”	29.062”
24”	36"	0.375"	35.25”	0.531”	34.938”
30”	42"	0.500"	41”	0.625”	40.75”
36”	48"	0.500"	47”	0.688”	46.624”

Exceptions to encasement pipe requirements shall be as shown on the drawings.

      f. All steel pipes shall be designed for the external and internal loads to which they will be subjected. Steel casing shall meet ASTM specifications and be designed to meet or exceed a minimum live load of a Cooper E-80 loading. The loading consists of 80 kip (356 kN) axle loads spaced 5-feet (1.5 m) on centers.
      g. K - Casing Insulators / Stainless Steel
      h. Casing End Seals:
         1) Seal each end of casing pipe with brick and Type @ Mortar.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:
   1. Comply with the lawful requirements of the North Carolina Department of Transportation, Cape Fear Public Utility Authority, public agencies, and owners of public utilities or other facilities respecting the safeguarding of structures and improvements that might be endangered by the jacking and boring, or micro tunneling construction operations.
   2. Install the required steel casing by means of jacking and boring, specified herein, and as recommended by the pipe manufacturer.
   3. The jacking and boring, along with the installation of the casing pipe shall be done simultaneously and continuously until the casing pipe is in final position.
   4. Be responsible for his means and methods of jacking and boring, and shall ensure the safety of the work, the Contractor's employees, the public, and adjacent property, whether public or private.
   5. Maintain traffic flow at all times during the progress of the work. Provide adequate signs, barricades, flag persons, lights, and other control devices in accordance with the provisions and requirements of the North Carolina Department of Transportation or City of Wilmington standards. No lanes of traffic shall be closed without prior approval.
   6. Contractor to provide erosion and sediment control to minimize erosion and the transport of sediment beyond the limits of the work area.
   7. Anticipate that portions of the jacking and boring will be below the groundwater table and dewatering will be required.
   8. Comply with all local, state, and federal laws, rules, and regulations at all times to prevent pollution of the air, ground, and water.
   9. Locate, mark, and protect existing utilities and facilities in the work area. Perform test pits as required.
   10. If there is a conflict between manufacturer's recommendations and the Drawings or Specifications, request instructions from Engineer in writing, before proceeding.

B. Jacking and Boring Operations:
   1. Provide and maintain adequate boring equipment and install support systems as required.
   2. The boring operations shall be progressed on a 24-hour basis without stoppage (except for adding lengths of pipe) until the leading edge of the casing pipe has reached the receiving pit, unless identified otherwise by state agency's permit.
   3. The boring operations shall consist of excavating the embankment material ahead of the casing, remove excavated material through the pipe and force the pipe through the embankment with jacks into the spaced provided. No jetting, sluicing, or wet boring is permitted.
   4. All surfaces shall be smooth and uniform without bulges, dents, or warping of lengths, and only new pipe shall be used.
   5. Finished lengths of pipe shall be furnished with beveled cut ends to facilitate proper welding of transverse joints. The diameter and wall thickness of the pipe shown on the drawings is the minimum required and no extra compensation shall be claimed by the Contractor if a larger and thicker pipe is used. Contractor is responsible in the event that the casing does buckle or collapse during these operations.

6. The over-cut by the cutting head shall not exceed the outside diameter of the casing pipe by more than ½-inch.
7. Required launching and receiving pits/shafts shall be excavated and maintained to the minimum dimensions necessary to perform the operations and allow for safe working practices.
8. The pits or shafts shall be adequately barricaded, sheeted, braced, dewatered, and ventilated as required, in accordance with applicable specifications and regulations.
9. Contractor to use thrust blocks designed to distribute loads in a uniform manner so that any deflection of the thrust block is uniform and does not impart excessive load on the shaft itself or cause the jacking frame to become misaligned.
10. Position jacks so that the resultant force is applied along the centerline of the casing pipe, and force is applied evenly to the entire end of the pipe.
11. Backstops shall be provided for adequately distributing the jack thrust without causing deformation of the soil or other damage.
12. Contractor to monitor and control the jacking pressure/force applied to ensure that pipe manufacturer's recommended limits are not exceeded.
13. Contractor responsible for all testing, survey, and documentation of the pre/post construction site conditions, in which to provide as a basis of comparison for the post construction conditions to be evaluated.
14. Once jacking has begun, the operation must continue without interruption, insofar as practical, to prevent the pipe from becoming firmly set in the embankment.

C. Steel Casing Installation
1. The installation of the casing shall be in accordance with manufacturer's recommendations and subject to the approval of the agency having jurisdiction.
2. The casing pipe shall be adequately protected to prevent crushing or other damage under the jacking pressures. Provide timbers for cushioning between the pipe pushed end and the jacking equipment.
3. The casing installation shall not produce upheaval, settlement, cracking, movement of the road.
4. Install casing piping concurrent with the bore, as earth is removed.
5. Surplus and unsuitable excavated material shall be disposed of by the Contractor.

D. Carrier Pipe Installation
1. All joints of the carrier piping within the casing shall be restrained.
2. Clean all dirt and debris from the casing piping.
3. Attach the centered/restrained casing spacers/guides to the carrier pipe sections, as required to prevent excessive sag, bending, shear stress and to support the pipe barrel in accordance with pipe manufacturer's recommendations. Piping is NOT to be supported by bells/joints.
4. A spacer shall be placed such that it supports the carrier pipe within 2 feet of the casing ends and a minimum of three spacers per 20-foot pipe section. For pipe sections, longer or shorter than 20 feet, follow the manufacturer's instructions and recommendations.
5. Lubricant for pipe guides shall be drilling mud or flax soap. Petroleum, or Oil based products are NOT allowed.
6. Protect and preserve the interior surfaces of the steel casing from damage.
7. Contractor to provide brick casing end seals.
8. K - Tracer wire shall be continued through casing.

E. Transitions from One Type of Pipe to Another:
   1. Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

END OF SECTION

SECTION 33 05 09.33

THRUST RESTRAINT FOR UTILITY PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe joint restraint systems for all pressurized mains (water and wastewater force).
   2. Includes fittings, valves, dead-ends, and other locations where change in pipe direction requires joint restraint.

B. Related Requirements:
   1. Section 33 05 05.31 – Hydrostatic Testing: Materials and methods for pipeline cleaning and testing.
   2. Section 33 05 07.13 - Horizontal Directional Drilling: Materials and methods for piping and appurtenances.
   3. Section 33 05 07.23 - Jacking and Boring: Materials and methods for carrier pipes and appurtenances.
   4. Section 33 14 13 - Water Distribution Piping and Appurtenances: Materials and methods for piping and appurtenances.
   5. Section 33 31 23 - Sanitary Sewer Force Mains, Valves and Appurtenances: Materials and methods for piping, valves, and appurtenances.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. ASTM International:
   1. ASTM A536 – Standard Specification for Ductile Iron Castings.

1.3 COORDINATION

A. General – Coordinate Work of this Section with the installation and modification of pressure main valves, bends, reducers, and dead-end fittings and pipe joints that require restraint.

B. Joint Restraint Systems – Field or factory applied joint restraint systems shall be used unless otherwise indicated by the ENGINEER. When multiple valves, bends, fittings are in close proximity, ENGINEER to design adequate total restraint length required for fitting combination(s). The combined fitting restrained length total must equal the sum of the individual fitting restrained lengths. Individual restrained end lengths applied to combined fitting end lengths can result in failure during testing or operation.

C. Thrust Blocks – Concrete thrust blocking shall only be used when required for special installations, such as such as cut-in tees, tapping sleeves, plugged/capped sections

removed from service, or other situations that would require retrofitting an existing service pipeline with joint restraints. ENGINEER shall design adequate size and weight of blocking to be installed for special installations.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer catalog information for restrained joint details and installation instructions.

B. Shop Drawings:
   1. Indicate restrained joint details and materials being used.
   2. Submit schedules showing restraint device models and locations to be installed.
   3. Include restrained joint installation procedures.

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

D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record locations of joint restraints on design plan and profile drawings by begin and end station as proceeds daily and transfer field data to final record drawing submittal.

1.6 QUALITY ASSURANCE

A. Perform Work according to AWWA 600 standards and manufacturer instructions.

B. Perform pressure testing according to Section 33 05 05.31 – Hydrostatic Testing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. 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.

PART 2 PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Provide pressure pipelines (water and force mains) with restrained joints and/or blocking at any change in direction including hydrant assemblies, bends, tees, reduc-

ers, blow-offs, dead-end mains, cut-in tees, tapping sleeves, etc. Thrust restraint shall be designed for a minimum pressure of **150 psi** at the lowest elevation in the pipeline test section.

2.2 JOINT RESTRAINT SYSTEMS

A. Refer to CFPUA Material Specification Manual (MSM) for the following products:

MSM Section	Material
C	Joint Restraints

B. Unless otherwise indicated, joint restraint systems may be factory or field applied systems.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify location of piping restraint locations in advance of pipe laying operations.

B. Verify that pipe and fittings identified for restraint are ready to receive Work and the correct restraint device is applied to that location.

C. Field measure and verify pipe restraint lengths indicated on drawings for Work to be installed.

3.2 PREPARATION

A. Clean surfaces of pipe and fittings that are to receive joint restraint systems.

3.3 INSTALLATION

A. Install joint restraint system such that joints are mechanically locked together to prevent joint separation in accordance with the manufacturer recommendations.

B. In special installations where concrete thrust blocking is required, allow 7-day minimum cure time before placing pipe pressure load on concrete blocking.

END OF SECTION

SECTION 33 05 13

PRECAST CONCRETE MANHOLES AND UTILITY STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Modular precast concrete manholes and structures with tongue-and-groove joints and masonry transition to cover frame, covers, anchorage, and accessories.

B. Related Sections:
   1. CFPUA Material Specification Manual (MSM)
   2. Section 01 51 00 – Bypass Pumping.
   3. Section 03 05 00 – Concrete.
   4. Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.
   5. Section 33 01 30.86 – Manhole Rim Adjustment.
   6. Section 33 14 22 – Testing of Sanitary Sewer Mains and Manholes.
   7. Section 33 31 11 – Sanitary Sewer Gravity Mains.
   8. Section 33 31 23 – Sanitary Sewer Force Mains, Valves and Appurtenances.

1.2 REFERENCE STANDARDS

A. American Association of State Highway Transportation Officials:
   1. AASHTO M91 – Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
   2. AASHTO M306 – Standard Specification for Drainage, Sewer, Utility, and Related Castings.

B. American Concrete Institute:
   1. ACI 530 – Building Code Requirements and Specification for Masonry Structures.

C. ASTM International:
   1. ASTM A48 – Standard Specification for Gray Iron Castings.
   2. ASTM A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM C32 – Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
   4. ASTM C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
   5. ASTM C497 – Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
   6. ASTM C877 – Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.
   7. ASTM C913 – Standard Specification for Precast Concrete Water and Wastewater Structures.
   8. ASTM C990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

1.3 QUALITY ASSURANCE

A. Perform Work according to ASTM and AASHTO standards and manufacturer's instructions.

1.4 WARRANTY

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Furnish a one-year manufacturer's warranty for concrete manholes and structures.

1.5 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Submittals:
   1. Section 01 70 00 – Execution and Closeout Requirements.
   2. Product Data: Submit manufacturer information for manhole covers, component construction, features, configuration, and dimensions.
   3. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
   4. Shop Drawings:
      a. Indicate structure locations and elevations.
      b. Indicate sizes and elevations of piping, conduit, and penetrations.
   5. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
   6. Qualifications Statement: Submit qualifications for manufacturer.
   7. Project Record Documents: Record actual locations of manholes and connections, and record invert elevations.

1.6 SITE CONDITIONS

A. DELIVERY, STORAGE, AND HANDLING
   1. Section 01 60 00 – Product Requirements.
   2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
   3. Handling: Comply with precast concrete manufacturer instructions and ASTM C913 for unloading and moving precast manholes and drainage structures.
   4. Bent Reinforcing steel bars are not permitted for use as lifting devices.
   5. Lifting devices shall be evaluated and approved by the Engineer.
   6. Storage:
      a. Store materials according to manufacturer instructions.
      b. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
      c. Repair property damaged from materials storage.
   7. Protection:
      a. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
      b. Provide additional protection according to manufacturer instructions.

B. EXISTING CONDITIONS
   1. Field Measurements:
      a. Verify field measurements prior to fabrication.
      b. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 MATERIAL SPECIFICATION MANUAL

A. Refer to CFPUA Material Specification Manual (MSM) for the following products:

MSM Section	Product
I	Castings and Access Covers
M	Coatings and Sealants
O	Structures

2.2 SOURCE QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements: Requirements for testing, inspection, and analysis.

B. Provide shop inspection and testing of completed assembly.

C. Verify that items provided have met factory testing requirements and are inspected upon delivery.

D. 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.

2.3 MATERIALS AND ACCESSORIES

A. Lining Systems
   1. MSM Section M – Coatings and Sealants

B. Grouts
   1. MSM Section N - Concrete
   2. Section 03 05 00 - Concrete

C. Sewer Guards
   1. Stainless steel straps, anchors and sewer guards required at all Manholes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements: Requirements for installation examination.

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 are ready for roughing into Work.

D. Verify that excavation base is ready to receive Work and excavation dimensions and elevations are as indicated on Drawings.

3.2 PREPARATION

A. 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.

B. Coordinate placement of inlet and outlet pipe or duct sleeves as required by other Sections.

C. Do not install manholes and structures where Site conditions induce loads exceeding structural capacity of manholes or structures.

D. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

3.3 INSTALLATION

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface structures or utilities in immediate or adjacent areas.

B. Correct over-excavation with Class 1 aggregate.

C. Remove large stones or other hard matter impeding consistent backfilling or compaction.

D. Protect manhole and structures from damage or displacement while backfilling operation is in progress.

E. Excavating:
   1. As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling and in indicated locations and depths.
   2. Provide clearance around sidewalls of manhole or structure for construction operations.
   3. If ground water is encountered, prevent accumulation of water in excavations, place manhole or structure in dry trench.
   4. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation as approved by Engineer.

F. Base and Alignment:
   1. Install manholes and structures supported at proper grade and alignment on compacted crushed-stone bedding or piles as indicated on Drawings.
   2. Grout base of shaft sections to achieve slope to exit piping, trowel smooth, and contour to form continuous drainage channel.
   3. Form and place manhole or structure cylinders plumb and level, to correct dimensions and elevations.

G. Polymer Concrete / Coatings:
   1. Install polymer concrete manholes in applications involving force main discharges and in other designated locations as specified by CFPUA. These manholes shall come with a minimum warranty of 50 years. Grinder pump force mains and low-capacity force main discharge manholes may be coated with an approved lining system, contingent upon prior approval from CFPUA.
   2. Manholes 12-feet in depth and greater shall be polymer concrete.

H. Precast Concrete Manholes:
   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. Assembly:
      a. Assemble multi-section manholes and structures by lowering each section into excavation.
      b. Install rubber gasket joints between precast sections according to manufacturer recommendations.
      c. Lower, set level, and firmly position base section before placing additional sections.
   4. Remove foreign materials from joint surfaces and verify that sealing materials are placed properly.
   5. Maintain alignment between sections by using guide devices affixed to lower section.
   6. Joint sealing materials may be installed on Site or at manufacturer's plant.
   7. Verify that installed manholes and structures meet required alignment and grade.
   8. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.
   9. Cut pipe flush with interior of structure.
   10. Shape inverts through manhole and structures as indicated on Drawings.

I. Grouting:
   1. Section 03 05 00 – Concrete
   2. Verify all surfaces have been inspected and prepared for application. All surfaces shall be free of dirt, oil, grease, and other contaminants.
   3. Surface shall be clean, sound and roughened to ensure a sufficient bond.
   4. Surface shall be saturated up to 24 hours prior to application but free of standing water at the time of application.
   5. Provide sufficient support for items to be embedded into the work. Diagrams, templates, and other forms can be used to properly locate such items.
   6. Refer to Manufacturer’s instructions for proper grouting application and installation.
   7. Application shall be inspected immediately after and any defects repaired or removed for re-installation if directed by the Engineer.

J. Castings:
   1. Set frame and cover at finished grade for manholes and other structures with covers located within unpaved areas and graded away from cover.
   2. Set frames using mortar and masonry as indicated on Drawings.
   3. Lay concrete brick in full bed of mortar and completely fill joints.
   4. If more than one course of concrete brick is required, stagger vertical joints.

K. Backfilling: As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.
   1. All structures shall be leak tested prior to backfilling.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements.

B. Testing:
   1. Perform testing in accordance with ASTM C497.
   2. Concrete Manhole Sections: As specified in Section 33 14 22 – Testing of Sanitary Sewer Mains and Manholes.
   3. Conduct a visual inspection of concrete structures.
   4. Repair all visible and detectable leaks.
   5. Leakage testing for structures shall be performed prior to backfilling by the following procedure:
      a. Temporarily plug all wall sleeves, piping entrances and other openings during test period.
      b. Fill structure to overflow level.
      c. Allow to stand for a minimum of four (4) hours.
      d. Refill to overflow level.
      e. Allow to stand for 24 hours.
      f. Examine exterior surfaces and joints for leakage. Measure drop in surface water. Allowable leakage is a drop of ½ inch or less during the test period and no visible signs of leakage.
      g. Repair all visible and detectable leaks. If leakage exceeds allowable limit, the structure shall be repaired by approved method per Engineer.

C. Equipment Acceptance: Contractor shall adjust, repair, modify, or replace components failing to perform as specified and rerun tests at no cost to the Owner.

3.5 ADJUSTING

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Vertical Adjustment of Existing Manholes and Structures:
   1. As specified in Section 33 01 30.86 – Manhole Rim Adjustment.

END OF SECTION

SECTION 33 14 13

WATER DISTRIBUTION PIPING, VALVES, HYDRANTS, AND APPURTENANCES

PART 1 GENERAL

1.1 DESCRIPTION

A. Section Includes Installation of:
   1. Pipe and fittings for public water mains and service connections.
   2. Valves, fire hydrants, blow offs, sampling stations, air release assemblies, and other water distributions appurtenances.

B. Related Requirements:
   1. CFPUA Material Specification Manual (MSM).
   2. Section 03 05 00 - Concrete.
   3. Section 09 91 00 - Painting and Protective Coatings.
   4. Section 31 23 34.01 - Excavating, Trenching, Dewatering and Backfilling.
   5. Section 33 01 12 - Identification for Utilities Piping.
   6. Section 33 05 05.31 - Hydrostatic Testing.
   7. Section 33 05 09.33 - Thrust Restraint for Utility Piping.
   8. Section 33 05 13 - Precast Concrete Manholes and Utility Structures.
   9. Section 33 14 14 - Public Water Service Connections.
   10. Section 33 14 20 - Disinfection of Water Pipelines, Facilities and Appurtenances.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T 180 – Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
   1. ASME B16.1 – Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

C. ASTM International:
   1. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
   2. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).
   3. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
   4. ASTM D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   5. ASTM D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
   6. ASTM D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
   7. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

8. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
9. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

D. American Water Works Association:
1. AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 – Ductile-Iron and Gray-Iron Fittings.
4. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. AWWA C116 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray Iron Fittings.
7. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast.
8. AWWA C153 – Ductile-Iron Compact Fittings.
9. AWWA C500 – Metal-Seated Gate Valves for Water Supply Service.
10. AWWA C502 – Dry-Barrel Fire Hydrants.
11. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
12. AWWA C512 – Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
13. AWWA C550 – Protective Interior Coatings for Valves and Hydrants.
14. AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances.
15. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
16. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm), for Water Transmission and Distribution.
17. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
18. AWWA C906 – Polyethylene Pressure Pipe and Fittings, 4-In. Through 65-In. for Waterworks.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP-60 – Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

F. National Fire Protection Association:
1. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
2. NFPA 291 – Recommended Practice for Fire Flow Testing and Marking of Hydrants.

G. NSF International:
1. NSF 61 – Drinking Water System Components - Health Effects.
2. NSF 372 – Drinking Water System Components - Lead Content.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements

B. Coordination:
   1. Coordinate Work of this Section with termination of water main connection at Site boundary, connection to CFPUA, and trenching.
   2. The existing system must be kept in operation at all times. Where connections are made to existing mains or other shutdowns are necessary, permission must be obtained and arrangements must be made with the CFPUA Distribution ORC, Utility Services Division for removing from service those mains that will be affected.
   3. No valves are to be operated unless a CFPUA representative is present. Any valves operated without a CFPUA representative present, or a directive may be subject of penalties in accordance with CFPUA's ordinance.
   4. Notify CFPUA no less than two business days prior to an event requiring a CFPUA representative to be present.
   5. The Contractor shall, at least two business days in advance, notify citizens subject to interruption of service by means of door hangers or any other approved method of the starting time and duration of such interruption.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittals: Requirements for submittals.

B. Product Data/Source Quality:
   1. Manufacturer information regarding pipe, pipe fittings, valves, hydrants, and appurtenances including component material, assembly, and parts diagrams.
   2. Shop test results and inspection data, certified by manufacturer.

C. Testing Procedures:
   1. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER and CFPUA approval prior to commencing testing.

D. Manufacturer Instructions:
   1. Detailed instructions on installation requirements, including storage and handling procedures.

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

F. Field Quality-Control Submittals:
   1. Results of Contractor-furnished laboratory testing and field test results.

1.5 CLOSEOUT SUBMITTALS:

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents:
   1. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work.
   2. Record actual locations of piping mains, valves, hydrants, connections, thrust restraints, elevations, and other utilities found and not indicated on design plans.

C. Operations and Maintenance Data:
   1. Furnish in operations and maintenance manuals complete data for materials in accordance with Section 01 60 00 - Product Requirements.

1.6 QUALITY ASSURANCE

A. Qualifications: Company specializing in manufacturing products specified in the CFPUA Materials Specification Manual.
   1. Cast manufacturer's name, pressure rating, and year of fabrication into valve body.

B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

C. Perform Work according to AWWA and PVC Pipe Association standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:
   1. Store materials according to manufacturer instructions.
   2. Block individual and stockpiled pipe lengths to prevent moving.
   3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
   4. Store PE and PVC materials out of sunlight.

D. 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.

1.8 SITE CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Furnish 10-year manufacturer's warranty for valves.

PART 2 PRODUCTS

2.1 CFPUA MATERIAL SPECIFICATION MANUAL

A. Refer to CFPUA Material Specification Manual (MSM) for the following products:

MSM Section	Material
A	Pipe
B	Fittings and Accessories
C	Joint Restraints
D	Valves and Accessories
E	Fire Hydrants
F	Service Saddles and Tapping Devices
I	Castings & Aluminum Access Covers
K	Miscellaneous
L	Electrical
M	Coatings and Sealants

2.2 MATERIALS & ACCESSORIES

A. Bedding, Cover, and Backfill:
   1. As specified in Section 31 23 34.01 - Excavating, Trenching, Dewatering and Backfilling.

B. Pipe Location Wire: As specified in Section 33 01 12 - Identification for Utilities Piping.

C. Thrust Restraints: As specified in Section 33 05 09.33 - Thrust Restraint for Utility Piping.

D. Service Connections: As specified in Section 33 14 14 - Public Water Service Connections.

E. Vaults and Utility Boxes: As specified in Section 33 05 13 - Precast Concrete Manholes and Utility Structures.

F. Fire Hydrant Drainage Gravel: Provide #57 Stone.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Identify project horizontal and vertical control points, establish easement and right-of-way lines, stakeout construction points for work and pipeline alignments, establish limits of disturbance.

C. Determine exact location and size of water mains, valves, hydrants, and appurtenances from Drawings

D. Verify location and elevation of existing facilities prior to excavation and installation of proposed interconnecting water mains, valves, and hydrants.

3.2 PREPARATION

A. Section 01 35 00 - Special Procedures.
   1. Pre-construction Site Audio/Video Inspections and Photography:
   2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing Site features.

B. Section 01 70 00 - Execution and Closeout Requirements.

C. All materials, unless otherwise directed, shall be unloaded as nearby as possible to the location of installation by the Contractor. Materials shall be handled with care to avoid damage.

D. All materials found during the progress of work to have flaws, cracks, or other defects will be rejected by the Engineer regardless of whether or not it has been installed and shall be replaced by and at the expense of the Contractor.

E. All PVC pressure pipe, upon delivery to the site and until such time as it is placed in the trench, shall be shielded from the weather and direct sunlight to prevent pipe deterioration.

F. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surfaces, interior linings, and components. If any part of the coating, lining or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer prior to attempting installation.

G. Pipe Cutting:
   1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
   2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
   3. Grind edges smooth with beveled end for push-on connections.

H. Remove scale and dirt on inside and outside before assembly.

I. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Placement: As specified in Section 31 23 34.01 - Trenching, Excavation, Dewatering and Backfilling.
   1. All mains shall be laid and maintained at the required lines and grades with fittings, valves, and appurtenances at the described locations. All pipe shall be laid to the depth as shown on the drawings, or when a depth is not indicated, with a minimum cover of thirty (30) inches and a maximum of (60) inches below finished grade. Grade lines shall be set by the Contractor. Realignments must be approved by the Engineer. The Contractor shall have suitable survey equipment on the site at all times.

2. After placement in the trench the spigot end of the pipe shall be centered in the bell and the pipe shall be driven home and then brought to the proper line and grade by tamping approved backfill material under it, except for the bell. Joint deflection shall not exceed manufacturer's limit.
3. The Work shall at all times progress with caution so as to prevent damage to underground obstructions both known and unknown. Should an obstruction not shown on the drawings be encountered, the Engineer shall be immediately notified, and he shall be responsible for alteration to the design should realignment be necessary. Notify the Engineer far enough in advance to allow the realignment to be accomplished by deflection in the pipe joints.

B. Pipe and Fittings:
   1. Handle and assemble pipe according to manufacturer instructions.
   2. Install pipe and fittings in strict conformance with AWWA C600 and AWWA C605.
   3. Install plastic pipe in conformance with ASTM D2774 and recommended practices of the UNI-BELL Plastic Pipe Association.
   4. Joint Deflection: Maximum joint deflection shall meet requirements of AWWA C600, AWWA C605, or AWWA Manual of Practice M23.
   5. Prevent foreign material from entering pipe during placement. Seal pipe openings with watertight plugs during Work stoppages using plugs designed for that purpose. If trench contains standing water in joining zone, plug shall remain in place until the trench has been pumped dry before proceeding pipe laying.
   6. Allow for expansion and contraction without stressing pipe or joints.
   7. Install access fittings to permit disinfection of water system performed under Section 33 14 20 – Disinfection of Water Distribution Mains.
      a. Blowoffs shall be installed for pipe flushing, disinfection, and test sampling.
      b. Blowoffs shall be located as follows:
         1) Dead ends.
         2) Stub-outs greater than one pipe section in length for future interconnecting mains.
         3) Valves closed against disinfection, flushing, and sampling.
      c. Blowoff should be installed as follows:
         1) Opening pointing downward.
         2) Minimum 24-inches clearance between opening and ground for proper sampling.
   8. Cover: Measure depth of cover from final surface grade to top of pipe barrel and record.
   9. Jointing:
      a. Fused HDPE:
         1) HDPE Pipe shall be joined by the butt-fusion process in accordance with pipe manufacturer’s directions.
         2) Contractor shall provide butt-fusion technicians who are trained and certified by the HDPE pipe manufacturer to complete the project. The date of technician certification shall not exceed 12 months before commencing construction.
         3) Butt-fusion means the butt-joining of the pipe by softening the aligned faces of the pipe ends in a suitable apparatus and pressing them together under controlled pressure.

4) The internal and external beads resulting from the butt-fusion process shall be visible and examined for penetration 360 degrees around the pipe diameter.
5) DI/HDPE Mechanical Joint Adaptors shall be ductile iron mechanical joint fittings per CFPUA Material Specification Manual and shall be joined to the HDPE pipe by a heat-fused joint on one end, and connected to a ductile iron pipe valve, or fitting with a mechanical joint on the other end.
6) Solvent epoxy cementing, electro-fusion couplings, and mechanical joining with bolt on wrap around clamps or mechanical joints without an adapter shall not be used for connections.

b. Push-On Joints:
1) The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove dirt, grit, oil or excess coatings and other foreign matter. For ductile iron pipe, the gasket shall be flexed inward and inserted in the gasket recess of the bell socket.
2) A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot ends, care will be taken to avoid contact with the ground.
3) The joint shall be completed by forcing the plain end to the bottom of the socket with a forked tool or jacking device or other approved method. All pipe shall have depth mark prior to insertion. Pipe cut in the field shall be filed to resemble the spigot end of manufactured pipe.
4) When deflection is required, the joint shall be completed prior to setting the deflection. The deflection shall conform to applicable AWWA Standards or manufacturer's recommendation.

c. Mechanical Joints:
1) The inside of the socket, the outside of the spigot end and the gland shall be thoroughly cleaned and or washed with an approved solution to remove dirt, grit, oil or excess coatings and foreign matter to improve gasket seating.
2) The gland shall then be placed on the plain end of the pipe with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end of the pipe.
3) The pipe shall be inserted into the socket and the gasket pressed firmly and evenly into the gasket recess. The joint shall be kept straight during the assembly and any deflection required shall be done after the joint has been assembled but prior to tightening the bolts.

C. Valves:
1. Valves shall be set and joined to the pipe and each type of joint as specified for pipe.
2. Cast iron valve boxes shall be firmly supported, maintained centered and plumb over the operating nut of the valve. Outside of paved areas, valve boxes shall be set in a 2' diameter x 6" thick concrete collar. The box cover shall be flush with the surface of the finished pavement. All water main valve box lids shall have the word “WATER” cast in the lid.
3. All reasonable effort must be made to locate valves/valve boxes, back of curb, in grass areas and at street corners, whenever possible.
4. Valve boxes in areas that will require sod at a later date must be left one to two inches above existing grade (to allow for sod thickness).

5. All valves must be centered over the operating nut and all valves, after being fully opened, will be backed off one-quarter turn to prevent them from being jammed open. This procedure should take place only after the main has passed pressure testing and has been certified by the Engineer.
6. Should the operating nut be more than three feet below the final grade, an extension shall be supplied and installed by the Contractor. The extension shall bring the nut to within twelve (12) inches of final grade.

D. Installing Valves on Existing Mains
1. When installing valves in existing mains (cutting-in), the Contractor shall insure that the pipe is kept clean at all times and no debris, ground water, mud, oil, etc., will make their way into the pipe.

E. Installation of Tapping Sleeves and Valves
1. Install the tapping sleeve and valve and pressure test prior to making the tap.
2. If leaks are present, the Contractor shall repair them to the satisfaction of the Engineer or Resident Project Representative.
3. Complete the tapping operation and close tapping valve.
4. Tapping valve shall not be opened until new main has been tested and certified for operation.

F. Hydrants
1. Each hydrant shall be connected to the main with a 6-inch branch line.
2. Hydrants shall be set with the pumper nozzle facing the roadway and with the center of the lowest outlet not less than 18 inches above the finished surrounding grade and the operating nut not more than 48 inches above the finished surrounding grade.
3. Set fire hydrants with safety flange not more than 6 inches and not less than 2 inches above grade.
4. The hydrant shall be set in a bed of # 57 stone which shall surround the barrel at least twelve (12) inches in all directions.
5. Hydrants and tees (runs and branches) shall be restrained using field-applied restraint system per CFPUA MSM.
6. Provide support blocking and drainage gravel while installing fire hydrants; do not block drain hole.
7. After main-line pressure testing, flush fire hydrants and check for proper drainage.

G. Thrust Restraints: As specified in Section 33 05 09.33 - Thrust Restraint for Utility Piping.
1. New main construction shall be restrained by means of field or factory applied systems as shown on the Engineer drawings.
2. Thrust blocks in new mains is prohibited except when directed by the Engineer.
3. Where a fitting or device is to be inserted into an existing main, thrust blocking shall be installed as directed by the Engineer or CFPUA.

H. Polyethylene (PE) encasement when indicated for ductile iron pipe and fittings:
1. Encase piping in PE as indicated on Drawings to prevent contact with surrounding soil material or insulation from adjacent cathodic protection system.
2. Comply with AWWA C105.
3. Where pipe exits ground, terminate encasement 3 to 6 inches above surface.

I. Pipe Locator Wire: Install per Section 33 01 12 - Identification for Utilities Piping.

J. Service Connections: As specified in Section 33 14 14 - Public Water Service Connections.

K. Disinfection of Potable Water Piping Systems: As specified in Section 33 14 20 - Disinfection of Water Distribution Mains.

L. Pipe Markers: According to CFPUA Details and Material Specification Manual.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Section 33 05 05.31 - Hydrostatic Testing.
   1. Pressure test piping system according to AWWA C600 and AWWA C605.

C. Section 33 14 20 - Disinfection of Water Pipelines, Facilities, and Appurtenances.

D. Pigging – Flushing and Cleaning Alternative for Large Mains
   1. For mains where flowrates cannot be achieved to create minimum cleaning velocities of 2 feet per second or greater, cleaning of the new piping system by pigging methods shall be established for the project by the Engineer. Pigging includes the following measures:
      a. Pig launching and retrieval equipment to minimize additional valves, fittings, and auxiliary water supplies.
      b. Valves and blowoff assemblies, which are installed as part of the project, shall be used as much as possible to minimize the number of temporary ports required for pigging.
      c. Pig materials used shall be specifically manufactured for flushing and cleaning pressure pipes, bends, and valves. The pigs shall be able to go through bends, open valves, and fittings, and provide adequate cleaning of the pipe.
      d. Pigging shall be accomplished by the controlled and pressurized passage of a series of hydraulic or pneumatic polyurethane plugs of varying dimensions, coatings, and densities.
      e. Pigs shall be selected by the Contractor and approved by the Engineer.
      f. The Contractor shall provide means to enter the pig into the system, control and regulate flow, monitor flows and pressures, and to remove the pig from the system.
      g. The Contractor shall maintain constant surveillance of the pig while active in the pipe system and immediately report problems encountered or any malfunctions discovered in the piping system.

END OF SECTION

SECTION 33 14 14

PUBLIC WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe and fittings for water service connections to small commercial, light industrial, and residential homes 2” service and smaller.
   2. Corporation stop assemblies.
   3. Curb stop assemblies.
   4. Backflow preventers.
   5. Meter setting equipment.
   6. Meter boxes.
   7. Trenching, bedding, and cover.

B. Related Requirements:
   1. CFPUA Material Specification Manual (MSM).
   2. Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.
   3. Section 33 14 13 – Water Distribution Piping and Appurtenances.
   4. Section 33 14 13 – Water Distribution Valves and Fire Hydrants.
   5. Section 33 14 20 – Disinfection of Water Distribution Mains.
   6. Section 33 05 13 – Precast Concrete Manholes and Utility Structures.

C. CFPUA provides potable water service which may be interrupted for repairs, system expansion, or other general requirements. CFPUA does not guarantee adequate fire flow for protection of life or property. There shall be no domestic use taps allowed on a dedicated fire line. Some facility owners choose to utilize this interruptible potable water supply from the CFPUA system for fire protection. If facility owners choose to utilize the potable water system for fire protection flow, the service for fire protection shall be configured according to Part 3 of this Section.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
   1. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. American Society of Sanitary Engineering:
   1. ASSE 1012 – Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.

2. ASSE 1013 – Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

D. ASTM International:
1. ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Castings.
2. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
3. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
4. ASTM D2737 - Standard Specification for Polyethylene (PE) Plastic Tubing.
5. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
6. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

E. American Welding Society:
1. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:
1. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
2. AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances.
3. AWWA C800 – Underground Service Line Valves and Fittings.
4. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
5. AWWA M6 – Water Meters – Selection, Installation, Testing, and Maintenance.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Any event requiring a CFPUA representative to be present shall require a minimum of 2 business day notice to schedule the event.

B. No valves are to be operated unless a CFPUA representative is present. Any valves operated without a CFPUA representative present, or a directive may be subject to penalties in accordance with CFPUA’s ordinance.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Informational Submittals:
1. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventers, and accessories.
2. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
3. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

C. Action Submittals:
   1. Test Reports: Submit all the results of the bacteriological tests to the CFPUA Engineering Inspector.
   2. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
   3. Qualifications Statement:
      a. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, pressure-pipe centerline elevations, and gravity-pipe invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Perform Work according to CFPUA standards and details.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. 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.

PART 2 PRODUCTS

2.1 MATERIAL SPECIFICATION MANUAL

A. Refer to CFPUA Material Specification Manual (MSM) for the following products:

MSM No.	Product
A	Polyethylene Service Tubing
F	Service Saddles/ Hinged Type for 2” PVC
F	Service Saddles/ Brass Alloy/ Stainless Steel Straps for Cast, Ductile & PVC Pipe
F	Service Saddles/ Ductile Iron/ Stainless Steel Straps for Cast, Ductile & PVC Pipe
F	Service Saddles/ Ductile Iron/ Stainless Steel Straps for HDPE Pipe
F	Service Saddles/ Hinged Type for 2” HDPE
G	Inline Valves
G	Straight Couplings (3/4" X 1”)
G	Straight Couplings (1”)
G	Meter Setters (5/8" X 3/4" Meter)
G	Meter Setters (1" Meter)
G	Meter Setters (1 1/2"& 2” Meter)
G	Dual Service U-Branch (5/8" X 3/4" Meter)
G	Dual Service U-Branch (1" METER)
G	Curb Stop Assemblies
J	Meter Box (5/8”, 3/4", & 1”) Single Service Non-Traffic Areas
J	Meter Box (5/8”, 3/4", & 1”) Dual Service Non-Traffic Areas
J	Meter Box (5/8”, 3/4", & 1”) Single Service Traffic Rated
J	Meter Box (5/8”, 3/4", & 1”) Dual Service Traffic Rated
J	Meter Box (1 1/2", & 2”) Single Service Non-Traffic Areas
J	Meter Box (1 1/2", & 2”) Single Service Traffic Rated
J	Lid Details (5/8”, 3/4", & 1”) Single Service Non-Traffic Areas
J	Lid Details (5/8”, 3/4", & 1”) Dual Service Non-Traffic Areas
J	Lid Details (5/8”, 3/4", & 1”) Single Service Traffic Rated
J	Lid Details (5/8”, 3/4", & 1”) Dual Service Traffic Rated
J	Lid Details (1 1/2" & 2”) Single Service Non-Traffic Areas
J	Lid Details (1 1/2" & 2”) Single Service Traffic Rated
L	Tracer Wire (Solid Copper)
L	Direct Bury Wire Splice Kit

2.2 CURB STOP ASSEMBLIES

A. For ⅝-inch through 2-inch services provide a CTS inlet X Female iron pipe thread curb stop on CTS line 3” from inlet of meter setter.

2.3 WATER METERS SINGLE SERVICE

A. Meter box shall be installed flush with grade. Box shall be sized and centered around the meter assembly to allow for access and future maintenance.

2.4 DUAL SERVICE

A. Meter box shall be installed flush with grade. Box shall be sized and centered around the meter assembly to allow for access and future maintenance.

B. U-branch shall be installed prior to meter setter.

C. Meter setter shall be installed to allow three (3) to six (6) inches from top of meter from bottom of lid.

D. Meter setter shall be installed in the upright position.

2.5 MATERIALS

A. Bedding: As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.

B. Cover: As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.

C. Soil Backfill from Above Pipe to Finish Grade: As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Verify that building service connections and municipal utility water main sizes, locations, and inverts are as indicated on Shop Drawings.

3.2 PREPARATION

A. Section 01 70 00 – Execution and Closeout Requirements.

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.

3.3 INSTALLATION

A. 1-inch Service Corporation Stop Assemblies:
   1. Make connection for each different kind of water main, using suitable materials, equipment, and methods as approved by Engineer.
   2. Provide service clamps for mains constructed of materials other than cast iron or ductile iron.
   3. Location:
      a. Locate and stagger corporation stops at least 36 inches apart longitudinally.
   4. Plastic Pipe Mains:
      a. Provide full support for service clamp for full circumference of pipe, with minimum 2-inch 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 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 has been approved by Engineer and CFPUA inspector.

B. Bedding:
   1. Excavate pipe trench as specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering, and Backfilling.
   2. Placement:
      a. Place bedding material as indicated on Drawings.
      b. Level fill materials in one continuous layer not exceeding 8 inches of compacted depth.
      c. Compact to 95 percent maximum density.
   3. Place fill materials as specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.

C. Pipe and Fittings:
   1. Maintain separation of water main from **sewer piping** according to code.
   2. Group piping with other Site piping Work whenever practical.
   3. Install pipe to allow for expansion and contraction without stressing pipe or joints.
   4. Install access fittings to permit disinfection of water system.
   5. Jointing of Pipe:
      a. Connections between different types of pipe and accessories shall be made with transition fittings approved by CFPUA's representative.
      b. Service laterals shall consist of a tapping saddle, corporation stop and a length of PE pipe with no joint installed between the main service tap and the service stop. Service laterals shall be installed perpendicular to the water main. Contractor shall install all material per the CFPUA Material Specification Manual allowing for meter installation at a later date by CFPUA personnel. Locator wire shall be installed as per specifications.
   6. Thrust Restraints: Form and place concrete for thrust restraints at each elbow or change of direction of pipe.
   7. Establish elevations of buried piping with not less than three (3) feet of cover.
   8. Pipe Markers: According to CFPUA MSM.
   9. Backfill trench as specified in Section 31 23 34.01 – Excavation, Trenching, Dewatering and Backfill for Pipes.

D. Curb Stop Assemblies:
   1. Set curb stops on 95% compacted soil.

E. Water Meters: 2-inch and smaller shall be set by CFPUA.

F. Backflow Preventers:
   1. Install backflow preventers where indicated on Drawings and according to manufacturer instructions.
   2. Testing and Installation Requirements: Comply with CFPUA requirements and plumbing codes, see CFPUA's website under Departments, Environmental Management – Backflow and Cross Connections.

G. Service Connections:

1. Install water service according to as indicated on Drawings.
2. Install water service to 18” of right-of-way and connect to building water service as specified in CFPUA details and referenced in CFPUA Material Specification Manual.
3. All meters installed on lines greater than 2-inch diameter must have a strainer and be installed in an appropriately sized, approved meter vault that provides sufficient access for reading, maintenance, and protection in accordance with Water Meter Vaults specification.

H. Service Intended for Fire Protection:
1. Two taps shall be installed, one for potable water and one for fire flow. The potable water tap shall be installed and metered in accordance with this Section. The fire flow tap shall not be metered, and the fire flow system shall be fully segregated from the potable system throughout the facility. A valve will be installed at the tap and the right-of-way or easement line denoting the CFPUA owned/privately owned boundary. A privately owned, privately maintained backflow prevention device shall be installed in the line immediately after entering a structure in accordance with the North Carolina State Building Code and the CFPUA Cross Connection Control Ordinance.

I. Pipe Locator Wire: As specified in Section 33 01 12 – Identification for Utilities Piping.

J. Disinfection of Water Piping System: Flush and disinfect system as specified in Section 33 14 20 – Disinfection of Water Distribution Mains.

3.4 TOLERANCES

A. Install pipe to indicated elevation to within tolerance of 1-inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements.

B. Pressure test water distribution system according to Section 33 05 05.31– Hydrostatic Testing of Water Distribution and Sanitary Sewer Force Mains.

C. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION

SECTION 33 14 20

DISINFECTION OF WATER PIPELINES, FACILITIES AND APPURTENANCES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Essential procedures for disinfecting new and repaired water mains. All new water mains, services, and appurtenances shall be disinfected before they are placed in service. All water mains taken out of service for inspection, repair, or other activities shall be disinfected before they are returned to service.
   2. Testing and reporting of results.

B. Each unit of constructed water main, services, and appurtenances shall be disinfected with chlorine upon successful completion of the hydrostatic test. The disinfection procedure shall be performed in strict conformance with Cape Fear Public Utility Authority (CFPUA) procedures for disinfecting water mains, as outlined in paragraphs 3.2 and 3.3 of this Section.

C. Related Requirements:
   1. CFPUA Material Specification Manual (MSM).
   2. Section 33 14 13 – Water Distribution Piping and Appurtenances.
   3. Section 33 14 14 – Public Water Service Connections.
   4. Section 33 14 13 – Water Distribution Valves and Fire Hydrants.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA B300 – Hypochlorites.
   2. AWWA C651 – Disinfecting Water Mains.
   3. AWWA M12 – Simplified Procedures for Water Examination.
   4. APHA, AWWA, WEF – Standard Methods for the Examination of Water and Wastewater.

B. North Carolina Public Water Supply:
   1. NCPWS Rules Governing Public Water Systems Section .1000 – Disinfection of Water Supply Systems.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Any event requiring a CFPUA representative to be present will require a two-business day notice to schedule the event.

B. No valves are to be operated unless a CFPUA representative is present. Any valves operated without a CFPUA representative present, or a directive may be subject to penalties in accordance with CFPUA's Ordinance.

C. The Contractor shall pay particular attention to the scheduling requirements outlined in the procedures. The Contractor shall be responsible for furnishing and installing all required chlorine injection and monitoring ports at no additional cost to CFPUA.

D. The mains will in no case be accepted by CFPUA for public use until the CFPUA Engineer approves the mains as having been properly disinfected.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Submittals:
   1. Product Data: Submit manufacturer information for proposed chemicals and treatment doses.
   2. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
   3. Disinfection Procedure: Submit description of procedure, including type of disinfectant and calculations indicating quantities of disinfectants required to produce specified chlorine concentration.
   4. Certify that final water complies with disinfectant quality standards of CFPUA.
   5. Test and Evaluation Reports: Indicate testing results comparative to specified requirements. All lab reports shall be from certified lab and submitted to CFPUA representative.
   6. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Disinfection Report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and completion.
   3. Test locations.
   4. Name of person collecting samples.
   5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
   6. Date and time of flushing start and completion.
   7. Disinfectant residual after flushing in ppm for each outlet tested.

1.6 QUALITY ASSURANCE

A. Perform Work according to AWWA C651.

B. QUALIFICATIONS
   1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
   2. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals:
   1. Calcium hypochlorite: Comply with AWWA B300.
   2. Sodium hypochlorite: Comply with AWWA B300.

2.2 CHLORINE RESIDUAL TEST KITS

1. Test kits shall use methodology conforming with *Standard Methods for the Examination of Water and Wastewater* or AWWA Manual M12.
2. Manufacturers:
   a. Hach Company.
   b. LaMotte.
   c. Fisher Scientific.
   d. Hellige.
   e. Or equal.

PART 3 EXECUTION

3.1 PREVENTIVE AND CORRECTIVE MEASURES DURING CONSTRUCTION

Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing such organisms. It is, therefore, essential that the procedures of this section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination. Also, any connection of a new water main to the active distribution system prior to receipt of satisfactory samples may constitute a cross-connection. Therefore, the new main must be isolated until all bacteriological and other tests are satisfactorily completed.

A. KEEPING PIPE CLEAN AND DRY: Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize the entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when work is stopped at the end of the day or for other reasons.

B. JOINTS: Joints of all pipes in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

C. PACKING MATERIAL: All packing material shall consist of molded or tubular rubber rings, or other approved material. Lead or asbestos material in any form shall not be permitted.

D. SEALING MATERIALS: No contaminated material or any material capable of supporting prolific growth of microorganisms shall be used for sealing or lubricating joints. Sealing and lubricating material or gaskets shall be handled in a manner that avoids

contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in closed containers and shall be kept clean. Soil conditions could warrant the upgrade of gasket material to a volatile resistant material.

E. CLEANING OF PIPE AND APPURTENANCES: If dirt enters the pipe, it shall be removed, and the interior pipe surface cleaned. If, in the opinion of the CFPUA representative, the dirt remaining in the pipe will not be removed by the flushing operation, then the interior shall be cleaned by mechanical means such as a hydraulically propelled foam pig or another suitable device. The cleaning method used shall not force mud or debris into the interior pipe joint spaces and shall be acceptable to CFPUA.

F. FLOODING BY STORM OR ACCIDENT DURING CONSTRUCTION: If the main is flooded during construction, it shall be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section of pipeline shall be flushed until water from the pipe runs clear.

3.2 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Chlorination Planning:
   1. Before calling the CFPUA office for a time to be set up for disinfection, all of the following shall be installed or supplied by the Contractor at no cost to CFPUA. This list shall be checked and/or assembled before the CFPUA Engineering personnel arrive.
      a. A valve may be required to be installed in the line to be disinfected near the CFPUA water main connection.
      b. A blowoff of a brass or approved material faucet may be required to be installed at the dead end of the line, at all closed valves, and every 1,200 feet to be disinfected for flushing purposes and bacteria sampling. The opening to this blowoff should point downward, and there should be at least twenty-four inches clearance between the opening and the ground for proper sampling.
      c. Mains connecting other mains with open valves within the system to be disinfected may cause “short circuits” resulting in improper disinfection. Valves on these connecting mains shall be checked to see if they should be closed to eliminate this problem. Blowoffs should be at both sides of valves closed to prevent “short circuits”.
      d. Successful hydrostatic testing and CFPUA acceptance of said testing of the line is required before disinfection procedures.
      e. A clean container shall be used to mix and/or dissolve the hypochlorite.
      f. A clean, new wooden mixer shall be present for mixing and dissolving the hypochlorite.
      g. A pump for pumping the chlorine solution into the line shall be present. This pump shall be gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. For small applications, the solutions may be fed with a hand pump, for example, a hydraulic test pump. Feed lines shall be of such material and strength as to withstand safely the maximum pres-

sures that may be created by the pumps. All connections shall be checked for tightness before the hypochlorite solution is applied to the main.

h. All temporary blowoffs and injection points shall be properly abandoned and physically disconnected when directed by CFPUA prior to the line being placed into service.

C. Verify that access fittings have been installed under Section 33 14 13 – Water Distribution Piping and Appurtenances.

D. Perform scheduling and disinfecting activity with startup, water pressure testing, adjusting, and balancing, and demonstration procedures, including coordination with related systems.

3.3 DISINFECTION PROCEDURE FOR NEW WATER MAINS AND FIRELINES

A. Provide required equipment to perform Work of this Section.

B. Method of Chlorination:

1. Use the continuous feed method for disinfection of all new water mains. This method must give a minimum of 10 mg/L of chlorine residual at the end of the 24-hr period.
    a. Continuous-Feed Method**:** The continuous-feed method is the process in which a concentrated solution of chlorine is injected into the water main. Caution shall be observed during the handling and injection of the chlorine solution as chlorine in any form is very toxic and any error could be harmful to the employees and to the public.
    b. Preliminary Flushing: Before chlorine solutions are injected, the main shall be filled with potable water to eliminate air pockets and shall be flushed to remove particulates. The flushing velocity in the main shall not be less than 3.0 ft/sec (preferably 3.5 ft/sec) unless the CFPUA representative determines that conditions do not permit the required flow or that the flow will cause undue problems when discharged to waste. An acceptable flushing velocity shall then be determined and used.
    c. Procedure for Chlorinating the Main:
        1) Water supplied from the existing distribution system or other Approved public water supply shall be made to flow at a constant, measured rate into the newly installed water main. In the absence of a meter, the rate may be approximated by Approved method.
        2) At a point, not more than 10 ft downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 50 mg/L and not greater than 100 mg/L free chlorine residual. To ensure that this concentration is provided, measure the chlorine concentration at regular intervals of distance and time in accordance with the procedures described in the current edition of *Standard Methods for the Examination of Water and Wastewater* or AWWA Manual M12, or by using Approved chlorine test kits.
        3) During the application of the chlorine, valves shall be adjusted by or under the supervision of the CFPUA representative to prevent the chlorine solution from entering the existing water system. The chlorine injection

shall not cease until the entire water main is filled with a chlorine concentration of not less than 50 mg/L. All appurtenances and valves shall be operated to ensure that the chlorine solution has contact with them. The chlorinated water shall be allowed to remain for a period of not less than 24-hours.

4) At the end of the 24-hour period, the chlorine residual shall be measured and shall not be less than 10 mg/L in any samples collected along the water main and at the end of said water main.

C. Final Flushing:
   1. Clearing the Main of Highly Chlorinated Water: Highly chlorinated water shall not remain in prolonged contact with pipe. At the end of the 24-hour contact period, the water shall be removed in order to prevent damage to the pipe lining or corrosion damage to the pipe itself. The highly chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system.
   2. Disposing of Highly Chlorinated Water: A neutralizing chemical shall be applied to the chlorinated water to be discharged to neutralize thoroughly the chlorine residual. Chlorine residual of water being disposed shall be neutralized by treating with one of the chemicals listed below:
      a. Ascorbic Acid
      b. Sodium Ascorbate
      c. Sulfur Dioxide
      d. Sodium Bisulfate
      e. Sodium Sulfite
      f. Sodium Thiosulfate

D. Bacteriological and Other Tests:
   1. Standard Conditions: After final flushing and before the new main is opened to the distribution system, two consecutive sets of acceptable samples, taken at least 24-hours apart, shall be collected from the new main. Samples shall be collected from every 1,200-ft of new water main, from the end of the water line, and from each branch. All samples shall be tested in accordance with *Standard Methods for the Examination of Water and Wastewater*. All samples shall show the absence of coliform organisms, and a free chlorine residual equal to the level present in the existing system and shall have no visible color or particulate matter. **Must be submitted in the form of an official report by a certified lab.**
   2. Special Conditions: If in the opinion of CFPUA, excess contamination has been allowed to enter the water main during construction or other events, bacteriological samples shall be taken at intervals of approximately 400 to 500 ft and shall be identified by location. Samples shall be taken of water that has stood in the new main for at least 16 hours after final flushing has been completed.
   3. Sampling Procedures: Sample collection shall be in accordance with *Standard Methods for the Examination of Water and Wastewater*. A copper or PVC assembly or a combination blowoff and sampling tap may be used for mains up to 8-inches diameter. Fire hydrants may not be used for sampling purposes. After samples have been collected, analyzed, and accepted, the sampling assemblies may be removed and retained for future use. All bacteriological analysis must be completed by a N.C. certified Drinking Water laboratory. The utility contractor

shall be responsible for all costs associated with the sampling and analysis of all samples required for acceptance. **All Lab Reports shall be delivered to the CFPUA Representative before any activation can proceed.**

E. Replace permanent system devices that were removed for disinfection.

3.4 DISINFECTION PROCEDURE FOR REPAIRED WATER MAINS

A. The following procedures apply primarily when mains are wholly or partially dewatered. After the appropriate repair procedures have been completed, the existing main may be returned to service prior to completion of the bacteriological testing to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

B. The following procedure is considered as a minimum that may be used.
   1. Swabbing with Hypochlorite Solution: The interior of all pipe and fittings used in making repair (particularly couplings and tapping sleeves) shall be swabbed with a five (5) percent hypochlorite solution (300 mg/l concentration) before they are installed.
   2. Flushing: Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the work location from both directions independently is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water and particulate matter are eliminated.
   3. Slug Chlorination: When practical, in addition to the procedures above, the section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated with a high concentration of chlorine (as much as 300 mg/L), and the concentration allowed to stay in contact with the main for a minimum of 15 minutes. After chlorination, flushing shall be resumed and continued until discolored water is eliminated and the water is free of noticeable high chlorine odor. A chlorine residual of no greater than 3.0 mg/L shall be acceptable.
   4. Sampling: Bacteriological samples shall be taken after repairs are completed to provide a record for determining the procedure's effectiveness. If the direction of flow is known, sample locations shall be determined. If the direction of flow is unknown, then samples shall be taken on each side of the main break. If bacteriological samples are unacceptable, the CFPUA representative shall determine corrective action. Daily sampling shall be continued until two successive daily samples are acceptable.

3.5 REPEAT DISINFECTION OF WATER MAIN

A. If the initial disinfection fails to produce satisfactory results as per specifications, the new main shall be reflushed, rechlorinated and resampled; CFPUA may also require further cleaning methods (i.e., pigging the line) if the disinfection fails twice. If check samples also fail to produce acceptable results, the new main shall be reflushed and rechlorinated by the continuous-feed method of chlorination until satisfactory results are obtained.

B. High velocities in the existing system, resulting from flushing the new main may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is advisable to also sample water entering the new main.

3.6 CONNECTION TO EXISTING SYSTEM

A. The NCPWS certifications, final acceptance, opening of valves and activation of the existing water system will only be allowed after satisfactory samples and chlorine levels have been produced. All sampling devices and blowoffs must be removed from the water main by the contractor prior to acceptance by CFPUA. The CFPUA Operations Department will activate the system when their procedures are completed.

3.7 FIELD QUALITY CONTROL

A. Section 01 70 00 – Execution and Closeout Requirements.

END OF SECTION

SECTION 33 14 22

TESTING OF SANITARY SEWER MAINS AND MANHOLES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes testing and inspection of gravity sewer main, manholes, and service laterals in accordance with NCDEQ and CFPUA requirements. Location or project specific testing requirements and procedures shall be set forth by CFPUA and Engineer in approval conditions. CCTV shall be required as a minimum. Additional Testing may be requested.

B. Sewer mains, service laterals, and manholes shall be inspected and tested in accordance with the reference standards and following table with notes.

	CCTV Inspection	Low Pressure Air Test	Exfiltration Test	Deflection Test	Infiltration/Exfiltration Limit	Vacuum Test
Sewer Mains	Yes	Yes (Note 1)	Yes (Note 2)	Yes (Note 3)	100 gpdim (Note 4)	
Sewer Laterals	Yes	Yes (Note 1)			100 gpdim (Note 4)	
Manholes	Yes					Yes (Note 5)

Notes:

1. When sewer main diameters are 24-inches and smaller; unless water table is 2-feet or more above the top of pipe at upstream end of main or the calculated air test pressure is greater than 9 psi.
2. When sewer main diameters are greater than 24-inches.
3. Mandrel pull test after backfill is placed and stable at grade for 30-days. As an alternative to waiting 30-days to permit stabilization of the soil-pipe system, certified test results from an independent testing firm verifying that the backfill of the trench has been compacted to a least 95% maximum density may be accepted by CFPUA.
4. 100-gallons per nominal diameter-inch-mile for section tested and under 2-feet positive head.
5. Not applicable to existing manholes modified or rehabilitated.
6. Vertical compaction testing shall be performed at two (2) feet above the pipe and be completed in 2 ft lifts.
7. Horizontal compaction testing shall be performed at the tie-in point and every 100 ft thereafter.
8. Manhole compaction testing is to be performed in 2 ft lifts.

C. Related Requirements:
   1. Section 33 05 13 – Precast Concrete Manholes and Utility Structures.
   2. Section 33 31 11 – Sanitary Sewer Gravity Mains.

1.2 REFERENCES

A. NC-DEQ Minimum Design Criteria for the Permitting of Gravity Sewers.

B. American Water Works Association:
   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   2. AWWA M23 – PVC Pipe – Design and Installation.

C. ASTM International:
   1. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
   2. ASTM D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
   3. ASTM F1416 – Standard Practice for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air

D. Uni-Bell PVC Pipe Association:
   1. UNI-B-6-98 – Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Acceptance of any deviation from these testing requirements is at the sole discretion of the CFPUA.

B. All defects in the pipelines, manholes and appurtenances shall be remedied by the Contractor at no additional expense to CFPUA and will be re-inspected as outlined in this Section.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Submit following items prior to start of testing:
   1. Testing procedures.
   2. List of test equipment.
   3. Testing sequence schedule.
   4. Provisions for disposal of flushing and test water.
   5. Test gage calibration.
   6. Deflection mandrel drawings and calculations.

C. Test Results: Certified copies of test results shall be furnished to the Owner and CFPUA within 1 week.

D. CCTV Inspection: Submit two copies of the CCTV inspection to CFPUA on hard drives. The digital media recordings, television inspection logs, and digital photographs shall be named and labeled to indicate the specific sewer segment, location, and contents.

PART 2 PRODUCTS

2.1 CCTV INSPECTION EQUIPMENT

A. The equipment used for the CCTV inspection shall be specifically designed and constructed for sanitary or pressure sewer inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera shall be a color, pan-and-tilt model. The camera shall be capable of being moved through the line in either direction at a uniform rate. A push camera system is acceptable for sewer laterals.

B. The camera, television monitor, and other components of the video system shall be capable of producing picture quality and resolution to the satisfaction of the Engineer.

C. Inspections shall be submitted to the Engineer or Owner in electronic (digital) NASSCO format that can be imported and exported with other NASSCO PACP certified software including POSM.

2.2 DEFLECTION TESTING OF PLASTIC SEWER PIPING

1. “Go/ No Go” mandrel.
2. Pull/retrieval ropes.

2.3 EXFILTRATION TESTING

A. Equipment:
   1. Plugs.
   2. Pump.
   3. Measuring Device.

2.4 INFILTRATION TESTING

A. Equipment:
   1. V-notch weirs.

2.5 LOW-PRESSURE AIR TESTING

A. Equipment:
   1. Air compressor.
   2. Air supply line.
   3. Shutoff valves.
   4. Pressure regulator.
   5. Pressure relief valve.
   6. Stopwatch.
   7. Plugs.
   8. Pressure Gage: Calibrate to 0.1 psi.
   9. Clear tubing for water table measurement.

2.6 VACUUM TESTING

A. Equipment:
   1. Vacuum pump.
   2. Vacuum line.
   3. Vacuum Tester Base:
      a. Compression band seal.

b. Outlet port.
4. Shutoff Valve.
5. Stopwatch.
6. Plugs.
7. Vacuum Gage: Calibrated to 0.1 in. Hg.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Verify the following:
1. Piping and manholes installation methods are compatible with testing requirements.
2. Testing equipment is calibrated and functioning.
3. Test procedures and recording methods have been submitted and approved.

3.2 PREPARATION

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Plugs:
1. Plug outlets, wye branches, and laterals.
2. Brace plugs to resist test pressures.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements

B. Section 01 70 00 – Execution and Closeout Requirements.

C. CCTV Procedures:
1. After the sewers are completely cleaned and water is introduced, the sewers shall be inspected by means of closed-circuit television to verify that the sewers have been thoroughly cleaned, to locate active sewer services and other connections, to document the condition, and to locate sewer defects.
2. Existing flow in the sewer being inspected shall be temporarily bypassed in accordance with the Bypass Pumping Plan if satisfactory images cannot be obtained with flow on the sewer. CFPUA will determine if the images are satisfactory.
3. Provide ventilation and air movement to prevent the presence of vapor or mist in the sewer.
4. CCTV inspections shall be performed in accordance with PACP© standards including the specific date and time of inspection.
5. The camera shall be moved through the sewer by devices that do not obstruct the camera view, or interfere with proper documentation of the sewer conditions, such as manual or power winches, TV cable, and powered rewinds.

6. When manually operated winches are used to pull the television camera through the line, two-way radios, telephones, or other suitable means of communication shall be established between the two manholes or access points to ensure adequate communications between members of the crew.
7. The camera shall be moved through the line in either direction at a moderate rate, stopping to permit proper documentation of the condition. In no case shall the television camera be pulled at a speed greater than 30-feet per minute. The camera shall be stopped at joints, defects, points of significance, tributary connections, service laterals, and other connections and shall be panned, tilted, and rotated to fully view the defects and connections. Inspections shall be documented.
8. Perform dye testing during the CCTV inspections to locate and confirm active service laterals when directed to by Engineer or CFPUA.
9. Inspections shall be performed from manhole centerline to manhole centerline or access point to access point.
10. Record accurate measurements of distances. Accuracy of the distance meter shall be checked above grade by a suitable device. The accuracy shall be within 1 percent.

D. Deflection Testing of Plastic Sewer Piping:
1. Perform vertical ring deflection testing on PVC sewer piping after backfilling has been in place for at least 30 days.
2. Allowable maximum deflection for installed plastic sewer pipe is no greater than five percent of original vertical internal diameter.
3. Perform deflection testing using "go, no go" mandrel.
4. Mandrel Diameter:
   a. Not less than 95 percent of base or average ID of pipe.
   b. Pipe Diameter: Comply with ASTM D2122.
5. Perform testing without mechanical pulling devices.
6. Locate, excavate, replace, and retest piping that exceeds allowable deflection.

E. Exfiltration Testing of Pipes Larger Than 24 Inches in Diameter:
1. Perform exfiltration testing not exceeding 100 gal. for each inch of pipe diameter for each mile per day for each reach of piping undergoing testing.
2. Perform testing with minimum positive head of 2 feet.

F. Infiltration Testing:
1. Maximum Allowable Infiltration: 100 gallons per nominal inch diameter of pipe for each mile per day for the reach of piping undergoing testing.
2. Include allowances for leakage from manholes.

G. Low-Pressure Air Testing:
1. Testing shall be accomplished by plugging the line at each end with pneumatic plugs.
2. Test each reach of gravity sewer piping between manholes.
3. Low-pressure air test all connected service laterals.
4. Introduce air pressure slowly to approximately 4 psig.
5. Determine ground water elevation above spring line of piping.
6. For every foot of ground water above spring line of piping, increase starting air test pressure by 0.43 psi.
7. Do not increase pressure above 9 psig.

8. Allow pressure to stabilize for at least five minutes.
9. Adjust pressure to 3.5 psig or to increased test pressure as determined above when ground water is present.
10. Do not make allowance for laterals unless a test section having more than 625 square feet of lateral surface area fails to pass the air test. Adjust the time required according to UNI-B-6-98.
11. Minimum Testing Duration in Minutes:
    a. Shall be calculated by multiplying the nominal pipe size (inches) by 0.625.
12. Record drop in pressure during testing period.
13. If air pressure drops more than 1.0 psi during testing period, piping has failed.
14. If 1.0 psi air pressure drop has not occurred during testing period, piping is acceptable; discontinue testing.
15. If piping fails, test reach of piping in incremental stages until leaks are isolated, repair leaks, and retest entire reach between manholes.
16. If unsatisfactory testing results are achieved, make necessary repairs and retest until result meets criteria.
17. Repair visible leaks regardless of quantity of leakage.
18. UNI-B-6-98 TABLE I – MINIMUM SPECIFIED TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

Min. Pipe Dia. (in.)	Time (min: sec)	Length For Min. Time (ft)	Time For Longer Length (sec)	Time (min:sec) for Length (L) Shown 100 ft	150 ft	200 ft	250 ft	300 ft	350 ft
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46

H. Vacuum Testing:
1. Repair both outside and inside of joint to ensure permanent seal.
2. Test manholes prior to backfill.
3. Test manholes with manhole frame set in place.
4. Vacuum Testing:
    a. Comply with ASTM C1244.
    b. Plug pipe openings; securely brace plugs and pipe.
    c. Plug lift holes with non-shrink grout.
    d. Inflate compression band to create seal between vacuum base and structure.
    e. Connect vacuum pump to outlet port with valve open, then draw vacuum to 10 in. Hg (5 psig).
    f. Close valve.
    g. Manhole Test Duration in Seconds:
        1) Manhole Diameter of 4 Feet: 60.
        2) Manhole Diameter of 5 Feet: 75.

3) Manhole Diameter of 6 Feet: 90.

h. Record vacuum drop during test period.

i. If vacuum drop is greater than 1 in. Hg during testing period, repair and retest manhole.

j. If vacuum drop of 1.0 in. Hg does not occur during test period, manhole is acceptable; discontinue testing.

k. If vacuum test fails to meet 1.0-in. Hg drop in specified time after repair, repair and retest manhole.

5. If unsatisfactory testing results are achieved, repair manhole and retest until result meets criteria.

6. Repair visible leaks regardless of quantity of leakage.

END OF SECTION

SECTION 33 31 11

SANITARY SEWER GRAVITY MAINS

PART 1 GENERAL

1.1 DESCRIPTION

A. Section Includes Installation of:
   1. Pipe and fittings for sewer gravity mains.
   2. Gasket materials, couplings and other gravity main appurtenances.

B. Related Requirements:
   1. CFPUA Material Specification Manual (MSM).
   2. Section 01 50 00 – Bypass Pumping.
   3. Section 03 05 00 – Concrete.
   4. Section 31 23 34 – Excavation, Trenching, Dewatering and Backfilling.
   5. Section 33 01 12 – Identification for Utilities Piping
   6. Section 33 14 22 – Testing of Gravity Sewer Mains and Manholes.
   7. Section 33 05 13 – Precast Concrete Manholes and Utility Structures.
   8. Section 33 05 07.13 – Utility Horizontal Directional Drilling.
   9. Section 33 05 07.23 – Jacking and Boring Pipe Construction.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
   2. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   3. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   4. AWWA C116 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray Iron Fittings.
   5. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast.
   6. AWWA C153 – Ductile-Iron Compact Fittings.
   7. AWWA C600 – Installation of Ductile Iron Mains and Their Appurtenances.
   8. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
   9. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. for Water Transmission and Distribution.
   10. AWWA C906 – Polyethylene Pressure Pipe and Fittings, 4-In. Through 65-In. for Waterworks.

B. ASTM International:
   1. ASTM D698 – 12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1557 – 12e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   3. ASTM D1785 – Standard Specification for Poly (Vinyl Cloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

4. ASTM D2241 – Standard Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
5. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
6. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Section 01 30 00 – Administrative Requirements

B. Coordination:
   1. Coordinate Work of this Section with connection to CFPUA and trenching.
   2. The existing system must be kept in operation at all times. Where connections are made to existing mains or other shutdowns are necessary, permission must be obtained and arrangements must be made with the CFPUA Wastewater Collections ORC, Utility Services Division for removing from service those mains that will be affected.
   3. Notify CFPUA no less than two business days prior to an event requiring a CFPUA representative to be present.
   4. The Contractor shall, at least two (2) business days in advance, notify citizens subject to interruption of service by means of door hangers or any other approved method of the starting time and duration of such interruption.
   5. Bypass pumping and hauling operations may be required to interrupt service. A bypass pumping plan shall be submitted in accordance with Section 01 50 00 – Bypass Pumping. Shutdowns must be held to a minimum in both number and duration.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittals: Requirements for submittals.

B. Product Data/Source Quality:
   1. Manufacturer’s literature and specifications, as applicable, for products specified in this Section.
   2. Shop test results and inspection data, certified by manufacturer.

C. Testing Procedures:
   1. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER’s approval prior to commencing testing.

D. Manufacturer Instructions:
   1. Submit manufacturer's instructions for handling, storing, and installing pipes and appurtenances.

E. Manufacturer Certificates:
   1. Certificates of compliance with referenced standards, where applicable, including those of AWWA and others required by Engineer.

F. Field Quality Control Submittals:
   1. Results of Contractor furnished testing and inspections.

1.5 CLOSEOUT SUBMITTALS

A. 01 70 00 – Execution and Closeout Requirements

B. Project Record Documents:
   1. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work.

   2. Record actual locations and elevations of piping mains, valves, hydrants, manholes, service laterals, cleanouts, connections, thrust restraints, and other utilities found and not indicated on design plans.

C. Operations and Maintenance Data:
   1. Furnish in operations and maintenance manuals complete data for materials in accordance with 01 60 00 - Product Requirements.

1.6 QUALITY ASSURANCE

A. Qualifications: Company specializing in manufacturing products specified in the CFPUA Materials Specification Manual.

B. Perform Work according to AWWA and PVC Pipe Association standards.

C. The bell ends of pipe shall face the direction of laying unless otherwise directed by the Engineer, for lines on appreciable slope, the Engineer may require that bell ends face upgrade.

D. All stainless-steel fasteners shall be 316.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:
   1. Store materials according to manufacturer instructions.
   2. Block individual and stockpiled pipe lengths to prevent moving.
   3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
   4. Store PE and PVC materials out of sunlight.

D. 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.

1.8 SITE CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.
   3. A minimum of ten-foot utility easement must be provided along the frontage of all lots and as shown for new developments.

1.9 WARRANTY

1. Section 01 70 00 – Execution and Closeout Requirements.

PART 2 PRODUCTS

2.1 CFPUA MATERIALS SPECIFICATION MANUAL

A. Refer to CFPUA Material Specification Manual (MSM) for the following products:

MSM Section	Material
A	Pipe
B	Fittings and Accessories
C	Joint Restraints
I	Castings & Aluminum Access Covers
K	Miscellaneous
L	Electrical
M	Coatings and Sealants
N.	Concrete

2.2 MATERIALS & ACCESSORIES

A. Bedding, Cover, and Backfill:
   1. As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.

B. Manholes:

   1. As specified in Section 33 05 13 – Precast Concrete Manholes and Utility Structures.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements.

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

C. Determine exact location and size of water mains, valves, hydrants, and appurtenances from Drawings.

D. Verify location and elevation of existing facilities prior to excavation and installation of proposed gravity sewer mains and services.

3.2 PREPARATION

A. Section 01 35 00 – Special Procedures
   1. Pre-construction Site Audio/Video Inspections and Photography:
   2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing Site features.

B. Section 01 70 00 – Execution and Closeout Requirements.

C. All materials, unless otherwise directed, shall be unloaded as nearby as possible to the location of installation by the Contractor. Materials shall be handled with care to avoid damage.

D. All materials found during the progress of work to have flaws, cracks, or other defects will be rejected by the Engineer regardless of whether or not it has been installed and shall be replaced by and at the expense of the Contractor.

E. All PVC pipe, upon delivery to the site and until such time as it is placed in the trench, shall be shielded from the weather and direct sunlight to prevent pipe deterioration.

F. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surfaces, interior linings and components. If any part of the coating, lining or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer prior to attempting installation.

G. Pipe Cutting:
   1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
   2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
   3. Grind edges smooth with beveled end for push-on connections.

H. Remove scale and dirt on inside and outside before assembly.

3.3 INSTALLATION

A. Placement: As specified in Section 31 23 34.01 – Trenching, Excavation, Dewatering and Backfilling.
   1. All mains shall be laid and maintained at the required lines and grades with fittings and appurtenances at the described locations. All pipe shall be laid to the depth as shown on the drawings, or when a depth is not indicated, with a minimum cover of thirty-six (36) inches unless otherwise shown or approved by engineer. Grade lines shall be set by the Contractor. Realignments must be approved by the

Engineer. The Contractor shall have suitable survey equipment on the site at all times.

2. After placement in the trench the spigot end of the pipe shall be centered in the bell and the pipe shall be driven home and then brought to the proper line and grade by tamping approved backfill material under it, except for the bell. Joint deflection shall not exceed manufacturer's limit.
3. The Work shall at all times progress with caution so as to prevent damage to underground obstructions both known and unknown. Should an obstruction not shown on the drawings be encountered, the Engineer shall be immediately notified, and he shall be responsible for alteration to the design should realignment be necessary. Notify the Engineer far enough in advance to allow the realignment to be accomplished by deflection in the pipe joints.

B. Pipe and Fittings
   1. Handle and assemble pipe according to manufacturer instructions.
   2. Install pipe and fittings in strict conformance with AWWA C600 and C605.
   3. Joint Deflection: Maximum joint deflection shall meet requirements of AWWA C600, C605 or AWWA Manual of Practice M23.
   4. Prevent foreign material from entering pipe during placement and Work stoppages using plugs designed for that purpose. If trench contains standing water in joining zone, plug shall remain in place until the trench has been pumped dry before proceeding pipe laying.
   5. Allow for expansion and contraction without stressing pipe or joints.
   6. Solvent epoxy cementing, electro-fusion couplings and mechanical joining with bolt on wrap around clamps or mechanical joints without an adapter shall not be used for connections.

C. Push-On Joints
   1. The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove dirt, grit, oil or excess coatings and other foreign matter. For ductile iron pipe, the gasket shall be flexed inward and inserted in the gasket recess of the bell socket.
   2. A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot ends, care will be taken to avoid contact with the ground.
   3. The joint shall be completed by forcing the plain end to the bottom of the socket with a forked tool or jacking device or other approved method. All pipe shall have depth mark prior to insertion. Pipe cut in the field shall be filed to resemble the spigot end of manufactured pipe.
   4. When deflection is required the joint shall be completed prior to setting the deflection. The deflection shall conform to applicable AWWA Standards or manufacturer's recommendation.

D. Mechanical Joints
   1. The inside of the socket, the outside of the spigot end and the gland shall be thoroughly cleaned and or washed with an approved solution to remove dirt, grit, oil or excess coatings and foreign matter to improve gasket seating.
   2. The gland shall then be placed on the plain end of the pipe with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end of the pipe.

3. The pipe shall be inserted into the socket and the gasket pressed firmly and evenly into the gasket recess. The joint shall be kept straight during the assembly and any deflection required shall be done after the joint has been assembled but prior to tightening the bolts.

E. Polyethylene Encasement
   1. Polyethylene (PE) encasement when indicated for ductile iron pipe and fittings:
   2. Encase piping in PE as indicated on Drawings to prevent contact with surrounding soil material or insulation from adjacent cathodic protection system.
   3. Comply with AWWA C105.

F. Transition from One Type of Pipe to Another
   1. Provide necessary adapters, special, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.
   2. Sewer service laterals shall be connected in accordance with Cape Fear Public Utility Authority Standard Drawing Details.
   3. No flexible couplings shall be used.

G. Pipe Restraint
   1. Provide restraint on ductile iron piping systems where shown or indicated in the Contract Documents below but not limited to:
      a. All ductile iron pipe aerial crossings and carrier pipes with any joints supported on pier or inside an encasement pipe shall require the use of a rigid joint restraint.
      b. All ductile iron pipe carrier pipes installed with joints inside an encasement pipe must utilize rigid restrained joints.

H. Service Connections
   1. In new sewer construction, PVC service connections shall be made by means of a wye, DIP service connections shall be made by means of a wye or a tee. All joints connected to the wye unit shall remain flexible.
   2. Service pipe for all properties shall be laid to the property line and plugged, as shown on the Standard Details. All sewer services shall be installed perpendicular to the main and terminate at the Right-Of-Way line. Sewer services in Cul-De-Sacs are required to be perpendicular or must originate in end of line manhole and terminate at Right-of-Way, no acute angles to downstream main.
   3. All services tying into ductile iron mains shall be constructed of class 50, DIP with Protecto 401 ceramic epoxy lining.
   4. Cleanouts shall be located a minimum of 6 feet from all property corners. Water meter boxes are to be a minimum of 5 feet from the property corner.
   5. In cases of extra depth where service pipe cannot be laid on a continuous grade to the property line, the Contractor shall construct risers as shown on the Plans. When pipe cannot be adequately supported on undisturbed earth, it shall be supported on a concrete cradle.
   6. Trench and backfill or bore to install lateral. Bore shall accommodate pipe without void around pipe. Bore shall be at least 5’ from the edge of pavement or back of curb on either side of the roadway unless approval to the contrary is given by the engineer.
   7. Connect lateral with wye.

8. Install sewer lateral with plug and one-way clean-out. Clean-out shall consist of a ¼ bend long sweep, with the necessary vertical 4" Schedule 40 PVC/DWV pipe stack. The clean-out plug shall be installed into a cast iron box and cover.

I. Service Reconnections
   1. Service reconnections require adapters for all joints that will not connect properly with ordinary factory joints. Approved pipe cutting methods shall be used to cut any pipe required for the connection. No mortar or collars shall be used on reconnections unless specifically approved by the Engineer.
   2. No flexible couplings shall be used.

J. Joining New Pipe to Old Pipe
   1. Joining PVC pipe to existing vitrified clay pipe requires an adapter approved in the Cape Fear Public Utility Authority's Materials Specification Manual for all joints that will not connect properly with ordinary factory joints. Approved pipe cutting methods must be used to cut any pipe required for the connection. No mortar or collars shall be used for such connections unless approved by the Engineer.
   2. No flexible couplings shall be used.

K. Joining Pipe to Manholes or Other Structures
   1. All manhole connection holes shall be core drilled with a maximum hole diameter not to exceed one and a half times the pipe diameter.
   2. Approved standard groutable PVC-to-manhole fitting approved in the Cape Fear Public Utility Authority's Materials Specification Manual, or a flexible rubber boot may also be used at the manhole connection. The connection at the manhole wall shall be flexible and watertight. Any annular space inside the manhole at the connection shall be filled with approved caulking material or joint filler.
   3. Pipe connections to existing manholes shall be made so that finished work will conform, as nearly as possible to the essential requirements for new manhole construction, as specified above. Drop connections on existing manholes ***shall be strengthened by use of eight #6 pins***, placed around the drop elbow and tee, or inside PVC drops may be used.
   4. Provide a minimum of six (6) inches of separation between edge of manhole core holes and manhole barrel joints. Provide a minimum six (6) inches separation between edges of core holes. Coring the manhole cone section is not allowed.

L. Sewer Manhole Inserts
   1. Sewer manhole inserts are required at all manholes. Stainless steel sewer manhole inserts are required at manholes located in traffic areas.

M. Pipe Markers: According to CFPUA Details and Material Specification Manual.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Section 33 14 22 – Testing of Sanitary Sewer Mains and Manholes.

END OF SECTION

SECTION 33 31 23

SANITARY SEWER FORCE MAINS, VALVES, AND APPURTENANCES

PART 1 GENERAL

1.1 DESCRIPTION

A. Section Includes Installation of:
   1. Pipe and fittings for sewer force mains and interconnections.
   2. Valves, air release assemblies, and other force main appurtenances.

B. Related Requirements:
   1. CFPUA Material Specification Manual (MSM).
   2. Section 01 50 00 – Bypass Pumping.
   3. Section 03 05 00 – Concrete.
   4. Section 31 23 34.01 – Excavation, Trenching, Dewatering and Backfilling.
   5. Section 33 01 12 – Identification for Utilities Piping
   6. Section 33 05 05.31 – Hydrostatic Testing.
   7. Section 33 05 09.33 – Thrust Restraint for Utility Piping.
   8. Section 33 05 13 – Precast Concrete Manholes and Utility Structures.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
   2. AWWA C110 – Ductile-Iron and Gray-Iron Fittings.
   3. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   4. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   5. AWWA C116 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray Iron Fittings.
   6. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast.
   7. AWWA C153 – Ductile-Iron Compact Fittings.
   8. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
   9. AWWA C512 – Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
   10. AWWA C517 – Resilient-Seated Cast Iron Eccentric Plug Valves.
   11. AWWA C600 – Installation of Ductile Iron Mains and Their Appurtenances.
   12. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
   13. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. for Water Transmission and Distribution.
   14. AWWA C906 – Polyethylene Pressure Pipe and Fittings, 4-In. Through 65-In. for Waterworks.

B. ASTM International:
   1. ASTM D698 – 12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

2. ASTM D1557 – 12e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
3. ASTM D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
4. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Section 01 30 00 – Administrative Requirements

B. Coordination:
1. Coordinate Work of this Section with termination of force main connection at Site boundary, connection to CFPUA, and trenching.
2. The existing system must be kept in operation at all times. Where connections are made to existing mains or other shutdowns are necessary, permission must be obtained and arrangements must be made with the CFPUA Wastewater Collections ORC, Utility Services Division for removing from service those mains that will be affected.
3. No valves are to be operated unless a CFPUA representative is present. Any valves operated without a CFPUA representative present, or a directive may be subject of penalties in accordance with CFPUA's ordinance.
4. Notify CFPUA no less than two business days prior to an event requiring a CFPUA representative to be present.
5. The Contractor shall, at least two business days in advance, notify citizens subject to interruption of service by means of door hangers or any other approved method of the starting time and duration of such interruption.
6. Bypass pumping and hauling operations may be required to interrupt service. A bypass pumping plan shall be submitted in accordance with Section 01 50 00 – Bypass Pumping. Shutdowns must be held to a minimum in both number and duration.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittals: Requirements for submittals.

B. Product Data/Source Quality:
1. Manufacturer's literature and specifications, as applicable, for products specified in this Section.
2. Shop test results and inspection data, certified by manufacturer.

C. Testing Procedures:
1. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER and CFPUA approval prior to commencing testing.

D. Manufacturer Instructions:
1. Submit manufacturer's instructions for handling, storing, and installing valves and appurtenances. Provide templates and setting drawings for valves and appurtenances that require anchor bolts or similar anchorages.

E. Manufacturer Certificates:
   1. Certificates of compliance with referenced standards, where applicable, including those of AWWA and others required by Engineer.

F. Field Quality Control Submittals:
   1. Results of Contractor furnished laboratory testing and field test results.

1.5 CLOSEOUT SUBMITTALS

A. 01 70 00 – Execution and Closeout Requirements

A. Project Record Documents:
   1. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work.
   2. Record actual locations of piping mains, valves, hydrants, connections, thrust restraints, elevations, and other utilities found and not indicated on design plans.

B. Record actual locations of piping mains, valves, hydrants, connections, thrust restraints, elevations, and other utilities found and not indicated on design plans.

C. Operations and Maintenance Data:
   1. Furnish in operations and maintenance manuals complete data for materials in accordance with 01 60 00 - Product Requirements.

1.6 QUALITY ASSURANCE

A. Qualifications: Company specializing in manufacturing products specified in the CFPUA Materials Specification Manual.
   1. Cast manufacturer's name, pressure rating, and year of fabrication into valve body.

B. Perform Work according to AWWA and PVC Pipe Association standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:
   1. Store materials according to manufacturer instructions.
   2. Block individual and stockpiled pipe lengths to prevent moving.
   3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
   4. Store PE and PVC materials out of sunlight.

D. 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.

1.8 SITE CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

1.9 WARRANTY

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Furnish 10-year manufacturer's warranty for valves.

PART 2 PRODUCTS

2.1 CFPUA MATERIALS SPECIFICATION MANUAL

A. Refer to CFPUA Material Specification Manual (MSM) for the following products:

MSM Section	Material
A	Pipe
B	Fittings and Accessories
C	Joint Restraints
D	Valves and Accessories
F	Service Saddles and Tapping Devices
I	Castings & Aluminum Access Covers
K	Miscellaneous
L	Electrical
M	Coatings and Sealants
N	Concrete

2.2 MATERIALS & ACCESSORIES

A. Bedding, Cover, and Backfill:
   1. As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.

B. Pipe Location Wire: As specified in Section 33 01 12 – Identification for Utilities Piping.

C. Thrust Restraints: As specified in Section 33 05 09.33 – Thrust Restraint for Utility Piping.

D. Vaults and Utility Boxes: As specified in Section 33 05 13 – Precast Concrete Manholes and Utility Structures.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Identify project horizontal and vertical control points, establish easement and right-of-way lines, stakeout construction points for work and pipeline alignments, establish limits of disturbance.

C. Determine exact location and size of water mains, valves, hydrants, and appurtenances from Drawings

D. Verify location and elevation of existing facilities prior to excavation and installation of proposed interconnecting force mains and valves.

3.2 PREPARATION

A. Section 01 35 00 – Special Procedures
   1. Pre-construction Site Audio/Video Inspections and Photography:
   2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing Site features.

B. Section 01 70 00 – Execution and Closeout Requirements.

C. All materials, unless otherwise directed, shall be unloaded as nearby as possible to the location of installation by the Contractor. Materials shall be handled with care to avoid damage.

D. All materials found during the progress of work to have flaws, cracks, or other defects will be rejected by the Engineer regardless of whether or not it has been installed and shall be replaced by and at the expense of the Contractor.

E. All PVC pressure pipe, upon delivery to the site and until such time as it is placed in the trench, shall be shielded from the weather and direct sunlight to prevent pipe deterioration.

F. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surfaces, interior linings, and components. If any part of the coating, lining or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer prior to attempting installation.

G. Pipe Cutting:
   1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
   2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
   3. Grind edges smooth with beveled end for push-on connections.

H. Remove scale and dirt on inside and outside before assembly.

I. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Placement: As specified in Section 31 23 34.01 – Trenching, Excavation, Dewatering and Backfilling.
   1. All mains shall be laid and maintained at the required lines and grades with fittings, valves, and appurtenances at the described locations. All pipe shall be laid to the depth as shown on the drawings, or when a depth is not indicated, with a minimum cover of thirty-six (36) inches and a maximum of sixty (60) inches below finished grade. Grade lines shall be set by the Contractor. Realignments must be approved by the Engineer. The Contractor shall have suitable survey equipment on the site at all times.
   2. After placement in the trench the spigot end of the pipe shall be centered in the bell and the pipe shall be driven home and then brought to the proper line and grade by tamping approved backfill material under it, except for the bell. Joint deflection shall not exceed manufacturer's limit.
   3. The Work shall at all times progress with caution so as to prevent damage to underground obstructions both known and unknown. Should an obstruction not shown on the drawings be encountered, the Engineer shall be immediately notified, and he shall be responsible for alteration to the design should realignment be necessary. Notify the Engineer far enough in advance to allow the realignment to be accomplished by deflection in the pipe joints.

B. Pipe and Fittings:
   1. Handle and assemble pipe according to manufacturer instructions.
   2. Install pipe and fittings in strict conformance with AWWA C600 and C605.
   3. Install plastic pipe in conformance with ASTM D2774 and recommended practices of the UNI-BELL Plastic Pipe Association.
   4. Joint Deflection: Maximum joint deflection shall meet requirements of AWWA C600 or AWWA Manual of Practice M23.
   5. Prevent foreign material from entering pipe during placement and Work stoppages using plugs designed for that purpose. If trench contains standing water in joining zone, plug shall remain in place until the trench has been pumped dry before proceeding pipe laying.
   6. Allow for expansion and contraction without stressing pipe or joints.
   7. Install access fittings to permit work performed under Section 33 05 05.31 – Hydrostatic Testing.
      a. Blowoffs shall be installed for pipe flushing and pressure testing as follows:
         1) Dead ends
         2) Valves closed against flushing or pressure testing.

b. Blowoff should be installed as follows:
    1) Opening pointing downward.
    2) Minimum 24-inches clearance between opening and ground for proper sampling.

8. Cover: Measure depth of cover from final surface grade to top of pipe barrel and record.
9. Jointing:
    a. Fused HDPE
        1) HDPE Pipe shall be joined by the butt-fusion process in accordance with pipe manufacturer's directions.
        2) Contractor shall provide butt-fusion technicians who are trained and certified by the HDPE pipe manufacturer to complete the project. The date of technician certification shall not exceed 12 months before commencing construction.
        3) Butt-fusion means the butt-joining of the pipe by softening the aligned faces of the pipe ends in a suitable apparatus and pressing them together under controlled pressure.
        4) The internal and external beads resulting from the butt-fusion process shall be visible and examined for penetration 360 degrees around the pipe diameter.
        5) DI/HDPE Mechanical Joint Adaptors shall be ductile iron mechanical joint fittings per CFPUA Material Specification Manual and shall be joined to the HDPE pipe by a heat-fused joint on one end, and connected to a ductile iron pipe valve, or fitting with a mechanical joint on the other end.
        6) Solvent epoxy cementing, electro-fusion couplings, and mechanical joining with bolt on wrap around clamps or mechanical joints without an adapter shall not be used for connections.
    b. Push-On Joints
        1) The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove dirt, grit, oil or excess coatings and other foreign matter. For ductile iron pipe, the gasket shall be flexed inward and inserted in the gasket recess of the bell socket.
        2) A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot ends, care will be taken to avoid contact with the ground.
        3) The joint shall be completed by forcing the plain end to the bottom of the socket with a forked tool or jacking device or other approved method. All pipe shall have depth mark prior to insertion. Pipe cut in the field shall be filed to resemble the spigot end of manufactured pipe.
        4) When deflection is required, the joint shall be completed prior to setting the deflection. The deflection shall conform to applicable AWWA Standards or manufacturer's recommendation.
    c. Mechanical Joints
        1) The inside of the socket, the outside of the spigot end and the gland shall be thoroughly cleaned and or washed with an approved solution to remove dirt, grit, oil or excess coatings and foreign matter to improve gasket seating.

2) The gland shall then be placed on the plain end of the pipe with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end of the pipe.
3) The pipe shall be inserted into the socket and the gasket pressed firmly and evenly into the gasket recess. The joint shall be kept straight during the assembly and any deflection required shall be done after the joint has been assembled but prior to tightening the bolts.

C. Valves:
1. Valves shall be set and joined to the pipe and each type of joint as specified for pipe.
2. Cast iron valve boxes shall be firmly supported, maintained centered and plumb over the operating nut of the valve. Outside of paved areas, valve boxes shall be set in a 2' diameter x 6" thick concrete collar. The box cover shall be flush with the surface of the finished pavement. All force main valve box lids shall have the word “SEWER” cast in the lid.
3. All reasonable effort must be made to locate valves/valve boxes, back of curb, in grass areas and at street corners, whenever possible.
4. Valve boxes in areas that will require sod at a later date must be left one to two inches above existing grade (to allow for sod thickness).
5. All valves must be centered over the operating nut/wheel and all valves, after being fully opened, will be backed off one-quarter turn to prevent them from being jammed open. This procedure should take place only after the main has passed pressure testing and has been certified by the Engineer.
6. Should the operating nut be more than three feet below the final grade, an extension shall be supplied and installed by the Contractor. The extension shall bring the nut to within twelve (12) inches of final grade.

D. Insertion Valves or Line Stops on Existing Mains
1. When installing valves in existing mains (cutting-in), the Contractor shall insure that the pipe integrity is maintained and there is no sewage release.
2. A contingency bypass plan must be in place before beginning work.

E. Installation of Tapping Sleeves and Valves
1. Install the tapping sleeve and valve and pressure test prior to making the tap.
2. If leaks are present, the Contractor shall repair them to the satisfaction of the Engineer or Resident Project Representative.
3. Complete the tapping operation and close tapping valve.
4. Tapping valve shall not be opened until new main has been tested and certified for operation.

F. Thrust Restraints: As specified in Section 33 05 09.33 – Thrust Restraint for Utility Piping.
1. New main construction shall be restrained by means of field or factory applied systems as shown on the Engineer drawings.
2. Thrust blocks in new mains are prohibited except when directed by the Engineer.
3. Where a fitting or device is to be inserted into an existing main, thrust blocking shall be installed as directed by the Engineer or CFPUA.

G. Polyethylene (PE) encasement when indicated for ductile iron pipe and fittings:

1. Encase piping in PE as indicated on Drawings to prevent contact with surrounding soil material or insulation from adjacent cathodic protection system.
2. Comply with AWWA C105.
3. Where pipe exits ground, terminate encasement 3 to 6 inches above surface.

H. Pipe Locator Wire: Install per Section 33 01 12 – Identification for Utilities Piping.

I. Pipe Markers: According to CFPUA Details and Material Specification Manual.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Section 33 05 05.31 – Hydrostatic Testing.
1. Pressure test piping system according to AWWA C600.

END OF SECTION

SECTION 33 32 15

WASTEWATER PUMP STATION STARTUP

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structure leakage testing.
   2. Scheduling field start-up meetings with manufacturer representatives, Owner, Engineer, and CFPUA to run all pump station equipment through its proper functions.
   3. Testing procedures and certification requirements by manufacturer's representative.
   4. Manufacturer's representative startup, field tests and O&M manuals for CFPUA operating personnel on operation and maintenance of equipment item.
   5. Contractor to schedule repeat start-ups as required for certification and acceptance.

B. Related Requirements:
   1. Section 33 05 13 - Precast Concrete Manholes and Utility Structures.
   2. Section 40 71 00 - Magnetic Flow Meter.
   3. Section 40 95 01 - Wastewater Pump Station SCADA Remote Telemetry Unit (RTU)
   4. Section 43 21 39 - Submersible End Suction Pump.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 WETWELL LEAKAGE TEST

A. Prior to testing, wet well shall be coated per Section 33 05 13 – Precast Concrete Manholes and Utility Structures.

B. Conduct a visual inspection of concrete wet wells and valve vaults. Repair all visible and defects.

C. Wet wells shall be leakage tested prior to backfilling by the following procedures:
   1. Temporarily plug all wall sleeves, piping entrances, and other openings during test period.
   2. Fill structure to overflow level.
   3. Allow to stand for a minimum of four (4) hours.
   4. Repair visible leaks.
   5. Refill to overflow level.

6. Allow to stand for 24 hours.
7. Examine exterior surfaces and joints for leakage. Measure the drop in surface water.
8. Allowable leakage is a drop of ½-inch or less during the test period and no visible signs of leakage.
9. Repair all visible and detectable leaks. If leakage exceeds the allowable limit, the structure shall be repaired by method approved by the Engineer.

3.2 PUMP FIELD SERVICES TESTING

A. The pumping manufacturer shall provide the services of a representative for a minimum of five (5) days to provide start-up and follow up advisory service, including O&M instructions to the operating personnel. Representative shall schedule at least two separate trips for these services. The Contractor, Owner, Engineer, and CFPUA shall be notified when manufacturer's representative is to be at the work site one week in advance to be present during start-up of equipment.

B. Provide pump manufacturer specified inspections and tests on each pump including but not limited to the following:
   1. Impeller, motor rating, and electrical connections check for compliance with the job requirements.
   2. Motor and cable insulation test for moisture content to insulation defects.
   3. Prior to submergence, run pump dry to establish correct rotation and mechanical integrity.
   4. Run pump for 30 minutes submerged, a minimum of six (6) feet under water.
   5. After operational test No. 4, Perform insulation test (No. 2) again.
   6. Certified records of the test shall substantiate the operation of the equipment at the design head, capacity, and horsepower as specified.
   7. Return elbows are securely bolted in place and fasteners are tight.
   8. Slide rails are installed properly. Pumps shall be raised to test reliability by CFPUA operator.
   9. No electrical connections, splices, or junction boxes within the wet well or in locations of condensing humidity.
   10. Ensure proper oil levels.

3.3 O&M MANUALS AND SPECIAL TOOLS

A. Furnish four (4) sets of operations and maintenance (O&M) manuals for each equipment item.

B. Provide any special tools specific to the equipment provided which is needed to perform maintenance and as recommended by the equipment manufacturer.

3.4 CERTIFICATION AND ACCEPTANCE OF FIELD STARTUP TESTING

A. Correct Equipment Deficiencies:
   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.

B. Furnish installation certificates from equipment manufacturer's representative attesting that equipment is properly installed and ready for operation.

C. Final certification and approval of all electric, instrumentation, and mechanical components is a required condition of project closeout and acceptance by CPFUA.
   1. Section 01 70 00 – Execution and Closeout Requirements (CFPUA Capital Projects).
   2. Section 01 70 00 – Execution and Closeout Requirements (Development Projects).

END OF SECTION

SECTION 40 71 00

MAGNETIC FLOW METER

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, calibrate, test, start-up, and place in satisfactory operation a magnetic flow meter.

B. Related Sections:
   1. Section 09 91 00 – Painting and Protective Coatings.
   2. Division 26 Sections.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ISA 5.1, Instrumentation Symbols and Identification.
   2. ISA 5.4, Instrument Loop Diagrams.
   3. ISA 20, Specification Forms for Process Measurement & Control Instruments, Primary Elements & Control Valves.
   4. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   5. UL 50, Safety Enclosures for Electrical Equipment, Non-Environmental Considerations.
   6. UL 508A, Industrial Control Panels.
   7. UL 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations.
   8. UL 2062, Enclosures for Use in Hazardous (Classified) Locations.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Manufacturers of magnetic flow meters furnished under this Section shall be experienced producing similar equipment and shall have the following qualifications:
      a. Shall manufacture magnetic flow meters that are fully-developed, field-proven, and of standardized designs.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Manufacturer’s product name and complete model number of devices proposed for use, including manufacturer’s name and address.
      b. Data sheets and manufacturer’s catalog literature.
      c. Description of construction features.
      d. Performance and operation data.

e. Installation, mounting, and calibration details; instructions and recommendations.
f. Service requirements.
g. Dimensions of magnetic flow meter and details of mating flanges and upstream/downstream straight run pipe lengths required.
h. Range of each device and calibration information.
i. Descriptions of materials of construction and listing of NEMA ratings for equipment.

2. Product Data:
   a. Manufacturer's literature, illustrations, specifications and engineering data including; dimensions, material size, weight and parts list for all components in sufficient detail to allow an item-by-item comparison with the Contract Documents.

B. Informational Submittals: Submit the following:
1. Manufacturer's Instructions:
   a. Shipping, handling, storage, installation, and start-up instructions.
2. Source Quality Control Submittals:
   a. Factory test reports and results.
3. Special Procedure Submittals:
   a. Submit written procedure for system checkout to ENGINEER.
   b. Submit notification to OWNER and ENGINEER at least 14 days before readiness to begin system checkout, but not prior to CFPUA's approval of the checkout procedure. Schedule system checkout on dates agreed to by OWNER and ENGINEER.
4. Field Quality Control Submittals:
   a. Submit the following prior to commencing system checkout and start-up.
      1) Completed calibration sheets for magnetic flow meter showing five-point calibration (0, 25, 50, 75, 100 percent of span), signed by factory-authorized serviceman.
   b. Field calibration reports
   c. Field testing reports.
5. Supplier's Reports:
   a. Installation inspection and check-out report.
   b. Submit written report of results of each visit to Site by Supplier's service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
6. Qualifications Statements:
   a. Manufacturer, when required by ENGINEER.

C. Closeout Submittals: Submit the following:
1. Operations and Maintenance Data:
   a. Include acceptable test reports, maintenance data and schedules, description of operation, wiring diagrams, and list of spare parts recommended for one year of operation with current price list.

D. Maintenance Materials Submittals: Submit the following:
1. Spare Parts and Test Equipment:
   a. Provide replacement spool piece where bypass piping is not provided.
   b. Transmitter.

c. Furnish a recommended list of additional spare parts and test equipment and itemized price.

1.5 STORAGE AND HANDLING

A. Prior to packaging, each manufacturer or Supplier shall securely attach tag number and instructions for proper field handling and installation to each instrument.

B. Comply with Section 01 60 00 - Product Requirements.

PART 2 PRODUCTS

2.1 MAGNETIC FLOW METERS

A. Manufacturers:
1. ABB Magmaster, plus MFF.
2. Emerson/Rosemount 8700 Series.
3. Toshiba LF 654 Series.
4. Or as approved.

B. Method of Operation: Produce a pulsed DC magnetic field that, when applied to a conductive liquid, generates an induced voltage as the liquid flows through the magnetic field. Generate voltage directly proportional to the flow of the metered liquid. Identify the ratio of flow velocity to voltage generated for all meter sizes, thereby permitting primary head and transmitter direct adaption and interchangeability without circuit modifications or system recalibration.

C. Performance Requirements:
1. Range:
   a. Minimum Flow Rate: <_____> GPM (Engineer to provide).
   b. Maximum Flow Rate: <_____> GPM (Engineer to provide).
   c. Average Flow Rate: <_____> GPM (Engineer to provide).
2. Indication: Provide remote panel mounting for digital display of flowrate and totalized flow.
3. Accuracy (with analog output):
   a. ±0.5 percent of flow rate, or better, over a range from 1 fps to 31 fps.
   b. ±0.005 fps, or better, at flows below 1 fps.
   c. Accuracy unaffected by changes in fluid velocity, density, pressure, temperature or conductivity (above minimum conductivity limits).
   d. System accuracy shall be proven by submittal of flow test curves of the actual meters being furnished.
      1) Test curves shall show a minimum of ten equally spaced flow points. Tests shall be performed using water and a weight or volume tank. A “master meter” used as a reference standard is not acceptable.
4. Repeatability: ±0.15 percent of flow rate, or ±0.0015 fps, whichever is greater.
5. Drift: Complete zero stability.
6. Minimum Fluid Conductivity Limit: Five microsiemens per centimeter or less.
7. Minimum Pre-amp Input Impedance: 1012 ohms.

8. Power:
    a. 120 VAC ± 10 percent, 60 Hz, ±3 Hz power supply.
    b. Power Consumption shall not exceed 50 watts for flowtube and transmitter combined.
9. Output:
    a. 4 to 20 mADC, direct acting and isolated, into 0 to 1000 ohms.
    b. High accuracy, field adjustable scaled pulse output (0.1 to 10 Hz or greater) to drive local totalizer.
10. Operating Temperature: Suitable for operation with process fluid temperature from 0° to 140°F.
11. Pressure Rating: Greater than or equal to 150 psi or test pressure specified in Section 33 05 05.31, Hydrostatic Testing, for appropriate piping system.

2.2 FLOW TUBE

A. Size: <_____> inches.

B. Flow Tube Material: Type 304 stainless steel.

C. Housing:
    1. Material: Carbon steel with corrosion-resistant polyurethane paint finish.
    2. Pressure Rating: 150 psi minimum.

D. Liner Material: Neoprene, Polyurethane, or Teflon (PTFE).

E. Electrodes Design and Material: Type 316L stainless steel or Hastalloy C.

F. Minimum Conductivity: 5 uS/cm (20 uS/cm for demineralized water).

G. Grounding Rings:
    1. Provide each primary head with two grounding rings installed on each end of the primary head.

H. Accidental Submergence Ratings: IP67; accidental submergence to 30 feet for up to 48 hours.

I. Zero Stability: Provide a sero stability feature as an inherent characteristic of the flowmeter system to avoid zero drift.

2.3 FLOW TRANSMITTER

A. Description: Microprocessor-based transmitter unit requiring no calibration over its expected life, under normal use.

B. Power Supply: Operate meters from 120 VAC (±1 percent) at 60 Hz (±5 percent). Factory-wire and assembly primary head and transmitter components, ready for external field connections. Provide required lengths of shielded signal cable for connecting the primary head and transmitter for the raceway route as detailed.

C. Housing: NEMA 4X enclosure; remotely mounted as indicated in the Schedule at the end of this Section.

D. Accuracy:
   1. ±1.0 percent of flow rate or better for flows above 1 foot/second.
   2. ±0.5 percent of flow rate or better for flows avove 2 foot/second.

E. Low Flow Cutoff: Adjustable low flow cutoff set point. Output shall be driven to zero (4 mAdc) when flow falls below low flow cutoff point.

F. Empty Pipe Detection: Drive output to zero (4 mAdc) when empty pipe is detected.

G. Totalization: Provide totalization of flow for direction of measured flow.

H. Temperature Range: -18 to 60 degrees C.

I. Outputs:
   1. 4-20 mA 0 to 1000 ohms, providing 50 megohms of isolation from ground, and isolated from the transmitter's power supply. Minimum of 250 ohms is required for HART communicator.
   2. Pulse output with minimum time duration of 0.5 seconds.

2.4 ACCESSORIES

A. Mounting:
   1. Provide complete Type 316 stainless steel mounting hardware for all transmitter and driver electronics locally mounted and remotely mounted from the flow tubes.
   2. Type of mounting (wall, support frame or pipe stand) as required inside vault and remote enclosure.

B. Shielded cable assemblies of sufficient length for connection between flowtube and transmitter electronics.

C. Type 316 stainless steel grounding rings for flowtubes.

D. Type 316 stainless steel grounding straps.

2.5 AC POWER ON-OFF SWITCH

A. Function: Local power on-off selector switch for magnetic flowmeters. All four-wire transmitters shall be provided with a 120 VAC power on-off selector switch located at the instrument.

B. Construction Features:
   1. Selector Switch: NEMA 4X rated, SPDT.
   2. Enclosure: NEMA 4X rated, non-metallic.
   3. Products and Manufacturers: Provide one of the following:
      a. Allen Bradley 800H rosite glass polyester enclosure.
      b. Or Pre-Approved equal.

2.6 SOURCE QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements.

B. Provide shop inspection and testing of meters.

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. Spedified shop tests are not required for Work performed by approved manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. To create optimum flow conditions, install meter with the manufacturer’s recommended straight length of pipe on the inlet side and outlet side of meter. Consult with specific meter manufacturer for optimum installation instructions.

B. Installation in accordance with manufacturer’s instructions.

C. Grounding:
   1. If the magnetic flowmeter does not provide a continuous flange-to-flange conductive path outside the area of the magnetic field, install ground rings and connect to each other with a No. 6 AWG ground wire.
   2. Ground magnetic flowmeter to the structure ground with a No. 6 AWG ground wire.

D. Electrical work for underground and potential flooding areas:
   1. Install drip leg in the conduit system and slope conduit downward away from magnetic flowmeter. Provide drain fitting in low part of conduit system to drain conduit system.
   2. Seal conduit entrance into magnetic flowmeter with RTV silicone sealant.
   3. Follow manufacturer’s instruction as required to maintain IP67 or IP68 rating.

E. Support piping adjacent to meter such that no weight is carried on meter casings.

3.2 CALIBRATION

A. Factory-set full-scale output to maximum flow rates.

B. Calibrate pulse output to provide a pulse every 1,000 gallons.

3.3 MANUFACTURER’S START-UP SERVICES

A. Manufacturer must certify that meter is properly designed and installed.

B. Provide a minimum of 8 hours of service.

END OF SECTION

SECTION 40 78 00

PANEL MOUNTED INSTRUMENTS AND DEVICES

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, calibrate, test, adjust and place into satisfactory operation panel instruments and devices.
   2. Contract Documents illustrate and specify functional and general construction requirements of the panel components and do not necessarily show or specify all components, wiring, piping, and accessories required to make a completely integrated system. CONTRACTOR shall provide all piping, wiring, accessories, and labor required for a complete, workable, and integrated system.

B. Coordination: Coordinate the installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems.

1.2 QUALITY ASSURANCE

A. Qualifications:
   1. Supplier:
      a. Shall be financially sound with at least five years of continuous experience in designing, implementing, supplying, and supporting process control systems for municipal wastewater pumping stations comparable to process control systems required for the Project, relative to hardware, software, cost, and complexity.
      b. Shall have record of successful process control system equipment installations. Upon ENGINEER's request, submit record of experience for at least five projects, each with the following information: project name, owner name and contact information, name, and contact information for contractor, name and contact information for engineer or architect, approximate and contract value of process control systems Work for which Supplier was responsible.
      c. Shall have experienced engineering and technical staff capable of designing, supplying, implementing, and supporting the instrument and control system and complying with submittal and training requirements of the Contract Documents.
      d. Shall be capable of training operations and maintenance personnel in process control system applications, and in operating, programming, and maintaining the control system and equipment.
      e. Shall have UL-approved panel shop.
      f. Supply and support system hardware components and software packages of fully developed and field-proven standardized designs that are not a highly unique, custom, or one-of-a-kind systems.
      g. Offer standard courses in general process control applications, programming, and maintenance of the PCS and equipment at a facility specifically utilized for training. Training facility shall have been in operation continuously for the previous two years, minimum.

h. Possess and maintain a documented program of failure analysis.

B. Acceptable Manufacturers:
1. Furnish instruments and devices by the named manufacturers or equal equipment by other manufacturers.
2. The named manufacturers have been specified to establish the standard of quality and performance of the equipment to be supplied.
3. Obtain all instruments or devices of a given type from the same manufacturer.

C. Manufacturers' Responsibilities and Services:
1. System Checkout and Start-Up
a. CONTRACTOR, under the supervision of the PMCS Supplier, and other instrument suppliers as applicable, shall perform the following:
1) Check and approve the installation of all PMCS components and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation.
2) Conduct a complete system checkout and adjustment, including calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. When there are future operational functions included in this work, they should be included in the system checkout. All problems encountered shall be promptly corrected to prevent any delays in start-up of the various unit processes.
b. CONTRACTOR shall provide all test equipment necessary to perform the testing during system checkout and start-up.
c. CONTRACTOR and Supplier shall be responsible for initial operation of monitoring and control system and shall make any required changes, adjustment, or replacements for operation, monitoring and control of the various processes and equipment necessary to perform the functions intended.
d. CONTRACTOR shall furnish to the ENGINEER certified calibration reports for field instruments and devices and panel mounted devices as soon as calibration is completed.
e. CONTRACTOR shall furnish ENGINEER an installation inspection report certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by authorized representatives of both CONTRACTOR and the Supplier.
2. On-Site Training
a. Primary Sensors/Transducers and Field Instruments:
1) Provide on-site operation and maintenance training by Supplier and the equipment manufacturer representatives prior to placing the equipment in continuous operation. The services of equipment manufacturer's representatives shall be provided for a minimum of eight hours for each type of instrument provided.
2) Training shall accomplish the following:
a) Provide instruction covering use and operation of the equipment to perform the intended functions.
b) Provide instruction covering procedures for routine, preventive and troubleshooting maintenance including equipment calibration.
c) Explain procedures for placing the equipment in and out of operation and explain necessary actions and precautions to be taken regarding the overall plant monitoring and control system.

b. Training covering the control equipment:
    1) The Supplier shall provide one day of operations training covering all system components.
    2) Training course shall accomplish the following:
        a) Provide all instructions necessary to operate and utilize all system components.
        b) Provide all instruction necessary to monitor and control the system processes from the designated control panel.
        c) Explain procedures for control of the system during scheduled or rescheduled shutdown and the subsequent start-up.
        d) Provide instructions for regular caretaking operations.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:
    1. Shop Drawings:
        a. Field Instruments:
            1) Manufacturer's product name and complete model number of devices proposed for use, including manufacturer's name and address.
            2) Instrument tag number in accordance with the Contract Documents.
            3) Data sheets and manufacturer's catalog literature. Provide data sheets in accordance with ISA 20 and annotated for features proposed for use. For instruments not included in ISA 20, submit data sheets using a format similar to ISA 20.
            4) Description of construction features.
            5) Performance and operation data.
            6) Installation, mounting, and calibration details; instructions and recommendations.
            7) Service requirements.
            8) Dimensions of instruments and details of mating flanges and locations of closed tanks, pipe sizes for insertion instruments, and upstream/downstream straight run pipe lengths required.
            9) Range of each device and calibration information
            10) Descriptions of materials of construction and listing of NEMA ratings for equipment
        b. Panels, Consoles, and Cabinets:
            1) Layout drawings that include:
                a) Front, rear, and internal panel views to scale.
                b) Tag number and functional name of components mounted in and on panel, console, or cabinet, as applicable.
                c) Product information on panel components.
                d) Nameplate location and legend including text, letter size and colors to be used.
                e) Location of anchorage connections.
                f) Location of external wiring and piping connections.
                g) Mounting and installation details, coordinated with actual application.
                h) Proposed layouts and sizes of operator interface graphic display panels and alarm annunciator panels.

i) Calculations substantiating panel heating and cooling provisions proposed.
j) Subpanel layouts and mounting details for items located inside control panels.

2) Product information on panel components including:
a) Manufacturer's product name and complete model number of devices being provided, including manufacturer's name and address.
b) Instrument tag number in accordance with the Contract Documents.
c) Data sheets and catalog literature. Submit data sheets as shown in ISA 20 and annotated for features proposed for use. For instruments not included in ISA 20, submit data sheets with format similar to ISA 20.
d) Description of construction features.
e) Performance and operation data.
f) Installation, mounting, and calibration details; instructions and recommendations.
g) Service requirements

3) Wiring and piping diagrams, including the following:
a) Name of each panel, console, or cabinet.
b) Wire sizes and types.
c) Pipe sizes and types.
d) Terminal strip and terminal numbers.
e) Wire color coding.
f) Functional name and manufacturer's designation for components to which wiring, and piping are connected.
g) Lightning and surge protection grounding.

4) Electrical control schematics in accordance with NFPA 79. Control schematics shall be in accordance with convention indicated in Annex D of NFPA 79. Standardized wiring diagrams that do not accurately reflect actual wiring to be furnished are unacceptable. Tables or charts for describing wire numbers are unacceptable.

5) Stock list or bill of materials for each panel including tag number, functional name, manufacturer's name, model number and quantity for components mounted in or on the panel or enclosure.

6) Detail showing anchorage plan of wire bundles between subpanels and front panel mounted devices.

c. Field wiring and piping diagrams, include the following:
1) Wire and pipe sizes and types.
2) Terminal numbers at field devices and in panels.
3) Fiber optic termination designations in the field and in panels.
4) Color coding.
5) Conduit numbers in which wiring will be located.
6) Locations, functional names, and manufacturer's designations of items to which wiring, or piping are connected.

d. Control System:
1) Submit the following general information:
a) Detailed block diagram showing system hardware configuration and identifying model numbers of system components.

b) Software listings for operating system, applications, and HMI.
c) Software language and organization.
d) Format, protocol and procedures for data transmission and communications with input/output modules and peripheral devices.
e) Control and failure modes.
f) Online and offline capabilities for programming, system utilities, and diagnostics.

2) Hardware:
a) Layout drawings showing front, rear, end, and plan views to scale of equipment, I/O components, power supplies, and peripheral devices.
b) Equipment ventilation and cooling requirements.
c) Interconnection diagrams, including termination details, cable identification list, and cable length.
d) Drawings showing equipment layout.
e) Installation requirements, instructions, and recommendations.

3) Software:
a) Licensing agreement with name of licensee, renewal requirements, release and versions, expiration dates (if any) and upcoming releases scheduled before Project completion. When upcoming releases are expected, provide descriptions, when available, of features that differ from the proposed release.
b) Provide information of number of run, client, and development licenses as well as I/O point count limit per license.
c) Standard technical and instructional documentation covering software for utility, system support, system documentation, display, communications, data logging and storage and diagnostic functions. Submit this information as electronic files.
d) Standard technical documentation covering all aspects of the computer system software functions and capabilities, including instruction set description and programming procedures related to monitoring, display, logging, reporting and alarming functions.

4) Documentation describing memory type, size and structure and listing size of system memory, I/O and data table memory and size of memory available for control programs.

5) System I/O Loop Wiring Diagrams: Prepare Shop Drawings on module-by-module basis and include the following information:
a) Rack numbers, module type and slot number, and module terminal point numbers. Include location and identification of intermediate panel and field terminal blocks and terminal numbers to which I/O wiring and power supply wiring is connected. Identify power supply circuits with designation numbers and ratings.
b) Wiring types, wire numbers, and color coding.
c) Designation of conduits in which field I/O wiring will be installed.
d) Location, functional name, tag numbers and manufacturer's module numbers of panel and field devices and instruments to which I/O wiring will be connected.
e) Prepare loop wiring diagrams in accordance with ISA 5.4.

f) Complete point-to-point interconnection wiring diagrams of field wiring associated with the system. Diagrams shall include the following:
   1. Field wiring between each equipment item, panel, instruments, and other devices, and wiring to control stations, panelboards, and motor starters. Some of this equipment may be specified in other Divisions. CONTRACTOR is responsible for providing complete point-to-point interconnection wiring diagrams for control and monitoring of that equipment.
   2. Numbered terminal block and terminal identification for each wire termination.
   3. Identification of assigned wire numbers for interconnections. Assign each wire a unique number.
   4. Schedule showing the wiring numbers and the conduit number in which the numbered wire is installed.
   5. Junction and pull boxes through which wiring will be routed.
   6. Identification of equipment in accordance with the Contract Documents.

2. Product Data:
   a. Product data for field instruments in accordance with requirements for Shop Drawings in this Section.
   b. Product data for panels, consoles, and cabinets in accordance with requirements for Shop Drawings in this Section.
   c. Product data for field wiring and piping provided for instrumentation and control service and not included under other Sections or contracts.
   d. Product data for control system, including software and hardware. Requirements for software product data are included in requirements for Shop Drawings under this Section.
3. Samples:
   a. Color charts for finish paint for metallic panels. Provide full range of paint manufacturer's standard and custom colors. Color selection will be by ENGINEER.
   b. Color charts for fiberglass-reinforced panels. Provide full range of panel manufacturer's standard and custom colors. Color selection will be by ENGINEER.
4. Factory Acceptance Test Procedure: Submit proposed procedures for factory testing required to comply with the Contract Documents. Test procedure shall include the following:
   a. Visual inspection of components and assembly.
   b. Description of hardware operational testing.
   c. Description of software demonstration.
   d. Description of testing equipment to be used.
   e. Sign-off sheets to be used at time of testing.

B. Informational Submittals: Submit the following:
   1. Documents to be submitted prior to pre-submittal conference, in accordance with Section 1.3 of this specification.
   2. System Software Documentation: Submit preliminary software documentation not later than 28 days prior to scheduled start of factory testing. Software documentation shall include the following:

a. Complete printed copies of all programming.
b. Complete listing of external and internal I/O address assignments, register assignments and preset constant values with function point descriptions. List unused/undefined I/O and data table registers available.
c. Copies of all configured HMI screens.

3. Manufacturer's Instructions:
   a. Shipping, handling, storage, installation, and start-up instructions.
   b. Templates for anchorage devices for materials and equipment that will be anchored to concrete or masonry.
4. Source Quality Control Submittals:
   a. Results of factory testing.
5. Special Procedure Submittals:
   a. Notification to OWNER and ENGINEER at least 14 days before readiness to begin system checkout at the Site. Schedule system checkout on dates acceptable to OWNER and ENGINEER.
   b. Written procedure for system checkout. Submit not less than 90 days prior to starting system checkout.
   c. Ninety days prior to starting system checkout submit written procedure for start-up.
6. Field Quality Control Submittals:
   a. Submit the following prior to commencing system checkout and start-up.
      1) Completed calibration sheets for each installed instrument showing five-point calibration (zero, 25, 50, 75, 100 percent of span), signed by factory-authorized serviceman.
   b. Field calibration reports
   c. Field testing reports.
7. Supplier's Reports:
   a. Installation inspection and check-out report.
   b. Submit written report of results of each visit to Site by Supplier's service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
8. Qualifications Statements:
   a. I&C Subcontractor.
   b. I&C Supplier.
   c. Manufacturers, when required by ENGINEER.

C. Closeout Submittals: Submit the following:
1. Operations and Maintenance Data:
   a. Submit operation and maintenance data.
   b. Include complete up-to-date system software documentation. Provide hardcopy and electronic copies.
2. Record Documentation:
   a. Prepare and submit record documents in accordance with Section 01 78 39 - Project Record Documents.
   b. Revise all PCS Shop Drawings to reflect as-built conditions in accordance with the following.
      1) Use "as-built" updates of approved Shop Drawings and submittals in operation and maintenance manuals.

2) Half-size black line prints of wiring diagrams applicable to each control panel shall be placed in clear plastic envelopes inside a suitable print pocket or container inside each control panel.
3) Submit drawings of the point-to-point interconnection wiring diagrams updated to reflect final as-built equipment information and as-installed field installation information.

D. Maintenance Materials Submittals: Submit the following:
1. Spare Parts and Test Equipment
a. General
1) Furnish the spare parts and test equipment in accordance with the Contract Documents, identical to and interchangeable with similar materials and equipment provided for the PCS under the Contract.
2) Provide source quality control for spare parts as part of factory testing prior to shipment of process control system equipment.
3) For process sensors and other analog instruments, Supplier shall submit a separate quotation for recommended list of spare parts and test equipment. Separately list and price each item recommended. Spare parts quotation shall include a statement that prices quoted are valid for a period of one year from date of equipment installation and that Supplier understands that OWNER reserves the right to purchase none, any, or all parts quoted. Upon request, Supplier shall submit documentation that stock of spare parts and test equipment is obtainable within 48 hours of receipt of OWNER's order.
b. Furnish the following spare parts:
1) Five of each type of input/output relay for each quantity of forty or fraction thereof provided under the Contract.
2) One of each type of PLC input/output module or card used.
3) One replacement power supply for each type and size provided under the Contract.
4) One-year supply of all expendable or consumable materials.
5) One per quantity of five or fraction thereof of gauges, indicators, and switches provided, complete with diaphragm seals, filled and ready to use.
6) One per quantity of ten of fraction thereof provided, per range of field instruments including insertion type instruments. No spares are required for inline instruments such as magnetic flow meters and flumes or venturis that include flow tubes through which flow is conveyed.
7) Twelve of each type and size of fuse used in instruments.
c. Furnish the following test equipment:
1) Three Fluke, Hewlett-Packard, or equal (latest in series) digital multimeter plus amprobe, high-voltage probe, test leads, case, and other recommended spares and accessories.
2) One of each set of special tools required to insert, extract, and connect internal or external connectors, including edge connectors.
3) One set of special calibration equipment required for system calibration.
4) One thermocouple calibrator, including case.
5) Two signal simulators (4 to 20 mA DC; 1 to 5 VDC), including case. One simulator shall be battery-powered and shall include charger.
6) One portable flow meter calibrator, for magnetic flow meter use only.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Prior to packaging, each manufacturer or Supplier shall securely attach tag number and instructions for proper field handling and installation to each instrument.

1.5 IDENTIFICATION TAGS

A. All panel instruments and devices shall have an identification tag meeting the following requirements:
   1. Tag numbers shall be as listed in the Instrument Index.
   2. Identifying tag number shall be permanently etched or embossed onto a stainless-steel tag which shall be fastened to the device housing with stainless steel rivets or self-tapping screws of appropriate size.
   3. Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch diameter stainless steel wire rope.
   4. All instruments and devices mounted within panels shall have the stainless-steel identification tag installed so that the numbers are easily visible to service personnel. Front of panel mounted components shall have the tag attached to the rear of the device.
   5. Front of panel mounted components shall have nameplates, which comply with the requirements specified in Section 26 29 15 - Pump Control Panels.

PART 2 PRODUCTS

2.1 POWER SUPPLIES

A. General: Single unit power supplies, located in control room panels, remote terminal units and field panels as required.

B. Single Unit Required Features:
   1. Solid state circuitry.
   2. Surface mounting.
   3. Input Power: 120 VAC ±10 percent, 60 Hz.
   4. Output Power: 24 VDC or as required.
   5. Line/Load Regulation: ±0.005 percent.
   6. Ripple: 0.25 mV RMS.
   7. Polarity: Floating output.
   8. Ambient Temperature: -20°C to +71°C.
   9. Response Time: <20µS.
   10. Overload Protection: Internal preset.
   11. Include mounting brackets, fuse, and mating connector for AC power plug.

C. Products and Manufacturers: Provide one of the following:
   1. Acopian Corporation, Gold Box Series A.
   2. Or equal.

2.2 UNINTERRUPTIBLE POWER SYSTEM

A. Uninterruptible Power System (UPS) shall be furnished to provide a reliable source of uninterruptible power with no break in AC output power during a complete or partial interruption of incoming line power. UPS shall include audio/visual alarms. UPS shall be UL listed.

B. Rating: 120 VAC, 60 Hz, [1500] <_____> VA / [865] <____> W minimum.

C. Description: On-line dual track power conditioner and true (0 ms transfer time) uninterruptible power supply providing isolation, line regulation and conditioning, using sealed 48 VDC maintenance free batteries and switch mode power supply for uninterrupted power with 0.5 to 0.7 power factor and 2.7 to 3.5 crest factor.

D. Required Features:
   1. Surge Protection and filtering.
   2. Operating Temperature: 0°C to 40°C.
   3. Relative Humidity: 0 to 95 percent non-condensing.
   4. Operating Computer Interface: USB.
   5. AC Input: 120 VAC, 60Hz, single phase.
   6. AC Output: 120 VAC, 60Hz, single phase, +3 percent, -3 percent.

E. Products and Manufacturers: Provide one of the following:
   1. APC #BR1500G with one (1) extended run battery pack #BR24BPG.
   2. Or equal.

2.3 SELECTOR SWITCHES, PUSHBUTTONS AND INDICATING LIGHTS

A. General:
   1. Selector switches, pushbuttons and indicating lights shall be supplied by one manufacturer and be of the same series or model type.
   2. Type:
      a. Heavy duty, oil tight.
   3. Provide legend plate for indication of switch, pushbutton, or light function (e.g., "OPEN-CLOSED", "HAND-OFF-AUTO").
   4. Mounting: Flush mounted on control panel front, unless otherwise noted.
   5. NEMA rated to match panel in which mounted.

B. Selector Switches:
   1. Type: Provide selector switches with number of positions as required to perform intended functions as shown and specified.
   2. Contacts:
      a. Provide number and arrangement of contacts as required to perform intended functions specified, but not less than one single pole, double throw contact.
      b. Type: Double break, silver contacts with movable contact blade providing scrubbing action.
      c. Rating: Compatible with AC or DC current with devices simultaneously operated by the switch contacts, but not less than 10 A resistive at 120 VAC or DC continuous.
   3. Switch Operator: Standard black knob.

C. Pushbuttons (Standard or Illuminated):

1. Type: Provide momentary lighted and/or unlighted, single and/or dual type pushbuttons as required to perform intended functions specified and shown.
2. Contacts: Comply with the requirements specified for selector switches.

D. Indicating Lights:
1. Type: Compact, LED, push-to-test.

E. Button and Lens Colors:
1. Green for indication of open, on, running.
2. Red for indication of closed, off (ready), stopped.
3. Amber for indication of equipment malfunction, process trouble and alarms (e.g., "HIGH LEVEL", "LOW LEVEL", etc.).
4. Blue for indication of electrical control power on.

F. Rotary Cam Switches:
1. Provide rotary cam switches with number of positions and poles as required to perform the required signal switching function specified and shown.
2. Contacts:
a. Gold-flashed contacts housed in mechanical contact blocks with number and arrangement of contacts as required to perform intended functions.
b. Contact Rating: Compatible with AC or DC through-put current of signals and devices simultaneously operated by the switch contacts, but not less than 20 A at 600 VAC or 250 VDC continuous.
3. Switch Operator: Standard black knob.

G. Products and Manufacturers: Provide one of the following:
1. Cutler-Hammer, Type E30.
2. Allen Bradley, Series 800.
3. Schneider Electric, Class 9001.

2.4 DIGITAL INDICATOR

A. General: The digital indicator shall accept an analog input and convert it to scaled numerical characters for digital display and also provide up to two alarm outputs.

B. Required Features:
1. Display Height: 0.56-inch.
2. Display Capacity: Four digits with decimal point position jumper selectable.
3. Display Type: Seven segment, red LED.
4. Accuracy: ± 0.05 percent.
5. Analog Input: 4 to 20 mADC.
6. Excitation Output: 15 VDC for powering transmitter.
7. Analog Output: Proportional 4 to 20 mADC.
8. Alarm Output: Dual with two 2 A relays.
9. Temperature Range: 0°C to 60°C.
10. Power: 120 VAC, + 10 to -15 percent, five watts.
11. Enclosure: NEMA 4 splash proof.

C. Products and Manufacturers: Provide one of the following:
1. Newport Electronics, Model Q9000E.

2. Precision Digital, Model PD690.
3. Or equal.

2.5 ANALOG INDICATOR

A. General: Indicator Unit shall be a signal monitoring instrument that provides continuous monitoring of a process variable on a scaled vertical bar display. Indicator shall match in appearance other panel mounted instruments.

B. Description: Indicator Unit shall display one process variable.

C. Required Features:
1. Input Signals: 1 to 5 VDC (into 10 megohm) or 4 to 20 mADC (into 250 ohm range resistor).
2. Power Required: 21 to 28 VDC; nominal input current at 24 VDC is 400 mA.
3. Displays: One segmented gas-discharge or LED vertical bar display.
4. Display Accuracy: One percent of input span.
5. Scale Length: Approximately 3-inches.
6. Operating Influences:
   a. Ambient Temperature: Maintains display accuracy ratings for temperature change within normal operating conditions.
   b. Supply Voltage: Maintains display accuracy ratings for supply voltage variation between 21 and 28 VDC.
   c. Electromagnetic Interference (EMI): Maintains display accuracy ratings when instrument is subjected to an electromagnetic field of up to ten volts/meter (when rack-mounted in cabinet with door closed). Display station must be installed in panel.
7. Operating Conditions:
   a. Ambient Temperature: 41 to 122°F (5 to 50°C).
   b. Maximum Temperature Variation: 36°F per hr (20°C per hr).
   c. Ambient Relative Humidity: Ten to 90 percent non-condensing.
8. Mounting: Display station installs in a nominal 1-inch by 6-inch panel cutout and shall match in appearance other panel mounted instruments.

D. Products and Manufacturers: Provide one of the following:
1. OTEK Corporation, Model HI-QSLIM.
2. Ametek/Dixson, Model BE051.
3. Or equal.

2.6 ELECTRONIC COUNTER

A. General: The unit shall be a self-powered, reset able, solid-state counter which provides silent, accurate and noise immune operation.

B. Required Features:
1. Power: Battery, five-year minimum life.
2. Display:
   a. Type: Liquid crystal.
   b. Digits: Eight.
   c. Figure Size: 1/2-inch approximately.

d. Display Life: 50,000 hours minimum.
3. Count Input: Dry Contact.
4. Operating Temperature: 0°C to 70°C.
5. Operating Humidity: 60 percent non-condensing.
6. Enclosure: NEMA 4X.
7. Accuracy: 100 percent.
8. CMOS Circuitry.
9. Mounting: Provide accessories for panel mounting.
10. Nameplate below the LCD display shall carry the equipment name and units as shown.

C. Products and Manufacturers: Provide one of the following:
1. Durant, Model 53300-400.
2. Or equal.

2.7 CYCLE TIMER

A. Type: Adjustable, microprocessor-based multipurpose timer/counter.

B. Construction Features:
1. Switch selectable ranges as follows:
a. 0 to 0.99 seconds.
b. 0 to 99.9 seconds.
c. 0 to 999 seconds.
d. 0 to 9.99 minutes.
e. 0 to 99.9 minutes.
f. 0 to 999 minutes.
g. 0 to 99.9 hours.
h. 0 to 999 hours.
2. Repeat Accuracy:
a. Timer: ±10 ms on all ranges.
b. Counter: 100 percent on all ranges.
3. Memory: Non-volatile memory that will retain entire program and present time/count periods at loss of power; programmable for both reset and non-reset power fail operation.
4. Operating Temperature: 32 to 140°F.
5. Cycle Progress Display: Three-digit display, programmable to run up to or down from the setpoint and to stop or continue up from zero after time-out/count-out.
6. Time/Count Periods: Three programmable presets; pulse, early and main.
7. Load Relays:
a. Type: DPDT.
b. Number: One early and one delayed.
c. Contact Ratings: Seven amps at 120 VAC.
8. Terminals: Screw terminals accessible at rear.
9. Housing: Fully gasketed, dust and watertight.
10. Power Input: 120 VAC.

C. Products and Manufacturers: Provide one of the following:
1. Automatic Timing and Controls Company, Model 365M.
2. Or equal.

2.8 ELECTRONIC TOTALIZER AND INTEGRATOR

A. General:
   1. Electronic integrator shall be a solid-state device to totalize a linear flow signal with respect to time. The integrated output shall be indicated on a front counter, calibrated to read directly in units of flow and shall be mounted on the panel face.

B. Required Features:
   1. Modular plug-in design.
   2. Variable dropout adjustment shall be provided to prevent erroneous counting at low flow rates.
   3. Input Signal: 4 to 20 mADC.
   4. Power Requirements: 120 VAC ±10 percent, 60 Hz.
   5. Accuracy: 0.5 percent of rate between 10 and 100 percent of full scale.
   6. Slide-out chassis.
   7. Suitable for flush panel mounting.
   8. Unit shall match in appearance other panel mounted instruments.
   9. Integrator Output Display:
      a. Integrally mounted six or eight-digit LCD.
      b. Non-reset.
      c. Battery backed to prevent loss of display in the event of power outages.
   10. Enclosure: NEMA 4X.
   11. Ambient Operating Temperature: 0°C to 55°C.
   12. Ambient Operating Humidity: 0 to 85 percent non-condensing.

C. Products and Manufacturers: Provide one of the following:
   1. Foxboro, Model 75RTA.
   2. Precision Digital, Model PD692.
   3. Or equal.

2.9 ELAPSED TIME METER (HOUR METER)

A. General: Unit shall be a powered, non-resettable time indicator, with easy to read analog figures.

B. Required Features:
   1. Power: 120 VAC, or 4 to 40 VDC.
   2. Accuracy: Within one percent.
   3. Capacity: Up to 99,999.9 hours (automatic recycle at zero); one-tenth hour resolution.
   4. Operating Temperature: -40°C to +68°C.
   5. Sealed against dirt and moisture.
   6. Tamperproof.
   7. Shock resistant.
   8. Panel mountable.
   9. Nameplate below display shall read "TOTAL HOURS".

C. Products and Manufacturers: Provide one of the following:
   1. Veeder-Root, 7795 Series.
   2. Honeywell, 20000 Series.

3. Or equal.

2.10 CONTROL RELAY

A. Type: General purpose, plug-in type rated for continuous duty.

B. Construction Features:
   1. Coil Voltages: 24 VDC or 120 VAC, as required.
   2. Contacts:
      a. Silver cadmium oxide rated not less than 5 A resistive at 120 VAC or 24 VDC continuous.
      b. For switching low energy circuits (less than 200 mA) fine silver, gold flashed contacts rated not less than 3 A resistive at 120 VAC or 28 VDC continuous shall be provided.
   3. Relays to have clear plastic dust cover.
   4. Relays to have pilot light to show energized coil.
   5. Relays to be UL recognized.

C. Products and Manufacturers: Provide one of the following:
   1. Square D Company, Type R and/or Type K.
   2. IDEC, RR Series.
   3. Or equal.

2.11 TIME DELAY RELAY

A. Type: Dial adjustable, plug-in type time delay relay providing ON delay timer operation.

B. Construction Features:
   1. Contacts:
      a. Type: DPDT.
      b. Rating: 5 A resistive at 120 VAC, 5 A at 24 VDC.
   2. Housing: Plug-in design with dust and moisture resistant molded plastic case.
   3. Power Input: 120 VAC or 24 VDC as required.
   4. Operating Temperature: 0°C to 55°C.
   5. Unit shall have LED to show timing status.
   6. Relays to be UL recognized.

C. Products and Manufacturers: Provide one of the following:
   1. Square D, Schneider Electric, 9050JCK11V20.
   2. Automatic Timing and Controls Company, Series 328E.
   3. IDEC, Series GT5P.
   4. Or equal.

2.12 ALTERNATOR RELAY

A. Type: Enclosed, general purpose duplex alternating relay. Provided for alternation of the lead pump for each run cycle.

B. Construction Features:
   1. Plug-in base.

2. Polycarbonate dust cover.
3. Continuous rated coils with AC pickup voltages of 85% of nominal. Coil voltage as required.
4. Contacts rated at 120 VAC, 80 percent P.F., 10 amperes continuous, 30 amps make, 3 amps break.
5. Solid-state alternating circuit driving electro-mechanical relay coil.
6. Relays shall feature state indicating LEDs in the cover.

C. Products and Manufacturers: Provide one of the following:
1. Potter & Brumfield #S89R11APP1.
2. Or equal.

2.13 CURRENT ALARM RELAY

A. Type: Direct current, electronic setpoint control relay which accepts 4 to 20 mADC input signal and provides dry circuit contact output based on trip point setting.

B. Performance Requirements:
1. Repeatability: Trip point repeats within ±0.2 percent of span.
2. Trip Adjustment: 0 to 100 percent of span.
3. Adjustable Deadband: 1 to 15 percent of span.

C. Construction Features:
1. Trip Adjustment: Multi-turn front panel adjustment.
2. Contacts: DPDT relays, rated 5 A at 120 VAC or 24 VDC non-inductive.
3. Enclosure: Standard housing designed for internal panel mounting.
4. Power Supply: 120 VAC, 60 Hz or 24 VDC, as required.

D. Products and Manufacturers: Provide one of the following:
1. Ronan, X54 Series.
2. Action Pak, Model AP 1080.
3. Or equal.

2.14 MULTIPLIER

A. General: Computing element shall multiply or divide the signals shown. Provide sufficient quantities to accommodate all signals.

B. Required Features:
1. Input/output bias adjustments.
2. Process current inputs and outputs (4 to 20 mADC).
3. Input/output isolation.
4. 24 VDC power.
5. Linearity: ±0.15 percent of span.
6. Operating Temperature: 0°C to 55°C.

C. Products and Manufacturers: Provide one of the following:
1. Action Instruments, Model Q498.
2. Or equal.

2.15 CURRENT AND VOLTAGE TRANSDUCER

A. General: Transducer shall convert a sinusoidal alternating current or voltage into a DC current output, proportional to the RMS value of input.

B. Required Features:
   1. Inputs: 50/60 Hz.
      a. Current: 1A or 5A current transformer secondaries.
      b. Voltage: 50 to 480 VAC.
   2. Output: 4 to 20 mADC into 0 to 500 Ohms.
   3. Zero adjustment: ±Two percent minimum.
   4. Span adjustment: ±Ten percent minimum.
   5. Accuracy: ±0.5 percent.
   6. Response time: ≤ 400 ms. to 99 percent rated output.
   7. Operating Temperature: 0°C to 50°C.
   8. Operating Humidity: 0 to 95 percent non-condensing
   9. Output Protection: Fully protected against open or short circuit outputs.
   10. Overload Capacity: Two times rated current of 1.25 times rated voltage on a continuous basis.
   11. Surge Withstand: Conform to ANSI C37-90a.

C. Products and Manufacturers: Provide one of the following:
   1. Crompton Instruments, 250 Series.
   2. Ametek, Exceltronic II Series.
   3. Or equal.

2.16 WATT TRANSDUCER

A. General: Measure active power, in both balanced and unbalanced, single or 3 phase systems.

B. Required Features:
   1. Frequency: 60 Hz.
   2. Voltage: 50 to 480 volts with ±20 percent range and 2 va maximum burden.
   3. Current: 1A or 5A current transformer secondaries with 0 to 125 percent range and 1 va maximum border.
   4. Output: 4 to 20 mADC in 0 to 500 ohms.
   5. Supply: 120 VAC.
   6. Accuracy: 0.5 percent.
   7. Response Time: Less than 400 msec up 99 percent rated output.
   8. Output Protection: Fully protected against open or short-circuited output.

C. Products and Manufacturers: Provide one of the following:
   1. Crompton Instruments, 250 Series.
   2. Or equal.

2.17 ELECTRONIC HORN

A. General: The horn shall be of the multi-tone electronic audible type.

B. Required Features:
   1. Internal volume control.
   2. Field selection of up to 16 different tones.
   3. Power: 120 VAC or 24 VDC (provide power supply as required).
   4. Operating Temperature: 32 to120°F.
   5. Enclosure Rating: NEMA 4X.

C. Products and Manufacturers: Provide one of the following:
   1. Panalarm, Model NTZ.
   2. Or equal.

2.18 SPARE PARTS AND TEST EQUIPMENT

A. CONTRACTOR shall furnish and deliver the spare parts and test equipment as outlined below, all of which shall be identical and interchangeable with similar parts furnished under this Section.

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. The following shall constitute the minimum spare parts:
   1. One per ten (two, if fewer than twenty) of each type of input-output relay furnished for this Contract.
   2. One replacement power supply for each type and size furnished for this Contract.
   3. A one-year supply of all expendable materials.
   4. One per ten (two, if fewer than twenty) of each type of panel mounted instrument including lights, pushbuttons, and PLC equipment.
   5. Three of each type and size of fuse used in panels and instruments.

D. The following shall constitute the minimum test and calibration equipment:
   1. All tooling required to insert, extract, and connect any internal or external connector, including edge connectors.
   2. All special calibration equipment required for system calibration.

E. All spare parts shall have been operated and tested in the factory as part of factory testing prior to shipment of the control system.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install each item in accordance with manufacturers recommendations and in accordance with the Contract Documents.

B. All items shall be mounted and anchored in compliance with Section 26 29 15 - Pump Control Panels.

3.2 START-UP, CALIBRATION, TESTING AND TRAINING

A. Comply with the requirements of Manufacturer's Responsibilities and Services described in the Quality Assurance article of this Section.

END OF SECTION

SECTION 40 95 01

WASTEWATER PUMP STATION
SCADA COMMUNICATIONS AND REMOTE TELEMETRY UNIT (RTU)

PART 1 GENERAL

1.1 DESCRIPTION

A. Section Includes:
   1. Contractor requirements for electrical and instrumentation/control work to contract and coordinate with an CFPUA approved vendor, as an authorized agent, to install and program Supervisory Control and Data Acquisition (SCADA) Remote Terminal Units (RTU's) as described within this Specification and the Drawings.

B. Vendor, as an authorized agent, shall provide a Statement of Work to be approved by the CFPUA to include the programming and installation of the equipment. Statement of Work shall include:
   1. Programming and installation of the equipment to include communications and programming of the HMI software, to provide a fully operational system in accordance with the drawings and specifications.
   2. Based on the Statement of Work, CFPUA will procure for the vendor certain equipment including the RTU, antenna, and related equipment.

C. Contractor shall provide an interface terminal cabinet for circuitry connections to the SCADA RTU. Such circuitry will originate at the pump station control panel and other panels and devices to monitor the pump station status as indicated within this Specification and the Drawings.

D. Vendor shall provide conduits, conductors, and cables between the interface terminal cabinet and the SCADA RTU in coordination with Contractor. Conductor and cable terminations in the SCADA RTU shall be made by Vendor.

E. Contractor shall provide 120V to the SCADA RTU as indicated in the project drawings.

F. Contractor shall provide a conduit for the SCADA RTU antenna cable as indicated in the project drawings. The antenna mast, mast grounding, and cable will be provided and installed by the Vendor, as an authorized agent.

G. The vendor, as an authorized agent, shall install, program, and configure the RTU to interface with CFPUA's existing SCADA system and provide programming to interface with the RTU at the central SCADA system.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures

B. Statement of Work by the vendor.

PART 2 PRODUCTS

2.1 CFPUA RTU AND SCADA PRODUCTS SECURITY PROTOCOLS

A. CFPUA's RTU and SCADA system product information is secure by policy and detailed information may be released via an approved vendor request associated with a specific capital or development project.

2.2 FUNCTIONALITY

A. Equipment control panels shall operate independently of the SCADA/telemetry system in the event of failure of the remote communications link.

B. The RTU shall provide local automatic monitoring from float switches, bubbler systems, transducers, ultrasonic level sensor inputs, and dry contacts. Inputs shall be provided for both digital inputs and analog (4-20ma DC) transducers. Simultaneous monitoring of analog and digital level sensing devices shall be supported. Battery backup power shall be provided so that monitoring is maintained during primary utility power failures. Specific functions may vary based upon the pump station type and configuration as noted within the contract documents. The inputs indicated in this specification apply for a typical duplex, submersible pump station.

C. Fail-safe inputs shall be provided indicating intrusion into the RTU enclosure and building (if applicable). Upon loss of this signal, or a series of devices providing this signal, the RTU shall report an alarm to the Central HMIs.

D. Basic Digital Dry Contact Inputs follow:

Pump 1 Run Status
Pump 1 Overtemp Alarm
Pump 1 Overload Alarm
Pump 1 H-O-A Out of Auto Position Status
Pump 2 Run Status
Pump 2 Overtemp Alarm
Pump 2 Overload Alarm
Pump 2 H-O-A Out of Auto Position Status
High Level Alarm
High/High Level Alarm
Power Problem
Generator Alarm
Generator Run Status
Automatic Transfer Switch Not in "Normal Position" Status
RTU Intrusion
Generator Fault / Shutdown
Building Intrusion (if applicable)

E. Basic Analog Inputs follow:

Wet Level
Flow Rate
Pump 1 Operating Speed (if VFD powered)

Pump 2 Operating Speed (if VFD powered)

F. If the lift station has generator power backup, four inputs shall be configured:
   1. Generator Run Status
   2. Generator Pre-Alarm / Alarm Condition
   3. Generator Fault / Shutdown Condition
   4. Pump Station Operating on Generator / ATS out of Normal Position

G. Contractor shall provide interface circuitry between equipment control panels and RTU panel.
   1. A terminal cabinet with terminal strips shall be installed for circuitry connections.
      a. If a terminal cabinet is installed, extend circuitry to the RTU to a Contractor provided terminal strip in the RTU enclosure.
      b. If a terminal cabinet is not installed, circuitry shall be terminated on a Contractor provided terminal strip in the RTU enclosure.
   2. Digital inputs shall be delivered by 14-gauge conductors in conduits.
   3. 4-20ma analog inputs shall be delivered by shielded, 2-wire, 18-gauge cables in aluminum conduits. Provide analog scaling and engineering units to Mobile Communications America, Inc. for proper calibration of analog signals.

PART 3 EXECUTION

3.1 INSTALLATION OF RTU INTERFACE COMPONENTS

A. A North Carolina-Certified Electrical Contractor shall perform installation in accordance with the current edition of the NFPA, NEC, UL and local electrical codes.
   1. The Contractor shall be responsible to run a 20 Amp, 120V AC circuit to the RTU and ensure all enclosures, ground busses, antenna masts, surge arrestors are grounded and bonded to the existing service main ground.
   2. All hardware and brackets shall be 316 stainless steel.
   3. All interface wiring shall be tagged with heat shrink pre-printed wire labels. Hand written labels are not acceptable.
   4. Contractor shall coordinate with Vendor, as an authorized agent and demonstrate to the CFPUA representative that all features and functions of the RTU perform.

3.2 STARTUP AND ACCEPTANCE

A. CFPUA has established specific procedures for integration and acceptance of a RTU into CFPUA's SCADA system. This procedure shall be followed. Before acceptance, a complete documented checkout of the RTU, Central HMIs interface and RF communications shall be completed and witnessed by CFPUA and the system supplier.

END OF SECTION

SECTION 43 21 39

SUBMERSIBLE END SUCTION PUMP

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment, and incidentals required to furnish and install solids handling submersible, end suction centrifugal pumps complete and operational with motors, control equipment, and accessories as shown and specified. Anchorage devices are included in the scope of this Section.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before submersible end suction pump Work.

C. Related Sections:
   1. Section 05 05 33 - Anchor Systems.
   2. Section 09 91 00 - Painting and Protective Coatings.
   3. Section 33 31 23 - Sanitary Sewer Force Mains, Valves, and Appurtenances.
   4. Section 33 32 15 - Wastewater Pump Station Startup.

D. Related Materials:
   1. CFPUA Design Guidance Manual.
   2. CFPUA Pump Station Turnover Document.
   3. CFPUA Material Specification Manual.

1.2 REFERENCES

A. Standards referenced in this Section are:
   1. ANSI/HI 1.3, Standard for Centrifugal Pumps for Design and Application.
   2. ANSI/HI 1.4, Standard for Centrifugal Pumps for Installation, Operation, and Maintenance.
   3. ANSI/HI 1.6, Centrifugal Pump Tests.
   4. ANSI/HI 9.1-9.5, Standard for Pumps – General Guidelines for Types, Definitions, Application, Sound Measurement, and Decontamination.
   5. ANSI/HI 9.6.2, Standard for Centrifugal and Vertical Pumps for Allowable Nozzle Loads.
   6. ANSI/HI 9.6.3, Standard for Centrifugal and Vertical Pumps for Allowable Operating Region.
   7. ANSI/HI 9.6.5, Centrifugal and Vertical Pumps for Condition Monitoring
   8. ANSI/HI 9.8, Pump Intake Design.
   9. ANSI/HI 11.6, Submersible Pump Tests.
   10. IEEE 85, Airborne Sound Measurements- Rotating Electrical Machinery.
   11. NEMA MG-1, Motors and Generators.

1.3 DESIGN REQUIREMENTS

A. Submersible Pumps: Follow requirements of the CFPUA Design Guidance Manual.

1.4 QUALITY ASSURANCE

A. Supplier's Qualifications:
   1. Supplier shall have a minimum of five years' experience producing substantially similar equipment to that required for the Project and shall be able to provide documentation of at least five installations in satisfactory operation for at least five years each.

B. Component Supply and Compatibility:
   1. Obtain all products included in this Section, regardless of component Supplier, from one submersible end suction pump manufacturer.
   2. Submersible end suction pump Supplier shall review and approve or prepare all Shop Drawings and submittals for all components provided under this Section.
   3. All components shall be suitable for specified service conditions and shall be integrated into overall assembly by the submersible end suction pump Supplier.

C. Certification
   1. Certification of Compliance:
      a. Obtain certification of compliance with the Contract Documents from the submersible end suction pump manufacturer on manufacturer letterhead; certification by manufacturer's representatives is not acceptable.
      b. Certification shall be worded as follows:
         "[*Insert manufacturer's name*] proposes to supply equipment included in Section 43 21 39, Submersible End Suction Pump, for the Cape Fear Public Utility Authority, Wilmington, NC, [*INSERT THE PROJECT NAME AND SITE NAME*]. We have examined the Contract Documents and understand the Project requirements insofar as they affect the proposed products. We certify that the products will operate satisfactorily under the conditions described in the Contract Documents and that the products meet the requirements of the Contract Documents:

         [List exceptions, deviations or changes necessary or recommended to accommodate the proposed products.]

         We further certify that the products to be furnished shall conform to the Standards referenced in Section 43 21 39 - Submersible End Suction Pump, of the Contract Documents.

         [List exceptions, deviations or changes necessary to accommodate the proposed products.]

         _____ _____
         Authorized Signature & Title Date"

      c. Provide justification for exceptions, variations, deviations, or changes. ENGINEER will determine whether exceptions, deviations, and changes are

acceptable. Exceptions, variations, deviations, and changes may result in rejection of products.

d. Provide certification before submitting Shop Drawings. Shop Drawings will not be reviewed prior to receipt of certification.
e. Acceptance of certification shall not relieve CONTRACTOR of responsibility for adequacy of all products.
f. Submittal of certification shall not relieve CONTRACTOR and Supplier of requirement to comply with submittal procedures in the Contract Documents.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:
1. Shop Drawings of:
a. Pump controls specified in this Section, including panel layout and wiring diagrams. Drawings shall be:
1) adequate for control panel fabrication, installation and maintenance.
2) approved prior to manufacture.
b. Include:
1) an elementary control (ladder) diagram.
2) interconnection wiring (schematic) diagram.
3) interior and exterior panel component layout drawings.
4) Component catalog cuts.
5) Contractor's installation drawings. This is Covered in Section 01 33 00 - Submittals.
2. Product Data:
a. Manufacturer’s literature, illustrations, specifications, paint certification (if required) and engineering data including; dimensions, materials, size, weight, and part lists for all components in sufficient detail to allow an item-by-item comparison with the Contract Documents.
b. Pump performance data and curves, range from minimum flow to shut-off head at full speed and all speed curves specified showing:
1) Overall pump efficiencies.
2) Required net positive suction head (NPSH).
3) Flow rate.
4) Head.
5) Brake horsepower.
6) Speed.
7) Shut-off head.
8) Curves shall indicate Preferred Operating Region (POR) and Allowable Operating Region (AOR), as defined in ANSI/HI 9.6.3.
9) Specify recommended ratio of available NPSH divided by required NPSH for water service.
10) For variable speed units, curves shall have at least five speeds plotted between maximum and minimum rpm.
c. Motor Data: Furnish certified motor data sheet for previously tested, electrically duplicate motor to that specified, including the following:
1) Speed-torque relationship.
2) Efficiency at ½, ¾, and full load.
3) Power factor at ½, ¾, and full load.
4) Slip at full load.

5) Run Amps, Start (or locked rotor) Amps, Run kW, Run kVA, start kVA, NEC Code Letter.
6) Temperature rises and results of dielectric tests.
7) Bearing type and lubrication medium
8) Insulation class and temperature ratings.

3. Testing Plans, Procedures, and Testing Limitations:
   a. Provide pump Supplier's proposed shop testing plan, including complete list of testing facility limitations.
   b. Provide proposed field-testing plan.

B. Informational Submittals:
1. Certificates: Provide certificate of compliance as specified in this Section.
2. Manufacturer Instructions:
   a. Provide Supplier's instructions for handling and installing products.
   b. Setting drawings, templates, and directions for installing anchor bolts and other anchorages.
3. Source Quality Control Submittals:
   a. Results of shop testing for complete pump and motor unit.
   b. Location of nearest permanent service headquarters of pump manufacturer to the Site.
4. Field Quality Control Submittals:
   a. Results of field testing.
   b. Submit a written report of the results of each visit to Site by pump manufacturer's service representative, including purpose and time of visit, tasks performed, and results obtained.
5. Qualifications Statements:
   a. Provide documentation of Supplier's qualifications as specified in Quality Assurance article of this specification.
6. Warranty Documentation:
   a. Manufacturer's Standard Warranty.
   b. Special Warranty, if specified.

C. Closeout Submittals: Submit the following:
1. Operation and Maintenance Manuals:
   a. Submit complete operation and maintenance manuals, including shop and field test reports, maintenance data and schedules, description of operation, and spare parts information.
   b. Provide operation and maintenance manuals per Section 01 70 00 – Execution and Closeout Requirements.
2. Warranty Documentation:
   a. Manufacturer's Standard Warranty.
   b. Special Warranty, if specified.

D. Maintenance Material Submittals: Furnish the following:
1. Spare Parts:
   a. One spare impeller, trimmed to match installed impeller.
   b. One spare pump.
2. Tools:
   a. Furnish two sets of special tools required for normal operation and maintenance of products furnished.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:
   1. Prior to shipping, completely inspect products to assure that components are complete and comply with all requirements. Box or crate products as required to prevent damage during shipment. Protect machined surfaces and matching connections to prevent damage.
   2. Deliver products to Site to ensure uninterrupted progress of the Work. Deliver anchorage products that are to be embedded in concrete in ample time to prevent delaying the Work.
   3. Inspect all boxes, crates, and packages upon delivery to Site and notify ENGINEER in writing of loss or damage to products. Promptly remedy loss and damage to new condition per manufacturer's instructions.
   4. Comply with Section 01 60 00 - Product Requirements.

B. Storage and Protection:
   1. Keep all products off ground using pallets, platforms, or other supports. Protect steel, packaged materials, and electronics from corrosion and deterioration.
   2. Comply with Section 01 60 00 - Product Requirements.

1.7 WARRANTY

A. Special Warranty on Submersible End Suction Pumps:
   1. Provide manufacturer's written warranty, running to the benefit of OWNER, agreeing to correct, at OWNER's option, remove, or replace materials or equipment specified in this Section and found to be defective for a period of two years after date of Substantial Completion. Replacement value of items regularly subject to wear in normal use, such as seals, bearings, impellers, rotors, and stator, may be prorated.

PART 2 PRODUCTS

2.1 SUBMERSIBLE END SUCTION PUMPS

A. Manufacturers:
   1. Products and Manufacturers: Provide products of one of the following:
      a. Xylem/Flygt N Series, Model _____
      b. F.E. Myers, Division of Pentair Pump, Model _____.
      c. Sulzer type ABS, Model_____.

B. System Description:
   1. Pumps:
      a. Comply with ANSI/HI 1.3, ANSI/HI 9.6.3, and ANSI/HI 9.8.
      b. Type: submersible, non-clog, end suction centrifugal slide-rail-mounted.
      c. Design:
         1) Constructed for operation under complete submersion, partial submersion, and dry conditions.
         2) Suitable for raw wastewater service.
   2. Performance Criteria: Each pump shall comply with the following

Pump tag numbers.	PS1, PS 2	
Primary rated head.		ft
Capacity at primary rated head.		gpm
Secondary rated head		ft
Capacity at secondary rated head.		gpm
Operating head range for full speed continuous operation.		ft
Minimum shutoff head.		ft
Static Head		ft
Maximum nominal pump speed.	1750	rpm
Capacity at minimum head at reduced speed.		gpm
Maximum power required at pump input shaft at any point from minimum operating head to shutoff head.		bhp
Efficiency at rated head, wire to water.		%
Motor Volt	230	V
Phase	3	
Wetwell depth (guide-rail mounted).		ft
Minimum liquid depth in wetwell (guide-rail and skid mounted)	See detail drawings	
Minimum NPSHA at rated head.		ft
Minimum pump discharge nozzle/elbow size.	4	in
Minimum test sphere diameter.	3	in

C. Materials:
   1. Stator Housing, Oil Chamber Housing, Impeller Casing, and Impeller: Cast iron, ASTM A48, Class 35B.
   2. Casing Wear Ring: Bronze, ASTM B62.
   3. Impeller Wear Ring: Martensitic stainless steel, Brinell 200-250.
   4. Shaft: Alloy steel, hard chrome plated; or martensitic stainless steel, AISI Type 416 or 420.
   5. Mechanical Seals: 2 tandem single type, oil lubricated with tungsten carbide or silicon carbide seal rings at all points, except the upper rotating seal, which shall be carbon.
   6. Discharge Base: Cast iron
   7. Guiderails: Stainless steel pipe (corrosion- resistant 316 or better), ASTM A312, Schedule 40S.
   8. Upper guiderail bracket, cable hooks, and chain hooks: AISI Type 316 stainless steel.

D. Pump Construction:
   1. Impeller Casing: The impeller casing shall have well-rounded water passages and smooth interior surfaces free from cracks, porosity, blowholes, or other irregularities.

The discharge nozzle shall be flanged and sufficiently rigid to support the pumping unit under all operating conditions.

2. Impeller: The impeller shall be dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge, and other matter normally found in wastewater. The impeller shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer as needed.
3. Wear Ring: Renewable wearing rings shall be provided in the casing and on the impeller unless the pump is capable of impeller to volute adjustment.
4. Oil Chamber Housing: The oil chamber shall contain a drain plug.
5. Mechanical Seals: The seal located between the seal chamber and the seal inspection chamber shall be a leakage- free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance. The seals shall require neither maintenance nor adjustment and shall be readily accessible for inspection and replacement.

   Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain that is accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

   The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

   Seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float or probe type switch that will signal if the chamber should reach 50% capacity.

   Seal lubricant shall be non-hazardous.

   Shaft seals lacking positively driven rotating members or conventional double mechanical seals which utilize a common single or double spring acting between the upper and lower units and requiring a pressure differential to offset external pressure and effect sealing, will not be acceptable. The seals shall not rely upon the

pumped media for lubrication and shall not be damaged if the pumps are run unsubmerged for extended periods while pumping under load.

E. Pump Removal System:
   1. Pumps shall automatically and positively mate with associated discharge piping when pump is lowered into place. Pumps shall be removable for inspection or service without requiring removal of bolts, nuts, or other fastenings.
   2. Provide for each pump guide rails of Schedule 40 Type 316 stainless steel.
   3. Provide each pump with chain of high-tensile strength, proof-tested, stainless steel chain. Provide sufficient length of chain for removing pump from wet well without requiring supplementary cords, cables, or chains. Connect chain to lifting eye or bail on pump with stainless steel, adjustable closure D-ring or similar hardware acceptable to ENGINEER. On oppose end of chain from pump, provide stainless steel, adjustable closure D-ring or similar hardware acceptable to ENGINEER. Chain and hardware shall be sized to sustain all tensile stresses during lifting of pump. For each pump, provide one suitable hook or bracket on wall just below operating floor to which chain will be hooked when not used for hoisting.
   4. Pump manufacturer shall provide guide rail brackets, self-sealing ANSI flange, stainless steel chain (as applicable) holder with support grip, and other items necessary for complete guide-in, pump removal system.
   5. Access Frames and Covers: Provide with each pump rectangular 6061 T6 aluminum alloy access frame and cover complete with heavy-duty stainless-steel hinges and locking hasp. Cover shall be capable of 300 psf live loading and have safety checked or abrasive, non-slip surface. Opening sizes shall be as shown on the Drawings. Access frames and covers shall conform to Material Specification Manual Section I12.

F. Motors:
   1. Motor shall be stainless steel solid shaft, ball bearing type. Motor casing shall be air-filled or oil-filled and watertight with moisture resistant Class H, 180 degrees C insulation. Voltage, phase, and frequency shall be as specified in “Design and Performance Criteria” in this Section.
      a. Motor shall be NEMA Design B, normal starting torque, normal slip, squirrel cage induction type, continuous duty.
      b. Isolate cable entry with internal terminal board.
      c. Motor shall be capable of continuous operation in a non-submerged condition without damage. Pump and motor shall be capable of intermittent operation up to 15 starts per hour in non-submerged condition, without damage.
      d. Motor shall be non-overloading for entire pump operating curve, shall have a minimum of 1.15 service factor, and provide full rated horsepower with a voltage unbalance of three percent. Motors for use with variable frequency drives shall have insulation system constructed in compliance with or exceeding NEMA MG-1 Part 31.
      e. Motor cable shall be suitable for submersible duty and be so indicated by code or legend permanently applied to cable.
      f. Motor thrust bearings shall be capable of continuous thrust loads under all conditions of pump operation from zero head to shut-off. Anti-friction bearings shall be rated for B-10 life of 50,000 hours.

g. Motor Sensors:
   1) For supplemental motor protection, each pump motor shall be equipped with at least three thermal sensors embedded in stator windings and wired to the associated control panel.
   2) Provide leakage sensor in lower part of stator housing, wired to leads in motor's watertight terminal chamber.
h. Motors shall have over-temperature sensors in motor windings.
i. Motor: list for National Electric Code Class 1, Division 1, Group D Hazardous location.
j. VFD applications: provide motors with inverter duty windings.

G. Control Panel: Follow Section 26 29 15 - Pump Control Panels.

2.2 ANCHOR BOLTS AND ANCHORS

A. Anchors: Follow Section 05 05 00 - Anchor Systems.

2.3 FINISHING

A. Shop Finishing:
   1. Epoxy Coating - Primer & Finish Coat: Pump is protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer and a polyester resin finish paint on the exterior of the pump.
   2. Coat machined, polished, and non-ferrous surfaces with corrosion prevention compound.

B. Field painting shall conform to Section 09 91 00 - Painting and Protective Coatings. Touch-up of factory-applied finishes shall be compatible with factory-applied finish and specified service conditions.

2.4 ACCESSORIES

A. Provide the following for each pump unless otherwise specified.
   1. Discharge Elbow.
   2.

2.5 SOURCE QUALITY CONTROL

A. Pump Shop Tests: Shop Test all pumps provided under this Section.
   1. Hydrostatically test pump bodies per ANSI/HI 1.6, to the greater of: twice specified pump discharge head at Design Point No. 1, or 1.5 times pump's shutoff head.

PART 3 EXECUTION

3.1 Inspection:

A. Examine conditions under which products are to be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.2 Installation:

A. Install products in conformance with manufacturer's instructions and recommendations, and the Contract Documents.

B. Anchorages:
   1. Install pumps on concrete bases. Provide anchorages in new or existing concrete, as applicable, per equipment manufacturer's recommendations and the Contract Documents.

C. General:
   1. Conform to ANSI/HI 1.4.
   2. Perform all fitting required for installation. Set products accurately in location, alignment, and elevation, plumb and true.
   3. Provide utility connections per the Contract Documents. Support piping and valves independent of pump. Verify that utilities and valves are tested and operational before placing equipment into operation. When pumps are connected to piping with rigid hardware, connection of discharge nozzle to piping shall conform to ANSI/HI 9.6.2.
   4. Align and adjust products and piping in presence of Engineer.
   5. Provide for initial operation lubricants recommended by equipment manufacturer.
   6. Prior to energizing motor driven equipment, rotate drive motor by an external source to demonstrate free operation of mechanical parts. Do not energize equipment until safety devices are installed, connected, and functional.

D. Field painting shall conform to Section 09 91 00 – Painting and Protective Coatings.

E. Field Quality Control:
   1. Site Tests:
      a. Following installation, Contractor and qualified field service representative of equipment manufacturer shall conduct operating tests of all equipment, functions, and controls at Site, in presence of Engineer and CFPUA. Should tests result in malfunction, make necessary repairs, revisions, and adjustments and restart test from beginning. Repeat tests and repairs, revisions, and adjustments until, in opinion of Engineer, installation is complete, and equipment is functioning properly and accurately, and is ready for permanent operation.
      b. Field Operating Test; follow Section 33 32 15 - Pump Station Startup, and:
         1) Field test equipment and its controls in local mode, followed by demonstrating proper operation and controls in automatic mode. Demonstrate that each part and component of system individually and all parts and components together function properly in manner intended. Total duration of testing shall be determined by CFPUA and shall be related to local conditions. All testing equipment and manpower shall be by Contractor.
         2) Conform to applicable provisions of ANSI/HI 9.6.5.

2. Manufacturer's Services: Provide qualified, factory-trained serviceman to perform the following:
    a. Instruct Contractor in installing equipment.
    b. Inspect and adjust equipment after installation and ensure proper operation.
    c. Test-operate the products in presence of Engineer and verify that equipment conforms to Contract Documents.
    d. Instruct Owner's personnel in operating and maintaining the products.
    e. Manufacturer's representative shall make a minimum of 3 visits, with a minimum of 4 hours onsite for each visit. First visit shall be for assistance in installing equipment; second visit shall be for checking completed installation and start-up of system; third visit shall be to instruct operations and maintenance personnel. Representative shall revisit the Site as often as necessary until installation is acceptable.
    f. Training: Furnish services of qualified factory trained specialists from manufacturer to instruct Owner's operations and maintenance personnel in recommended operation and maintenance of products.

3.3 ANCHORS AND ANCHOR BOLTS

A. Use expansion anchors in precast and cast-in-place concrete.

3.4 FIELD QUALITY CONTROL

A. Operational Test: Demonstrate that all pumping station equipment is electrically, mechanically, structurally, and otherwise acceptable, and that it is safe, in optimum working condition, and conforms to the specified operating conditions by supplying sufficient clear water and operating station through several pumping cycles. During operation 1) observe and record operation of pumps, discharge gage readings, amperage draw, pump controls and liquid level controls, 2) check calibration of instrumentation equipment, test manual control devices, and automatic control systems, and 3) be alert to any undue noise, vibration, or other operational problems.

B. Manufacturer's Start-Up Services: Provide for a minimum of two 8-hour days including O&M instructions to the operating personnel. Representative shall schedule at least two separate trips for these services. The Owner shall be notified when Manufacturer's representative is to be at the work site one week in advance to be present during start-up of equipment.

END OF SECTION