PROJECT MANUAL

Town of Wake Forest
Public Safety Warehouse
1412 Forestville Road,
Wake Forest, NC 27587

OWNER: **Town of Wake Forest**
Mickey Rochelle
Facilities Director / ADA Coordinator
301 South Brooks Street
Wake Forest, NC 27587

PREPARED BY: **Stephen T. Baxter, Architect PLLC**
(919) 819-1536 Phone
STBaxter.ARCH@outlook.com

DATE: January, 2025

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Town of Wake Forest
Public Safety Warehouse
1412 Forestville Road
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TOWN *of*
WAKE FOREST

Request for Bids

Town of Wake Forest Public Safety Warehouse
Bid # 0007-2024

Sealed Bids to be received until
Wednesday, February 5, 2025 at 10:00am

Pre-Bid Conference
Wednesday, January 15, 2025 at 10:00am
Conference Rooms A & B in Wake Forest Town Hall, 301 South Brooks Street, Wake Forest, NC 27587

NOTICE TO BIDDERS

Sealed bids will be received by the Town of Wake Forest, NC at Town Hall, Conference Rooms A & B, 301 South Brooks Street, Wake Forest, NC 27587 until 10:00am on Wednesday, February 5, 2025 when they will be opened and read aloud.

Town of Wake Forest Public Safety Warehouse
Bid # 0007-2024

A mandatory pre-bid conference will be held in Conference Rooms A & B at Wake Forest Town Hall, 301 South Brooks Street, Wake Forest, NC 27587 on Wednesday, January 15, 2025 at 10:00am. All prospective bidders are required to attend.

Copies of the bid documents may be obtained by contacting Stephen Baxter, Architect at STBaxter.ARCH @ outlook.com.

The Town of Wake Forest reserves the right to reject any or all bids and to make the award as deemed in the best interest of the Town of Wake Forest.

Instruction to Bidders

1. **Submittal**

   All bids must be submitted to the Town of Wake Forest at Wake Forest Town Hall, Conference Rooms A & B, 301 S. Brooks Street, Wake Forest, NC 27587 by **Wednesday, February 5, 2025 at 10:00am**. All bids must be submitted in a sealed envelope marked: Bid #0007-2024 Town of Wake Forest Public Safety Warehouse.

2. **PREBID MEETING - MANDATORY**

   Wednesday, January 15, 2025 at 10:00am

   Conference Rooms A & B in Wake Forest Town Hall, 301 South Brooks Street, Wake Forest, NC 27587

3. **USE OF CONTRACT DOCUMENTS**

   These Bidding Documents are to be used only for the purpose of understanding this bid and consideration toward submitting a proposal. They may not be used for any other purpose.

4. **SPECIFICATIONS**

   The Specifications are intended to describe the complete project including all materials, processes, equipment, etc. Bidders are expected to carefully examine the Contract Documents, visit the site of the proposed construction, and determine the availability of materials and method required, in order to become thoroughly familiar with the project, the requirements, and to include the cost thereof in the proposal. Bidders shall contact the Project Coordinator at least five (5) days prior to the bid date for clarification of any item not fully understood.

5. **BIDDER'S QUALIFICATIONS**

   For projects exceeding $30,000, consideration will be given only to Contractors who submit evidence that they are properly licensed as required by Chapter 87 of the North Carolina Licensed General Statutes to bid and perform the work described herein as the general contractor. In addition, the Owner may make such other investigations as he deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish the Owner all such information and data for this purpose as the Owner may request.

   The Owner reserves the right to consider as unqualified to do the work of general construction any Bidder who does not habitually perform with his own forces a minimum of ten percent (10%) of the work involved in construction of the improvements embraced in this contract.

   Awarded contractor shall be authorized to conduct business in the state of North Carolina as found by checking the Secretary of State records and/or Register of Deeds office, indicating proper registration and active status. This is a condition of executing the contract.

6. **FAMILIARITY WITH LAWS**

   It is assumed that the Bidders are familiar with local, state and federal laws, rules, ordinances, and

regulations that may 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. No plea for misunderstanding or ignorance on the part of the Contractor will in any way serve to modify the provisions of this contract. The Contractor agrees that in carrying out this contract he will comply with all applicable Federal, state and local laws, specifically including, without limitation, the Occupational Safety and Health Act of 1970 and Section 1324A, the Immigration Reform and Control Act.

7. AMERICAN WITH DISABILITIES ACT (ADA)

The Contractor shall comply with the provisions of the Americans with Disabilities Act (ADA) (www.ADA.gov) as amended from time to time and all rules and regulations promulgated thereunder. The contractor hereby agrees to indemnify the Owner from and against all claims, suits, damages, costs, losses and expenses in any manner arising out of or connected with the failure of the contractor, its subcontractors, agents, successors, assigns, officers or employees to comply with the provisions of the ADA or rules and regulations promulgated thereunder.

8. MINORITY PARTICIPATION

The Town of Wake Forest's minority participation goal is **10%** of the bid amount.

9. ADDENDA

No oral interpretation will be made to any Bidder as to the meaning of the Bidding Documents. Questions and requests for such interpretation shall be made in writing to the Project Coordinator listed. Any Addenda will be provided to known interested parties, but it shall be the Bidder's responsibility to make inquiry as to any Addenda issued. All such Addenda shall become part of the Contract and all Bidders shall be bound by such Addenda whether or not received or acknowledged.

It is the bidder's responsibility to make sure that all Addenda are received. All Addenda will be posted with the bid listing on the Town website. https://www.wakeforestnc.gov/finance/purchasing-warehouse/bids-announcements

10. UNBALANCED BIDS

The Contractor shall not submit a bid containing any unbalanced bid prices. Any unit or lump sum bid price that does not reflect reasonable actual costs that the Contractor anticipates for the performance of the item(s) in question along with a reasonable proportional share of the Contractor's anticipated profit, overhead cost, and other indirect costs is an unbalanced bid price. Any bid containing unbalanced bid prices may be deemed non-responsive and rejected.

11. COLLUSIVE AGREEMENTS

Each bidder submitting a bid shall execute and attach the Non-Collusion Affidavit of Prime Bidder affidavit attesting that he has not entered into a collusive agreement with any other person, firm or corporation in regard to any bid submitted.

12. BID Bond

5% of the bid amount.

13. PERFORMANCE AND PAYMENT BOND

100% of the bid amount.

14. PREPARATION OF BID

The Town's bid forms must be used when provided – submit one original. Bidders shall label their bid proposal with business name, bid name and bid date, then seal their bid proposal inside an envelope. If mailing a bid proposal, provide a sealed envelope within the postal envelope.

15. ITEMS REQUIRED TO BE SUBMITTED WITH THE BID

Failure to submit the following with the bid is considered a non-responsive bid and the bid will not be considered:

_____ Bid Form with bid price(s) written or typed

_____ Signatures on Forms and notarized where noted

_____ Non-Collusion Affidavit of Prime Bidder

_____ Addendums (**If Issued**)

_____ Minority Participation forms

_____ E-589 CI Form

_____ Bid Bond (**If Required**)

16. RECEIPT AND OPENING OF BIDS

Each Bid is to be submitted in a sealed envelope and plainly marked with the project name, bid number, and bid opening time. If mailed, the sealed envelope containing the Bid is to be enclosed in another envelope to avoid it being opened before the advertised time. Bids received prior to the advertised bid opening will be securely kept as sealed. Bids received after the advertised bid opening time will be returned to the Bidder unopened.

17. WITHDRAWAL OF BIDS

Bids may be withdrawn by written request prior to or within seventy-two hours (72) after the opening of bids by contacting the bidding officer. To withdraw an opened bid, proof must be given of a mathematical error or omission as opposed to judgment or interpretation error.

18. MINIMUM NUMBER OF BIDS (FORMAL CONTRACTS ONLY)

North Carolina General Statute 143-129 and 143-132 prohibits the awarding of a formal contract unless at least three (3) competitive bids are received from reputable and qualified contractors. Therefore, if fewer than three (3) such bids are received, they will not be opened but returned to the contractors; and the project may be re advertised. The Town's formal limit is $500,000.

19. ALTERNATIVE BIDS

No alternative bids will be considered unless alternative bids are specifically requested.

20. AWARD OF CONTRACT; REJECTION OF BIDS

The Town reserves the right to hold bids for a period of sixty (60) days for the purpose of reviewing the bids and investigating the qualifications of the Bidders. The Town reserves the right to reject any or all bids, for any reason. The Town intends to award a contract to the lowest responsive, responsible bidder, complying

with the conditions of the bidding documents. The Town reserves the right to award a contract that is deemed in its best interest.

21. BID PROTEST PROCEDURE

Prospective bidders or suppliers who feel disadvantaged by the solicitation must submit a written protest within five (5) calendar days prior to the opening of proposals. Actual bidders or subcontractors who are aggrieved by the award of a contract must submit a written protest within five (5) days of the Town announcing its intent to award. The protest must be addressed to the Purchasing Manager, Town of Wake Forest, who will make the final determination after consulting with counsel.

22. EXECUTION OF AGREEMENT

The successful Bidder is required to execute a Contract within ten days (10) days after notice of award. Failure to do so constitutes a default and the Owner may elect to award to the next lowest bidder or re- advertise the bid.

23. LIQUIDATED DAMAGES

$500 per day after the completion date.

24. INSURANCE REQUIRMENTS

A. Workers' Compensation: Insurance covering all employees meeting Statutory limits in compliance with the applicable state and federal laws. The coverage must include employer's liability with a minimum limit of $1,000,000 for each accident.

B. Commercial General Liability: Coverage shall have minimum limits of $1,000,000 per occurrence, general aggregate, products/completed operations aggregate, personal and advertising injury. This shall include premises and operations, independent contractors, products and completed operations, broad form property damage, XCU coverage and contractual liability. The coverage shall be written on an occurrence basis. This limit should apply on a per project or per location aggregate basis. **The Town of Wake Forest shall be listed as an additional insured, under this coverage.**

C. Business Auto Liability: Coverage shall have a minimum limit of $500,000 per occurrence, combined single limit for bodily injury liability and property damage liability. This shall include owned vehicles, hired vehicles and non-owned vehicles.

D. Umbrella/Excess Liability: At the option of the contractor, the limits of the primary general liability, auto liability and employers' liability may be less than stipulated herein, with an excess policy providing the additional limits needed. This form of coverage must be approved by the municipality and will only be acceptable when both the primary and excess policies include the coverage and endorsements required herein.

E. Professional Liability: Coverage shall have a minimum limit of $1,000,000 per occurrence, unless a higher limit is required by the Town. This coverage is only required for contracts that include professional services.

F. Special Requirements

1. Current, valid insurance policies meeting the requirements herein identified shall be maintained to be considered an "eligible contractor". Renewal certificates shall be sent to the Town 30 days prior to any expiration date. There shall also be a 30-day notification to the Town in the event Of cancellation or modification of any stipulated insurance coverage. Certificates of insurance

meeting the required insurance provisions shall be forwarded to the Town of Wake Forest. Wording on the certificate, which states that no liability shall be imposed upon the company for failure to provide such notice, is not acceptable.

2. It shall be the responsibility of the contractor to ensure that all subcontractors comply with the same insurance requirements that he is required to meet.

3. The Town of Wake Forest shall be listed as certificate holder on the certificate of insurance.

25. INDEMNIFICATION

To the extent permitted by law, the Contractor agrees to defend, pay on behalf of, indemnify, and hold-harmless the Town of Wake Forest, its elected and appointed officials, employees, agents, and volunteers against any and all claims, demands, suits or losses, including all costs connected therewith, for any damages which may be asserted, claimed or recovered against or from the Town of Wake Forest, its elected or appointed officials, employees, agents, and volunteers by reason of personal injury, including bodily injury or death and/or property damage, including loss of use thereof resulting from the negligence of the Contractor.

26. MATERIALS

The name of a certain brand, make, manufacturer or definite specification is to denote the quality standard of the article desired and not to restrict competitive bidding. It is set forth and conveyed to prospective bidders the general style, type, character and quality of the article desired. Bidders, however, may submit to the Project Coordinator evidence that proposed substitutions are fully up to standards specified and obtain his approval before placing orders.

27. ERRORS, OMISSIONS, AND DEVIATIONS

The Contractor is responsible for all errors, omissions, and deviations from the Contract requirements.

28. OSHA COMPLIANCE PLAN/POLICY

Contractor hereby acknowledges that it has reviewed and agrees to abide by all OSHA safety regulations and Town of Wake Forest safety regulations. Contractor may be required to submit a copy of the company's current written OSHA Compliance Plan/Policy within 48 hours of request. If requested, no field work shall take place until the plan has been submitted and reviewed by the Town's Safety Officer.

29. NON-COLLUSION and ANTI-DISCRIMINATION

Bidder certifies that this proposal is made in good faith and without collusion or in connection with any other person bidding on the same work, nor will any official or employee of the Town of Wake Forest be admitted to share any part of this contract should an award be made to the undersigned. Bidder further certifies that in connection with the performance of this contract not to discriminate against any employee or applicant for employment because of race, creed, color, religion, national origin, gender, age, political affiliation or handicap.

30. TAXES

FEDERAL: The Town of Wake Forest is exempt from and will not pay Federal Excise or Transportation taxes.
STATE: Applicable North Carolina Sales and Use Taxes shall not be shown on bids, but shall be added to

invoices as a separate item. The Town is not tax exempt.

NORTH CAROLINA SALES TAX

The Owner may apply for a refund of all sales and/or use taxes paid in North Carolina by the Contractor on purchases of items which are annexed to, affixed to, or in some manner become a part of any building or structure being erected, altered or repaired under Contract with the Owner; and these taxes shall not be included in the bid amounts or the Contract sum. The Contractor shall include and pay all other taxes imposed by governmental authorities, which are applicable to the work.

The Contractor will be reimbursed for applicable sales and/or use taxes he has paid in North Carolina based on the following. **The Contractor should apply for reimbursement by itemizing and completing a notarized sales and use tax report form and submitting it with each pay request. Failure to submit this form will result in the invoice not being paid.** The contractor will be required to complete a sales and use tax report affidavit in order to receive the last payment of the project.

A Sales Tax Affidavit must be completed and submitted for this project before final payment will be released.

31. PAYMENT

N.C.G.S. 143-134.1 prohibits retainage on public projects that cost less than $100,000.00 in total. Prior to final payment, the Contractor will be required to submit any forms, warranties, etc. that the Owner requires. The payment of the final amount due the Contractor shall release the Owner from any and all claims or liabilities on account of the work performed and the materials furnished upon the work. The payment terms shall be Net 30 days.

32. ETHICS POLICY / CODE OF CONDUCT

The Town of Wake Forest has established guidelines for ethical standards of conduct in that Town *representatives should maintain high standards of personal integrity, truthfulness, honesty, and fairness* in carrying out public duties; avoid any improprieties in their roles as public servants including the appearance of impropriety; and never use their position or power for improper gain. In establishing an ethics policy, the Town of Wake Forest desires to protect the public against decisions that are affected by undue influence, conflicts of interest, or any other violation of these policies as well as promote and strengthen the confidence of the public in their governing body.

33. E-VERIFY

CONTRACTOR shall comply with the requirements of Article 2 of Chapter 64 of the NC General Statutes. Further, if CONTRACTOR utilizes a subcontractor, CONTRACTOR shall require the subcontractor to comply with the requirements of Article 2 of Chapter 64 of the NC General Statutes.

34. HUBSCO REPORTING

All **building** construction and repair projects ($30,000 & Over) require a E-Verify. Contractor shall comply with the requirements of Article 2 of Chapter 64 of the NC General Statutes. Further, if Contractor utilizes a subcontractor, Contractor shall require the subcontractor to comply with the requirements of Article 2 of Chapter 64 of the NC General Statutes. If a minority participation report is required to be submitted to the State of NC Department of Administration HUB Office, any information that is requested from the contractor must be provided before the last invoice will be paid.

35. Iran Divestment Act.

Contractor certifies that; (i) it is not identified on the Final Divestment List or any other list of prohibited

investments created by the NC State Treasurer pursuant to N.C.G.S. 143-6A-4; (ii) it will not take any action causing it to appear on any such list during the term of this Purchase Order, and (iii) it will not utilize any subcontractor to provide goods or services hereunder that is identified on any list.

36. Divestment from Companies that Boycott Israel.

Contractor represents, covenants, and certifies that it is not listed on the list of restricted companies developed and published by the North Carolina State Treasurer as required by N.C.G.S. 147-86.81.

37. Dispute Resolution

Any construction related disputes resulting from this bid shall be resolved using the procedures set for by the State Building Commission pursuant to NCGS 143-128(g) 143-135.26(11). These procedures may be viewed at: https://files.nc.gov/ncdoa/documents/files/sbc_Dis_rules.pdf

38. Title VI

During the performance of this contract, the Consultant, for itself, its assignees and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

(1) **Compliance with Regulations:** The contractor shall comply with the Regulation relative to nondiscrimination in Federally-assisted programs of the Town of Wake Forest (hereinafter, "Town") Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

(2) **Nondiscrimination:** The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, national origin, sex, religion, age, or disability in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor shall not participate either directly or indirectly in the discrimination prohibited by section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

(3) **Solicitations for Subcontractors, Including Procurements of Materials and Equipment:** In all solicitations either by competitive bidding or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, or national origin.

(4) **Information and Reports:** The contractor shall provide all information and reports required by the Regulations or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Town to be pertinent to ascertain compliance with such Regulations, orders, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information the contractor shall so certify to the Town as appropriate and shall set forth what efforts it has made to obtain the information.

(5) **Sanctions for Noncompliance:** In the event of the contractor's noncompliance with the nondiscrimination provisions of this contract, the Town shall impose such contract sanctions as it or the Town may determine to be appropriate, including, but not limited to:

(a) withholding of payments to the contractor under the contract until the contractor complies, and/or

(b) cancellation, termination, or suspension of the contract, in whole or in part.

(6) **Incorporation of Provisions:** The contractor shall include the provisions of paragraphs (1) through (6) in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The contractor shall take such action with respect to any subcontract or procurement as the Town may direct as a means of enforcing such provisions including

sanctions for noncompliance: Provided, however, that, in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the Town to enter into such litigation to protect the interests of the Town, and, in addition, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

39. PROJECT COORDINATOR / CONTACT

Stephen T. Baxter, Architect
STBaxter.ARCH@outlook.com

40. QUESTIONS AND CLARIFICATIONS

Any questions regarding this bid must be submitted by email to the Project Coordinator.

41. REFERENCES

All bidders must submit a minimum of three references for similar projects. Please submit the name of the project, the company and location the project was for and contact information for the person that was responsible for the project for the client.

42. STANDARD TERMS & CONDITIONS

The Town of Wake Forest's Standard Terms and Conditions listed at: https://www.wakeforestnc.gov/sites/default/files/uploads/purchasing/2023/9-27-23_towf_standard_terms_and_conditions.pdf will govern all matters related to the goods and/or services provided by you or your company (the "Vendor") to the Town of Wake Forest (the "Town") under a Town purchase order. Additional Terms and Conditions stated on the face of a Town purchase order shall take precedence over any conflicting Standard Terms and Conditions stated. Any Terms and Conditions not stated, but incorporated by reference therein, shall be binding only if provided or signed by the Town and attached hereto. In the event that a binding written contract signed by both the Vendor and the Town exists, the Terms and Conditions of that contract shall supersede any conflicting Standard Terms and Conditions.

PROPOSAL FORM

Wake Forest Public Safety Warehouse
Bid #0007-2024

The undersigned bidder affirms and declares that he has carefully examined all bidding documents and Instructions to Bidders which are acknowledged to be a part of this proposal, and agrees to provide all labor, materials, equipment, supervision, permits; abide by all local, state and federal laws, rules, regulations, and ordinances applicable to perform the work listed in the specifications and scope of work for the following sum to wit:

TOTAL BASE BID – Lump Sum

_____ Dollars $_____

Construction Duration from NTP _____

ITEM 1- Scope of Project

Site work and construction of a new 6,991 square foot, wood frame with masonry veneer walls on a concrete slab with associated plumbing, mechanical, power, lighting, fire alarm, and sprinkler system.

ITEM 2- Addendums

All addendums must be acknowledged in order for the proposal to be considered.

Addendum #1 _____

Addendum #2 _____

Addendum#3 _____

The Town of Wake Forest intends to award a contract to the overall lowest responsible, responsive bidder taking into consideration quality, performance, and the time specified in this bid. The Town of Wake Forest reserves the right to reject or all proposals and to make the award as deemed in the best interest of the Town of Wake Forest.

All bidders MUST complete and submit with their bid the enclosed Non-Collusion Affidavit of Prime Bidder.

SIGNATURE PAGE

Wake Forest Public Safety Warehouse – Bid #0007-2024

The undersigned certifies that they have read and understood all the provided bidding documents, the project specifications, and agree to the terms and conditions stated herein.

This bid must be signed by a responsible official of the bidding organization and notarized.

_____ **(SEAL)**

Date

_____

Company

_____ _____

Authorized Signature | Federal Identification #

_____ _____

Printed Name and Title | Email Address

_____ _____

Street Mailing Address | City, State, Zip Code

_____ _____

Contactor's NC License No. | Telephone Number

On this day of_____, 20___, before me_____(name) appeared and, being duly sworn, did execute the foregoing proposal, and did so state that he/she was properly authorized by_____ _____(name of company) to execute the proposal and did so on his/her free act and deed.

Notary Public_____My Commission Expires_____(SEAL)

NON-COLLUSION AFFIDAVIT OF PRIME BIDDER

attach to bid (required)

State of_____)

County of_____)

Project: Wake Forest Public Safety Warehouse Bid #0007-2024

_____, being first duly sworn, deposes and says that:

1. He is (owner, partner, officer, representative or agent) of_____, the Bidder that has submitted the attached Bid;

2. He is fully informed respecting the preparation and contents of the attached bid and of all pertinent circumstances respecting such Bid;

3. Such Bid is genuine and is not a collusive or sham Bid;

4. Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this Affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly, with any other Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bids of any other Bidder, or to fix any overhead, profit or cost element of the Bid price or the Bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Town of Wake Forest or any person interested in the proposed Contract; and

5. The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees or parties in interest, including this Affiant.

_____ _____

Name Title

Subscribed and Sworn to before me this_____Day of_____, 20_____

Notary Public:_____ (Seal)

My Commission Expires:_____

IDENTIFICATION OF MINORITY BUSINESS PARTICIPATION

Project: Bid # 0007-2024

I, _____

(Name of Bidder)

do hereby certify that on this project, we ***intend to*** use the following M/WBE firms as construction subcontractors, vendors, suppliers, or providers of professional services.

Minority Firm Name and Address	Minority Category*	Phone Number	Type of Work

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

The total value of M/WBE firms contracting is proposed to be $_____

The total percentage of M/WBE firms contracting is proposed to be _____%

Identification of HUB Certified/ Minority Business Participation

I,_____,

(Name of Bidder)

do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work Type	Minority Category	HUB Certified (Y/N)	$ Amount

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**),

Female (**F**) Socially and Economically Disadvantaged (**D**)

** HUB Certification with the state HUB Office required to be counted toward state participation goals.

The total value of minority business contracting will be ($)_____.

The total percentage of minority business contracting will be (%)_____.

Town of Wake Forest -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 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 business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

SEAL

Title:_____

State of_____, ***County of***_____

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

Notary Public_____

My commission expires_____

Town of Wake Forest --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 Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

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: _____

SEAL

Signature: _____

Title: _____

State of _____, **County of** _____

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

Notary Public _____

My commission expires _____

STATE OF NORTH CAROLINA

AFFIDAVIT

TOWN OF WAKE FOREST

I,_____(the individual attesting below), being duly authorized by and on behalf of_____(the entity bidding on project hereinafter "Employer") after first being duly sworn hereby swears or affirms as follows:

1. Employer understands that E-Verify is the federal E-Verify program operated by the United States Department of Homeland Security and other federal agencies, or any successor or equivalent program used to verify the work authorization of newly hired employees pursuant to federal law in accordance with NCGS §64-25(5).

2. Employer understands that Employers Must Use E-Verify. Each employer, after hiring an employee to work in the United States, shall verify the work authorization of the employee through E-Verify in accordance with NCGS§64-26(a).

3. Employer is a person, business entity, or other organization that transacts business in this State and that employs 25 or more employees in this State. (mark Yes or No)

   a. YES_____, or

   b. NO _____

4. Employer's subcontractors comply with E-Verify, and if Employer is the winning bidder on this project Employer will ensure compliance with E-Verify by any subcontractors subsequently hired by Employer.

This____day of_____, 20 _.

_____

Signature of Affiant

Print or Type Name: _____

State of_____ County of _____ (Affix Seal)

Signed and sworn to (or affirmed) before me, this the _____

day of_____, 20___.

My Commission Expires:

_____ _____

Notary Public

TOWN *of*
WAKE FOREST

301 S. Brooks Street
Wake Forest, NC 27587
t 919.435.9400

www.wakeforestnc.gov

[Organization Name]
[Address]
[City, State Zip]

[Date]

Dear [Vendor Name],

We would like to thank you for your work on the [project name]. Below you will find the sales tax verification to be completed for the project. Prior to the official closeout and the issuance of the final payment, the Town of Wake Forest must receive a copy of this document with a notarized signature of an authorized official of your organization.

Sales Tax Affidavit

The Town of Wake Forest will not accept any transfer of liability for taxes due on admissions that the lessee has failed to charge and remit to the State of North Carolina or other taxing jurisdictions.

All users of facilities are solely responsible for collecting and remitting any and all applicable sales and use taxes to the North Carolina Department of Revenue and that the Town of Wake Forest assumes no obligation or responsibility for said taxes.

Authorized Official Name: _____

Authorized Official Signature: _____

Date: _____

Subscribed and sworn before me this_____day of_____,_____.

Notary Public: _____

My Commission Expires: _____

TOWN OF WAKE FOREST,NC
CERTIFICATE FOR NORTH CAROLINA SALES TAX

Project or Contract Number:____________________ **Date:**____________

Contractor:____________________ **Period Covered:**____________

Invoice Date	Invoice Number	Name of Vendor	Item Cost	State Tax	County Tax	Extra Tax	Total Invoice	County Paid
							-	
							-	
							-	
							-	
							-	
							-	
							-	
							-	
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		TOTALS	-	-	-	-	-	

I certify that the above listed vendors were paid sales tax upon purchase of building material during the period covered by the construction estimate, and the property upon which such taxes were paid with will be used in the performance of this contract. No tax on purchases of tangible personal property purchased by such contractors for use in performing the contract which does not annex to, affix to, or in some manner become a part of the project, building, structure or repairs is included in the above list.

Signed:____________________ Dated:____________________

Subscribed and sworn before me this_____day of _____,_____.
(date) (year)

Notary Public:_____

My Commission Expires:_____

NCDOR
Web-Fill
7-18

E-589CI
Affidavit of Capital Improvement

Form E-589CI, Affidavit of Capital Improvement, may be used to substantiate that a contract, or a portion of work to be performed to fulfill a contract, is to be taxed for sales and use tax purposes, as a real property contract for a capital improvement to real property.

The receipt of an affidavit of capital improvement for services to real property, absent fraud or other egregious activities, establishes that the subcontractor or other person receiving the affidavit should treat the transaction as a real property contract for sales and use tax purposes.

A real property contract is a contract between a real property contractor and another person to perform a capital improvement to real property.

Section I. Single Use *(Complete this section to issue the affidavit for a single capital improvement.)*

A

Owner, Lessee/Tenant, or RealProperty Contractor

TOWN OF WAKE FOREST

Address

301 S. BROOKS STREET

City	**State**	**Zip Code**
WAKE FOREST	NC	27587

B

Real Property Contractor *(General Contractor or Subcontractor)* *Hired to perform capital improvement*

Address

City	**State**	**Zip Code**

Describe capital improvement to be performed:

Project Name

Project Address (where the work is tobe performed) **City** **State** **Zip Code**

I certify that, to the best of my knowledge, this affidavit is accurate and complete and that the transaction described to be performed by the Real Property Contractor (General Contractor or Subcontractor identified in box "B") shall be treated as a real property contract for a capital improvement to real property for sales and use tax purposes. I understand that if it is determined that I issued this affidavit in error and the transaction is subject to sales tax as a retail sale of repair, maintenance, and installation services to real property, I will be liable for payment of any additional taxes determined to be due.

Signature of Authorized Person:_____ Title:_____ Date: _____

Section II. Blanket Use *(Complete this section to execute a blanket affidavit for capital improvements.)*

C

Real Property Contractor

Address

City **State** **Zip Code**

D

Real Property Contractor or Subcontractor *Hired to perform capital improvement*

Address

City **State** **Zip Code**

To be completed by the Real Property Contractor identified in Box C.

I certify that I am a Real Property Contractor who performs capital improvements to real property and all transactions with the real property contractor (subcontractor) identified in box "D" shall be treated as real property contracts for capital improvements to real property for sales and use tax purposes. I understand that if it is determined that I issued this affidavit in error and the transaction is subject to sales tax as a retail sale of repair, maintenance, and installation services to real property, I will be liable for payment of any additional taxes determined to be due.

Signature of Authorized Person:_____ Title:_____ Date: _____

Affidavit of Capital Improvement Instructions

Form E-589CI, Affidavit of Capital Improvement, may be issued to substantiate that a contract, or a portion of work performed to fulfill a contract, is a capital improvement to real property and subject to sales and use tax as a real property contract. Generally, services to real property are retail sales of or the gross receipts derived from repair, maintenance, and installation services, unless a person substantiates that a transaction is subject to tax as a real property contract, subject to tax as a mixed transaction contract, or the transaction is not subject to sales and use tax. A "real property contract" is a contract between a real property contractor and another person to perform a capital improvement to real property.

A mixed transaction contract is a contract that includes both a real property contract for a capital improvement and repair, maintenance, and installation services for real property that are not related to the capital improvement. For a mixed transaction contract, if the allocated sales price of the taxable repair, maintenance, and installation services included in the contract is less than or equal to twenty-five percent (25%) of the contract price, then the repair, maintenance, and installation services portion of the contract, and the tangible personal property, digital property, or service used to perform those services, are taxable as a real property contract for sales and use tax purposes.

- A person that issues Form E-589CI is liable for any additional tax due on the transaction in excess of tax paid on purchases pursuant to N.C. Gen. Stat. § 105-164.4H(a), if it is determined that the transaction is not a capital improvement, but rather the transaction is subject to tax as a retail sale.
- A person who receives Form E-589CI from another person, absent fraud or other egregious activities, is not liable for any additional tax on the gross receipts from the transaction if it is determined that the transaction is not a capital improvement.
- Form E-589CI **is not an affidavit of tax paid** on tangible personal property, or digital property purchased or used to fulfill a real property contract.
- Form E-589CI may not to be used to purchase tangible personal property, or digital property exempt from sales and use tax.

Exceptions from the Issuance of Form E-589CI to Establish a Transaction is to be Taxed as a Real Property Contract
In lieu of issuing an affidavit of capital improvement, a person may substantiate by other records that a transaction is a real property contract or a mixed transaction contract subject to tax as a real property contract, as discussed above, for a capital improvement to real property. However, where subcontractors are involved, it may be in the best interest of all parties to use Form E-589CI to ensure proper application of the sales and use tax laws.

Section I. Single Use Instructions
A person may complete "Section I - Single Use" for a one time use to substantiate that a transaction is a real property contract for a single capital improvement to real property and subject to sales and use tax as a real property contract. When a real property contractor hires a subcontractor to perform a portion of the overall real property contract and there is not a recurring business relationship between the two parties (when a period of no more than twelve months elapse between transactions between two parties), "Section I – Single Use" may be completed and the form issued to the subcontractor as notice that the transaction is subject to sales and use tax as a real property contract.

The following scenarios are for reference to assist a person to complete and issue Form E-589CI. The scenarios presented are not intended to cover all possible uses of the form.

A property owner oversees the entire activity to real property that is a real property contract for a capital improvement to real property. The property owner hires various subcontractors to complete the real property contract or portions thereof:

- **Box A - Owner, Lessee/Tenant or Real Property Contractor:** Enter property owner's name and address.
- **Box B - Real Property Contractor** *(General Contractor or Subcontractor)*: Enter a single subcontractor's name and address.
- Owner listed in Box A must describe the real property contract activity to be performed.
- Owner listed in Box A must enter the project address (if different than the address entered in BoxA).
- Authorized Person (owner) signs, enters title (owner), enters the date, and issues to the person listed in Box B.

A property owner hires a general contractor to oversee the entire activity to real property that is a real property contract for a capital improvement to real property. The general contractor hires a subcontractor to perform the real property contract, or portion thereof:

- **Box A - Owner, Lessee/Tenant or Real Property Contractor:** Enter general contractor's name and address.
- **Box B - Real Property Contractor** *(General Contractor or Subcontractor)*: Enter subcontractor's name and address.
- General contractor listed in Box A must describe the real property contract activity to be performed.
- General contractor listed in Box A must enter the project address.
- Authorized Person (general contractor) signs, enters title (general contractor), enters the date, and issues to the person listed in Box B.

A lessee/tenant hires a general contractor for the installation of equipment that is to be attached to real property and will be depreciated under the Internal Revenue Code:

- **Box A - Owner, Lessee/Tenant or Real Property Contractor:** Enter lessee/tenant's name and address.
- **Box B - Real Property Contractor** *(General Contractor or Subcontractor)*: Enter general contractor's name and address.
- Lessee or tenant listed in Box A must describe the capital improvement to be performed and indicate the equipment will be depreciated under the Internal Revenue Code.
- Authorized Person (typically lessee or tenant) signs, enters title (lessee or tenant), enters the date, and issues to the person listed in Box B.

Section II. Blanket Use Instructions
A real property contractor may complete "Section II – Blanket Use" and issue the form to another real property contractor (subcontractor) who is used **exclusively** to perform part, or all, of real property contracts with respect to capital improvements to real properties, where the parties have a recurring business relationship (when a period of no more than twelve months elapse between transactions between two parties). A blanket use affidavit continues in force so long as the real property contractor named in "Box C" and the real property contractor (subcontractor) named in "Box D" maintain a recurring business relationship or until the affidavit is withdrawn or otherwise notified by the issuer of the form.

The blanket use will generally apply for the following: (1) a builder who hires the same contractor(s) only for new construction; (2) a real property contractor who hires the same subcontractor(s) only for reconstruction; (3) a real property contractor who hires the same subcontractor(s) for remodeling or renovation and the activities performed by the subcontractor(s) for the other party are never repair, maintenance, and installation services for real property based on the contract or agreement

between the parties; and (4) a real property contractor who exclusively hires the same subcontractor(s) to perform part, or all, of its real property contracts for capital improvements to real properties.

A general contractor or subcontractor hires a subcontractor that will replace the complete electrical wiring in all renovated homes:

- **Box C - Real Property Contractor:** Enter the hiring real property contractor's name and address.
- **Box D - Real Property Contractor** *(General Contractor or Subcontractor)*: Enter the hired subcontractor's name and address.
- Authorized person listed in Box C signs, enters title, enters the date, and issues to the person listed in Box D.

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. This Article illustrates one method of summarizing the Work. Revise to accurately describe Project.

Work included in the project is listed below:

New construction for the Town of Wake Forest Public Safety Warehouse. This will be a new 6,991sf vehicle storage garage with equipment storage, offices, and restroom facilities that will include new slab on grade, wood frame structure with masonry veneer, standing seam metal roof, and associated sitework / utilities.

B. Project Location: 1412 Forestville Road, Wake Forest, NC 27587

C. Owner: Town of Wake Forest

1.3 CONTRACT

A. Project will be constructed under a general construction contract.

END OF SECTION 011000

SECTION 012300 - ALTERNATES

PART 2 - GENERAL

2.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

2.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

2.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

2.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

PART 3 - PRODUCTS (Not Used)

PART 4 - EXECUTION (Not Used)

END OF SECTION 012300

SECTION 012900 - PAYMENT PROCEDURES

PART 5 - GENERAL

5.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

5.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

5.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

5.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

    a. Application for Payment forms with Continuation Sheets.
    b. Submittals Schedule.

2. Submit the Schedule of Values to Architect at earliest possible date but no later than (seven) 7 days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

    a. Project name and location.
    b. Name of Architect.
    c. Architect's project number.
    d. Contractor's name and address.

e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.

      1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

5.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. **Architect** will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit (three) 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

G. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final, liquidated damages settlement statement.

END OF SECTION 012900

SECTION 013300 - SUBMITTAL PROCEDURES

PART 6 - GENERAL

6.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

6.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

6.3 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will **not** be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.

1. Initial Review: Allow (fifteen) 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow (twenty-one) 21 days for initial review of each submittal.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately **4 x 5 inches** on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.

c. Name and address of Architect.
d. Name and address of Contractor.
e. Name and address of subcontractor.
f. Name and address of supplier.
g. Name of manufacturer.

E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect..
2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

PART 7 - PRODUCTS (NOT USED)

PART 8 - EXECUTION

8.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

8.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

C. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

END OF SECTION 013300

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 9 - GENERAL

9.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

9.2 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities include, but are not limited to, the following:
   1. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
   2. Ventilation.
   3. Electric power service.
   4. Lighting.

C. Support facilities include, but are not limited to, the following:
   1. Project identification and temporary signs.
   2. Waste disposal facilities.
   3. Field offices.
   4. Storage and fabrication sheds.
   5. Lifts and hoists.
   6. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:
   1. Pest control.
   2. Security enclosure and lockup.
   3. Barricades, warning signs, and lights.
   4. Temporary enclosures.
   5. Fire protection.

E. Related Sections include the following:
   1. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.

9.3 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
   1. Architect.
   2. Testing agencies.
   3. Personnel of authorities having jurisdiction.

B. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.

C. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

9.4 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

9.5 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 10 - PRODUCTS

10.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Portable Chain-Link Fencing if needed: Minimum 2-inch 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized steel bases for supporting posts.

C. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

D. Water: Potable.

10.2 EQUIPMENT

A. General: Provide equipment suitable for use intended.
   1. Field Offices Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

D. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

PART 11 - EXECUTION

11.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 12 - GENERAL

12.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

12.2 SUMMARY

A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:
   1. Division 1 Section "Alternates" for products selected under an alternate.
   2. Division 1 Section "Closeout Procedures" for submitting warranties for contract closeout.

12.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

12.4 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified material or product cannot be provided.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    g. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
    h. Cost information, including a proposal of change, if any, in the Contract Sum.
    i. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    j. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

12.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

12.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger Project structure.
7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

12.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

PART 13 - PRODUCTS

13.1 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures: Procedures for product selection include the following:

1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named or equal.

2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer from the source named that complies with requirements or equal.

3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.

5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
6. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

13.2 PRODUCT SUBSTITUTIONS

A. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 14 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017700 - CLOSEOUT PROCEDURES

PART 15 - GENERAL

15.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

15.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Operation and maintenance manuals.
4. Warranties.
5. Instruction of Owner's personnel.
6. Final cleaning.
7. Waivers of Lien.

B. Related Sections include the following:
1. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
2. Division 1 Section "Demonstration and Training" for requirements for instruction of Owner's personnel.

15.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic negative, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.

9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

15.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. [Submit demonstration and training videotapes.]

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

15.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit 3 (three) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

15.6 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.

1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

    a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
    d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.
4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Note related Change Orders, Record Drawings (and Product Data), where applicable.

D. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings, (and Record Specifications), where applicable.

E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

15.7 OPERATION AND MAINTENANCE MANUALS

A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Operation Data:

a. Emergency instructions and procedures.
b. System, subsystem, and equipment descriptions, including operating standards.
c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
d. Description of controls and sequence of operations.
e. Piping diagrams.

2. Maintenance Data:

a. Manufacturer's information, including list of spare parts.
b. Name, address, and telephone number of Installer or supplier.
c. Maintenance procedures.
d. Maintenance and service schedules for preventive and routine maintenance.
e. Maintenance record forms.
f. Sources of spare parts and maintenance materials.
g. Copies of maintenance service agreements.
h. Copies of warranties and bonds.

B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

15.8 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within (fifteen) 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 16 - PRODUCTS

16.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 17 - EXECUTION

17.1 DEMONSTRATION AND TRAINING

A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Provide instructors experienced in operation and maintenance procedures.
2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
3. Schedule training with Owner through Architect with at least (seven) 7 days' advance notice.
4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

17.2 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    h. Sweep concrete floors broom clean in unoccupied spaces.
    i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
    j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
    k. Remove labels that are not permanent.
    l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

        1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

    m. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    n. Replace parts subject to unusual operating conditions.
    o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    q. Clean ducts, blowers, and coils if units were operated without filters during construction.
    r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
    s. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

PROJECT STANDARD SPECIFICATIONS

PROJECT SPECIAL PROVISIONS – PARKING LOT

SECTION 01000
DEFINITIONS and REFERENCE STANDARDS
(REVISED 4-9-19)

PART 1 - DEFINITIONS

A. EASEMENT – An interest in land owned by another that entitles its holder to a specific use.

B. INVERT - The lowest point in the internal cross section of a pipe or other culvert.

C. RIGHT OF WAY - The area that encompasses public streets, sidewalks and utility strips.

D. SUBGRADE - That portion of the roadbed prepared as a foundation for the pavement structure.

PART 2 – REFERENCE STANDARDS

A. All materials, products and procedures incorporated into the work shall be in strict accordance with the following codes, standards and specifications. Wherever reference is made to any published standard, code or standard specification, it shall mean the latest edition in effect at the invitation for bids.

B. American Association of State Highway and Transportation Officials (AASHTO)

C. American National Standards Institute (ANSI)

D. American Society of Testing and Materials (ASTM)

E. American Water Works Association (AWWA)

F. City of Raleigh Public Utilities Handbook – is available on the City's website at the following path:
Public Utilities Handbook | Raleighnc.gov

G. Town of Wake Forest (ToWF) Manual of Specifications, Standards and Design (MSSD) - is available on the Town's website at the following path: Manual of Specifications, Standards & Design | Town of Wake Forest, NC (wakeforestnc.gov). Where standard specifications between ToWF, NCDOT or the project specifications herein are in conflict, the more stringent standard specification shall apply.

H. Ductile Iron Pipe Research Association (DIPRA)

I. Manual on Uniform Traffic Control Devices for Streets and Highways, as prepared by the National Advisory Committee on Uniform Traffic Control Devices (MUTCD)

J. North Carolina Department of Transportation (NCDOT) Standard Drawings – may be obtained at the following link: https://connect.ncdot.gov/resources/Specifications/Pages/default.aspx

K. North Carolina Department of Environmental Quality (NCDEQ)

L. National Electrical Code (NEC)

M. National Electrical Manufacturers Association (NEMA)

N. Natural Resources Conservation Service (NRCS)

O. Occupational Safety and Health Act (OSHA)

P. Underwriters Laboratories, Inc. (UL)

END OF SECTION

SECTION 02000
CONTRACTOR SUBMITTALS
(Revised 4-9-19)

PART 1 – SUBMITTALS

1.01 GENERAL

A. The Contractor shall transmit five (5) copies of submittals in sufficient time to allow thorough review by the Engineer. The Engineer will retain two (2) sets of submittals and return three (3) sets of submittals to the Contractor following review.

B. Submittals shall be accompanied by a letter of transmittal containing the date, project name, Contractor's name, supplier, manufacturer, number and title of submittal, notification of exceptions and/or deviations from the Contract requirements, and any other pertinent data to facilitate review.

C. The Contractor shall thoroughly check all submittals for accuracy and conformance to the intent of the Contract Documents, and make any necessary changes, prior to submitting them to the Engineer. All submittals shall bear the Contractor's certification stating that they have been so checked. **This certification shall include the following statement: "By this Submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers, and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all contract requirements." SUBMITTALS WITHOUT THE CONTRACTOR'S CERTIFICATION WILL BE RETURNED TO THE CONTRACTOR WITHOUT REVIEW.**

D. No material shall be ordered, fabricated or shipped or any work performed until the Engineer returns the required submittal to the Contractor with satisfactory review indicated.

E. The Engineer's review of the Contractor's submittals shall in no way relieve the Contractor of any responsibility under the Contract. An acceptance of a submittal shall be interpreted to mean that the Engineer has no specific objections to the submitted material, subject to conformance with the Contract Documents.

1.02 SHOP DRAWINGS

A. The Contractor shall submit to the Engineer for review shop drawings for all fabricated work and for all manufactured items for which shop drawings are required elsewhere in the project manual. This shall include, but not be limited to, items related to paving materials, concrete, storm drainage,

water/reclaimed water distribution, sanitary sewer, traffic control, traffic signalization, structural (i.e. bridges, headwalls, retaining walls), engineering fabric/grids, pavement markings, and erosion control.

B. Where manufacturer's publications in the form of catalogs, brochures, illustrations or other data sheets are submitted, items for which approval is requested shall be shall be specifically indicated. Submittals showing only general information shall not be acceptable.

C. Within ten (10) days after notice to proceed, the contractor shall submit his preliminary schedule of shop drawing submittals to the Engineer for approval.

1.03 LAYOUT AND INSTALLATION DRAWINGS

A. The Contractor shall submit to the Engineer for review layout and installation drawings for all pipes, valves, fittings, sewers, manholes, electrical, conduits, etc. to be provided under this contract.

B. Within ten (10) days after notice to proceed, the contractor shall submit his preliminary schedule of layout and installation drawing submittals to the Engineer for approval.

PART 2 – OTHER REQUIREMENTS

2.01 PROGRESS SCHEDULE

A. The Contractor shall submit to the Engineer for review and approval the proposed progress schedule in accordance with Article 108-2 of the General Conditions.

B. The schedule shall be kept up to date and presented with each month's billing information and shall be made available at the bi-weekly progress meetings and at other times as may be deemed necessary by the Town Engineer or his representative. A blank form for the Town of Wake Forest Progress Chart is available for use by the Contractor.

C. Progress schedule shall be updated monthly and submitted to the Engineer with the application for payment. The Engineer may withhold progress payments until such time as the schedule or revised schedule is received.

D. Progress schedule shall be prepared in the form of a horizontal bar chart showing in detail the proposed sequence of work. Schedule shall be time scaled showing start and completion dates for each stage of the work. The schedule shall account for all subcontractors. The schedule shall provide for proper sequence of construction considering various crafts, purchasing time, submittal review, material delivery, equipment fabrication and similar time-consuming factors. The schedule shall show as a minimum, earliest starting

earliest completion, latest starting, latest completion, and total float for each task or item.

2.02 LIST OF SUBCONTRACTORS

A. The Contractor shall submit to the Engineer for review, prior to the preconstruction conference, a listing of all subcontractors. This submittal shall include a description of the work to be performed by each subcontractor, the estimated value of such work, and the subcontractor's experience performing similar work.

END OF SECTION

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SECTION 02315

TRENCHING FOR UTILITIES

PART 1 GENERAL

1.01 SCOPE

A. Provide labor, equipment, and material to perform required excavating, backfilling, and compacting for utilities and related structures as specified herein and indicated on the Drawings. Work shall include, but not be limited to, the following:
   1. Survey staking as required for construction.
   2. Protection of existing improvements.
   3. Location of existing utilities.
   4. Use of explosives.
   5. Dewatering.
   6. Excavating, backfilling, and compacting for utilities.
   7. Installation of warning / identification tape and tracer wire.
   8. Borrow material.
   9. Disposal of surplus material.
   10. Demolition and removal of existing structures.
   11. Soil Testing.

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 03000 Clearing and Grubbing
   2. Section 16000 Sedimentation and Erosion Control
   3. Section 11000 Water Distribution System
   4. Section 12000 Sanitary Sewer System
   5. Section 17000 Temporary and Permanent Grasses

B. The City of Raleigh Public Utilities Handbook, as it relates to this Section, shall be used in conjunction with this specification. All aspects of the project construction shall conform to this handbook unless specifically noted otherwise herein. It is the Contractors responsibility to obtain this document from the City's Public Utilities Department. It can be obtained by phone at 919-857-4540 or on the internet at Public Utilities Handbook | Raleighnc.gov under departments and public utilities.

C. In the event of a discrepancy between this specification and the Handbook, the Contractor shall use the more stringent of the two documents. Notify the Owner immediately of the discrepancy.

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 - Standard Specifications for Roads and Structures (NCDOT).
   2. American Society of Testing Materials (ASTM)
      a. D698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49 Kg) Rammer and 12-inch Drop (Standard Proctor).

b. D1556 Density of Soil in Place by the Sand-Cone Method.
c. D1586 Penetration Test and Spilt-Barrel Sampling of Soils.
d. D2049 Test for Relative Density of Cohesionless Soils.
e. D2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
f. D2487 Classification of Soils for Engineering Purposes.
g. D3839 Standard Guide for Underground Installation of "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Pipe and Fittings.

3. American Water Works Association (AWWA)
   a. Fiberglass Pipe Design Manual of Water Supply Practices M45
   b. PVC Pipe Design and Installation Manual for Water Supply Practices M23
   c. Ductile Iron Pipe and Fittings Manual for Water Supply Practices M41
4. Uni-Bell PVC Pipe Association
   a. B-5-89 Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Sewer Pipe.
5. Ductile Iron Pipe Research Association (DIPRA)
   a. 8-08/5M Design of Ductile Iron Pipe

1.04 DEFINITIONS

A. Backfill: A specified material used in filling the excavated trench and placed at a specified degree of compaction.
   1. Materials: Materials listed herein include processed materials plus the soil classifications listed under the Unified Soil Classification System, (USCS) (Method D2487 and Practice D2488). The soil materials are grouped into five broad categories according to their suitability for this application.
      a. Class I: Angular, 6 to 40-mm (1/4 to 1-1/2-in), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shell.
      b. Class II: Coarse sands and gravels with maximum particle size of 40 mm (1-1/2 in.), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, 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 shall not be used for bedding, haunching, or initial backfill.
      e. Class V: This class includes the organic soils OL, OH, and PT as well as soils containing frozen earth, debris, rock larger than 40 mm (1 1/2 in.) in diameter, and other foreign materials. These materials shall not be used for bedding, haunching, or initial backfill.
   2. Backfill Zones: Each backfill zone shall extend the full width of the trench bottom.
      a. Foundation: Extending down from the bottom of bedding zone as defined below.
      b. Pipe Embedment
         1) Bedding: Extending from 4 inches below the pipe bottom to the pipe bottom for 30-inch diameter and smaller and 6 inches below the pipe bottom for pipes larger than 30 inches in diameter.

2) Haunching: Extending from the bedding (bottom of the pipe) to the pipe spring line.
3) Initial Backfill: Extending from the haunching (pipe spring line) to 1 foot above the top of the pipe.

c. Final Backfill: Extending from the initial backfill to the finish ground elevation.

B. Laying Conditions:
1. Type 1: Flat bottom trench with loose backfill.
2. Type 2: Flat bottom trench with backfill lightly consolidated to centerline of pipe.
3. Type 3: Pipe bedded in 4 inches minimum of loose soil and backfill lightly consolidated to top of pipe.
4. Type 4: Pipe bedded on Class I material to 1/8 pipe diameter (4 inch minimum) Backfill compacted to top of pipe a minimum of 80 percent of standard proctor.
5. Type 5: Pipe bedded in compacted Class I material to pipe centerline with 4-inch minimum under pipe. Backfill to top of pipe with Class I, II, or III and compact to 90 percent of standard proctor.

C. 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).

D. Excavation: The removal of soil or rock to obtain a specified depth or elevation.

E. Lift: Layer of soil placed on top of a previously prepared or placed soil.

F. Rock: Solid, homogeneous material which cannot be removed without the systematic drilling and blasting exceeding 1 cubic yard in volume. Material having a standard penetration rate less than 1-inch of penetration over 50 blows across continuous materials is defined as “rock.” Rock is further defined as materials and obstructions encountered that cannot be practically excavated with a large track mounted backhoe, such as a CAT-325 or larger, equipped with a 42-inch rock bucket and new rock teeth. Practical excavation is defined as the ability to remove at least 10 cubic yards during one (1) hour of continuous digging. Removal of "hard material" will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

G. Pipe Springline: A line running horizontally through the center of the pipe.

H. 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.

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01330, Submittal Procedures:
1. 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. Warning / Identification tape.
b. Geofabric for trench stone wrap.
2. Test Reports: Submit for the following:
a. Moisture-density relations of soils.
b. Field moisture content.

c. Soil classification.
d. In-place field density.
e. Geotechnical engineer's daily field reports.
f. Third-party test reports for pre-construction condition assessments, crack monitoring and vibration monitoring per Section 02300, Earthwork.

PART 2 PRODUCTS

2.01 STONE

A. Class I material shall be #67 or #78M stone in accordance with NCDOT specifications Section 1005, General Requirements for Aggregate.

B.

2.02 WARNING AND IDENTIFICATION TAPE

A. Tape shall be a minimum 3-inch wide polyethylene plastic tape manufactured specifically for identification of buried utilities with means of enabling detection by a metal detector to a minimum depth of 3 feet. Tape shall be color coded and continuously imprinted with warning and identification markings in bold black letters to read "CAUTION - BURIED (utility) LINE BELOW." Color and printing shall be permanent, unaffected by moisture or soil and shall be as follows:

Utility	Color	Marking
1. Reclaimed Water	Purple	Caution – Buried Reclaimed Water Line Below
2. Sewer	Green	Caution - Buried Gravity Sewer Main Below Buried Pressure Sewer Line Below
3. Water	Blue	Caution – Buried Water Line Below

B. Tape shall be by Blackburn Manufacturing, Joseph G. Pollard Co., or Reef Industries Inc or approved equal.

C. Warning tape shall only be installed for pressure mains constructed of PVC materials.

2.03 TRACER WIRE AND INDICATION POSTS

A. All non-ferrous pressure mains shall be provided tracing wire and test ports in such a manner as to be able to properly trace all mains without loss or deterioration of signal or without the transmitted signal migrating off the trace wire.

B. Tracer wire shall be #12 gauge solid (bare) copper and continuous to the greatest extent possible. The tracer wire shall be securely bonded together at all wire joints with an approved industrial crimp connector to provide electrical continuity. It shall be accessible at all tracer wire test ports.

C. Test ports with marker posts shall be located at bends and no further than 500 feet apart. The test port shall consist of a standard valve box (as specified in Section 02530), shall be H-20 traffic load rated flush with grade in non-paved areas and flush with final asphalt or concrete pavement elevation and shall be located over the downstream or outgoing main. The valve box shall be equipped with a lid stamped “TS” and painted green for sewer mains, blue for water mains, and Pantone 522C for reuse mains. At each test port, a loop of wire shall be brought up and looped inside the box. The loop of wire inside the box shall be a minimum of three feet.

2.04 TRACER WIRE FOR NONMETALLIC WATER SERVICE PIPE

A. Where nonmetallic water service pipe is allowed, all new nonmetallic water service pipes shall be provided tracing wire in such a manner as to be able to properly trace all mains and service laterals without loss or deterioration of signal or without the transmitted signal migrating off the trace wire.

B. Tracing shall be #12 gauge solid (bare) copper and continuous to the greatest extent possible. The tracer wire shall be securely bonded together at all wire joints with an approved industrial crimp connector to provide electrical continuity.

C. The meter box at or near the right of way and or easement shall serve as the test port with the tracing wire brought up into the meter box with the service lateral and looped in the meter box. The loop wire inside the meter box shall be a minimum of three feet.

D. For new nonmetallic water service laterals where no tracer is installed on the main, provide an anode (1 pound minimum) for the tracing wire termination at the point of the new tap on the main.

E. For nonmetallic service lateral installations less than 8 feet, the tracing wire shall be attached to the pipe. For nonmetallic service lateral installations deeper than 8 feet, the tracing wire shall be installed at a depth of 7 to 8 feet. For nonmetallic service laterals that are installed in encasement pipe, the tracing wire shall be routed through the encasement pipe.

F. For nonmetallic service lateral that installed by directional drilling, the tracer wire shall be attached to and pulled through with the service pipe.

G. The wire shall be protected from damage during the execution of the work. No breaks or cuts in the tracer wire shall be permitted. Spliced connections shall only be allowed between the main liner tracer wire (if applicable) and the lateral tracer wire. Industrial crimps shall be used to provide electrical continuity and the crimps shall be similar metal to eliminate galvanic corrosion.

H. Contractor shall perform a continuity test on all tracer wire in the presence of the Owner or Owner's representative. If the tracer wire is found to be not continuous after testing, Contractor shall repair or replace the failed segment of wire at his own expense.

I. Copper clad steel tracer wire (#12) as manufactured by Copperhead Industries, or approved equal is an approved alternative to #12 bare solid copper tracer wire.

2.05 TRACER WIRE FOR GRAVITY SEWERS AND LATERALS AND MANHOLE MARKERS

A. In accordance with General Statute 87-121(g), gravity sewers and laterals installed after October 1, 2014 shall be electronically locatable.

B. All new gravity sewer main and sanitary sewer lateral shall be provided tracing wire in such a manner as to be able to properly trace all mains without loss or deterioration of signal or without the transmitted signal migrating off the trace wire.

C. Tracing shall be #12 gauge solid (bare) copper and continuous to the greatest extent possible. Copper clad steel tracer wire (#12) as manufactured by Copperhead Industries, or approved equal is an approved alternative to #12 bare solid copper tracer wire. The tracer wire shall be securely bonded together at all

wire joints with an approved industrial crimp connector to provide electrical continuity. It shall be accessible at all tracer wire test ports.

D. For gravity mains, test ports shall be provided at frequency of 500 feet or at every manhole, whichever is the shorter of the distance. The test port shall consist of a standard valve box (as specified in Section 02530), shall be H-20 traffic load rated flush with grade in non-paved areas with concrete collar as shown on Detail W-17, and flush with final asphalt or concrete pavement elevation and shall be located over the downstream or outgoing main. The valve box shall be equipped with a lid stamped “TS” and painted green. At each test port, a loop of wire shall be brought up and looped inside the box. The loop of wire inside the box shall be a minimum of three feet. All tracing wire for branch mains and laterals that terminate into the manhole shall be routed around the circumference of the manhole and spliced to the main tracing line.

E. For sanitary sewer laterals, the cleanout at the right of way and or easement shall serve as the test port with the tracing wire brought up outside the cleanout assembly and wrapped around the assembly stack twice at a depth of approximately 12-inches below grade. Extend a loop of the wire to the top of cleanout.

F. For new sanitary sewer laterals where no tracer is installed on the main, provide an anode (1 pound minimum) for the tracing wire termination at the point of the new tap on the existing main.

G. For gravity main and or lateral installations less than 8 feet, the tracing wire shall be attached to the pipe. Tracer wire shall be laid flat and securely affixed to the pipe at 10 foot intervals. Where lateral taps are made by service saddles, the tracer wire shall not be allowed to be placed between the saddle and main. For gravity main and or lateral installation deeper than 8 feet, the tracing wire shall be installed at a depth of 7 to 8 feet. The wire shall be protected from damage during the execution of the work. No breaks or cuts in the tracer wire shall be permitted.

H. Spliced connections shall only be allowed between the main line tracer wire and branch main and lateral tracer wire. Industrial crimps shall be used to provide electrical continuity and the crimps shall be similar metal to eliminate galvanic corrosion.

I. Contractor shall perform a continuity test on all tracer wire in the presence of the Owner or Owner's representative. If the tracer wire is found to be not continuous after testing, Contractor shall repair or replace the failed segment of wire at his own expense.

J. Where existing branch mains are reconnected to a main line that is replaced or realigned, tracing wire is not required for the section of branch main that is reconnected unless it is replaced from manhole to manhole. All main lines that are replaced or realigned shall be provided tracing wire.

K. For gravity sewer mains and laterals that are installed in encasement pipe, the tracing wire shall be routed through the encasement pipe.

L. Manhole markers shall be placed adjacent to manholes at the discretion of Owner or Owner’s representative.

2.06 TRACER WIRE FOR REUSE MAINS

A. Tracer wire to be installed on all PVC reuse pipe in such a manner as to be able to properly trace all mains without loss or deterioration of signal or without the transmitted signal migrating off the trace wire.

B. Tracer wire shall be #12 gauge solid (bare) copper and continuous to the greatest extent possible. Copper clad steel tracer wire (#12) as manufactured by Copperhead Industries, or approved equal is an approved alternative to #12 bare solid copper tracer wire. The tracer wire shall be securely bonded together at all wire joints with an approved industrial crimp connector to provide electrical continuity. It shall be accessible at all tracer wire test ports.

C. Test ports with marker posts shall be located at bends and no further than 300 feet apart. The test port shall consist of a standard valve box with a concrete collar, shall be H-20 traffic load rated flush with grade in non-paved areas with concrete collar as shown on detail W-17, and flush with final asphalt or concrete pavement elevation and shall be located over the downstream or outgoing main. The valve box shall be equipped with a lid stamped “TS” and painted Pantone 522C for reuse mains.

D. At each test port, a loop of wire shall be brought up and looped inside the box. The loop of wire inside the box shall be a minimum of three feet.

E. The wire shall be protected from damage during the execution of the work. No breaks or cuts in the tracer wire shall be permitted. Industrial crimps shall be used to provide electrical continuity and the crimps shall be similar metal to eliminate galvanic corrosion.

F. Contractor shall perform a continuity test on all tracer wire in the presence of the Owner or Owner's representative. If the tracer wire is found to be not continuous after testing, Contractor shall repair or replace the failed segment of wire at his own expense.

G. All main lines that are replaced or realigned shall be provided tracing wire.

H. For reuse mains that are installed in encasement pipe, the tracing wire shall be routed through the encasement pipe.

PART 3 EXECUTION

3.01 PROJECT SAFETY

A. Contractor is responsible for Project safety.

B. Perform work in conformance with applicable State and Federal safety regulations including, but not limited, to the following:
   1. North Carolina Safety and Health Standards for the Construction Industry (29CFR 1926 Subpart P and U).
   2. NC OSHA Industry Guide No. 14, Excavations.
   3. NC OSHA Industry Guide No. 20, Crane Safety.

C. Provide barriers, warning lights, and other protective devices at excavations as necessary for safety of workers and the public.

D. Provide sloping of bank, shoring, sheeting, or other means of maintaining the stability of the trench in accordance with the requirements of the Associated Contractor's Manual of Accident Prevention OSHA, Part 1926.P.

E. In trench depths of 22 feet or greater, provide certification sealed by Structural Engineer certifying that trench box, sheeting and shoring meets OSHA requirements.

3.02 VIDEO AND PHOTOGRAPHIC INSPECTIONS

A. Provide pre and post construction video inspections of the project area in accordance with Section 01320, Video and Photographic Documentation.

B. Submittal shall be in accordance with Section 01330, Submittal Procedures.

3.03 PROTECTION OF UNDERGROUND FACILITIES

A. Refer to paragraph 4.04 of the General Conditions and SC-4.04.A.2 of the Supplementary Conditions concerning the protection of Underground Facilities.

B. Prior to beginning any excavation work or boring, the Contractor shall, through field investigations, determine any conflicts or interferences between existing utilities and new utilities to be constructed under this project. This determination shall be based on the actual locations, elevations, slopes, etc., of existing utilities as determined in the field investigations, and locations, elevation, slope, etc. of new utilities as shown on the Drawings. If an interference exists, the Contractor shall bring it to the attention of the Engineer as soon as possible. If the Engineer agrees that an interference exists that was not apparent from the Contract Documents, or could not have been identified during a site visit during bidding, he shall modify the design as required. Additional costs to the Contractor for this change shall be processed through a Change Order as detailed elsewhere in these Contract Documents. An interference shall be defined for these purposes as a conflict with an existing utility or structure that prevents the proposed utility from being installed where shown or specified after existing utilities and structures are adequately supported by the Contractor. In the event the Contractor fails to complete adequate field evaluations to identify conflicts, or bring a potential conflict or interference to the attention of the Engineer prior to beginning excavation work, any actual conflict or interference which does arise during the Project and could have been avoided with diligent utility location efforts shall be corrected by the Contractor, as directed by the Engineer, at no additional expense to the Owner.

C. A change in conditions may be considered due to the location of the existing facilities as allowed in the General Conditions. This does not include the cost for repair of damaged facilities not properly located in advance of construction.

D. Separation distances shall be in accordance with utilities requirements.

3.04 CONSTRUCTION STAKING

A. Provide construction staking as indicated in paragraph 4.05 of the General Conditions. Engineer will only provide electronic design files for Contractor’s surveyor and key reference points and benchmarks as shown on the Drawings.

B. Contractor shall report to Engineer whenever a reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations. Contractor shall be responsible for the accurate replacement or relocation of such reference points or property monuments by a registered professional surveyor in the State of North Carolina.

3.05 LOCATION OF INSTALLED UTILITIES

A. Contractor shall be responsible for locating contract installed utilities as requested by third parties proposing to dig in the contract area until the date that the entire contract is recommended for final payment by Engineer to Owner.

3.06 WATER CONTROL

A. Prevent surface water from entering the trench.

B. When trench bottom is below the existing ground water table, install a dewatering system to maintain water table a minimum of two (2) feet below trench bottom. Provide personnel experienced in dewatering work at the job site.

C. Maintain dewatering until backfilling has proceeded above the existing ground water level.

D. Dispose of water from dewatering operations in accordance with the North Carolina Sedimentation Pollution Control Act.

E. In no case shall trench water or groundwater be pumped into or allowed to enter the sanitary sewer system.

3.07USE OF EXPLOSIVES

A. Blasting is allowable for the removal of rock, as defined herein, unless specifically prohibited by the Owner, Engineer or a Utility Owner with an existing utility within the proximity of the proposed blast site. The contractor shall review the drawings for specific areas where blasting is prohibited.

B. Obtain required permits for blasting (e.g., from City of Raleigh Fire Marshall’s Office) prior to blasting, 24 hours minimum.

C. Store, handle, and use explosives in accordance with all applicable local, state, and federal regulations, and in accordance with the provisions of the "Manual of Accident Prevention and Construction" of the Associated General Contractors of America, Inc. Federal regulations include, but are not limited to, Title 27, Chapter 11, Part 555 of the Code of Federal Regulations (CFR) and OSHA Standards – Part 1926, Subpart U.

D. Provide seismographic monitoring during progress of blasting operations.

E. Take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden. Keep the explosive materials that are on the job site in specially constructed boxes provided with locks. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within 500 feet of a utility, structure, or property which could be damaged by vibration, concussion or falling rock, keep a blasting log containing the following information for each and every shot. This log shall be kept in an orderly manner and made available to the Engineer and Owner upon request.
   1. Date of shot
   2. Time of shot
   3. Crew supervisor
   4. Number and depth of holes
   5. Approximate depth of overburden
   6. Amount and type of explosive used in each hole

7. Type of caps used (instant or delay)
8. The weather
9. Seismograph instrument and readings

F. Use explosives in such a way to minimize vibration to existing utilities and structures.

G. Provide only experienced personnel for blasting in accordance with accepted practices.

H. Contractor is responsible for safety of life and damage to property resulting from the use of explosives. The Owner and Engineer shall be made aware of all blasting activities prior to their occurrence.

I. Provide services of a testing firm experienced in monitoring vibrations resulting from blasting operations as specified in Section 01450, Quality Control.

J. In addition to the above testing/monitoring requirements required, Contractor shall provide the services of a "third party" geotechnical testing firm experienced in monitoring vibrations resulting from blasting operation as specified in Section 01450, Quality Control. The firm selected shall be evaluated by the Engineer and Owner for approval as the official "third party".

K. Third Party testing/monitoring as related to blasting operations shall include the following:
   1. Pre-Construction Condition Assessment
      a. Prior to beginning construction, the third party testing firm shall perform a pre-construction condition assessment to document the conditions of buildings and other sensitive structures within ***Distance for Blast Assesment*** feet of the proposed blasting area. The assessment shall be performed on all adjacent properties and any other properties as directed by the Engineer or Owner. The assessment should include video and photographic documentation of all exteriors including building foundations, and installation of crack monitors on cracks that might occur or expand due to construction vibrations. Provide all documentation described above to the Owner and Engineer prior to construction.
   2. Crack Monitoring During Construction:
      a. During construction, the third party testing firm shall perform periodic readings of the crack monitors installed prior to construction. Provide readings to the Engineer and Owner within 48 hours of taking the reading. If crack readings monitoring confirm that vibrations are not contributing to crack width, crack monitors may be read once per week. More frequent readings may be required by Owner or Engineer if construction activities could result in greater earthborne vibrations. Testing firm shall notify the Engineer and Owner immediately if monitoring indicates that construction operations have contributed to crack widening. The testing firm shall prepare a detailed plan for repaired the structure and the Contractor shall repair the structure at no cost to the Owner. Contractor shall submit a plan for review that proposes alternate construction methods to address the vibration problems and minimize further damage.
   3. Vibration Monitoring During Construction:
      a. The third party testing firm shall monitor vibrations at no less than four locations along the perimeter of the project during all blasting activities. The locations shall be based on the location of construction activities and their relative position to offsite structures. Prior to construction, a plan

showing the proposed monitoring locations shall be submitted to the Engineer and Owner for approval. Adjustments may be made to the locations upon approval. The sensitivity range of the seismograph shall be selected such that the recording is initiated below the maximum allowable particle velocity of 1 in/sec and extends above the highest expected intensity. Specific activities of the vibration source (i.e., blasting) shall be indexed in time to allow correlation with the arrivals on the vibration.

b. The maximum allowable particle velocity is 1 in/sec. The contractor shall notify the Engineer and Owner immediately if monitors indicate that the vibrations are above the criteria established. Activities causing the vibrations shall be suspended until a revised construction plan has been developed by the testing firm to alleviate the problem. The problem shall be resolved by the Contractor at no additional cost to the Owner.
c. The vibration monitors shall consist of digital seismographs that display the particle velocities and associated frequencies plotted against the criteria established for this project. Each seismograph shall contain geophones with response capability in three mutually perpendicular axes or components; one vertical and two horizontal (radial and transverse). The frequency response of the geophones shall be linear from at least 4 Hz to more than 200 Hz. The sensitivity shall range from less than 0.02 in/sec to more than 5.0 in/sec. The BlastMate III by Instantel is one type of seismograph that is suitable for this project.
d. Vibration monitors shall be field calibrated by the testing firm before each recording period. The transducer shall be positioned with the longitudinal axis toward the vibration source. Transducers must be adequately coupled with the ground. Operation and calibration of all equipment shall be per manufacturer's recommendations. Vibration records shall be collected in waveform plot or strip chart plot. The peak vector sum of the particle velocity in longitudinal, transverse, and vertical planes shall be shown along with the respective dominant or principle frequencies. The highest recorded particle velocity (i.e., the vector sum of the three orthogonal directions), when indexed to a particle vibration event, shall be reported as the peak particle velocity. The recorded peak particle velocity shall be compared to criteria appropriate for the subject of concern.
e. The Engineer and Owner shall be notified immediately of any complaint received by the Contractor. The Contractor shall immediately review those construction activities inducing the vibration and prepare a report documenting all relevant data such as the time and date of the complaint, a description of the construction activities, data from the monitoring instruments for the subject time/date, complaint information (including photographs, if possible) of the alleged damage. The Contractor shall submit for review a detailed plan for repair and revised construction plan to address the vibration problems to minimize further damage and complaints. The Contractor shall perform necessary repairs at no additional cost to the Owner.
f. The testing firm shall provide monthly reports containing the results of the crack monitors and vibration monitors during those activities that generate earthborne vibrations, including but not limited blasting operations. The reports shall document that the firm is provided the work described herein.

L. Submit monitoring reports in accordance with Section 01450, Quality Control.

M. Allowance established in Section 01270, Unit Prices, shall be utilized to pay for costs of the third party monitoring.

N. The Owner reserves the right to require the removal of rock by other means if blasting operations result in possible hazardous conditions.

O. The Contractor shall provide as contingency, on-site, by-pass pumping capability when blasting within 100 feet of existing sanitary sewer infrastructure or where required otherwise as noted on the Drawings or specified in other sections of the project manual.

3.08 EXCAVATING

A. Excavation shall be by open cut, unless otherwise indicated on the Drawings or specified herein. Other than where specifically indicated on the Drawings, short sections of trench may be tunneled or direct bored with the approval of the Engineer.

B. Stockpile excavated material in such a manner that it will not obstruct the flow of runoff, streams, endanger Work, impair the use or appearance of existing facilities, or be detrimental to the completed Work.

C. Contractor shall segregate excavated material so as to maintain material suitable for backfill separate from material that is unsuitable.

D. Trench dimensions at the pipe embedment and foundation zone, shall be as detailed on the drawings.

E. Shape trench bedding to provide uniform bearing for the full pipe length. Bottom shall be free of protrusions that could cause point loading on pipe. Provide bell holes as required for properly making pipe joint.

F. Do not over excavate. Excavation below grade without approval of Engineer shall be backfilled with Class I material at no additional cost.

G. Undercut soils that become unsatisfactory by construction activity or by being left exposed to the weather shall be replaced with Class I backfill material at no additional cost.

H. Remove shoring, bracing, and sheeting, unless otherwise noted, as the trench is backfilled. Engineer shall have the authority to require that the sheeting be left in place. Once the trench box has been removed to the top of the pipe (or initial backfill zone), the stone shall be replenished to have the required stone over the pipe for the entire width of the excavation. This includes area displaced by the trench boxes and any voids outside the box.

I. Excavation of trench shall not advance more than 100 feet ahead of the installation. In no case should the excavation extend beyond that which can be backfilled by the end of the workday.

J. Correct unstable soil conditions encountered at trench foundation by the following method:
   1. Excavate below grade as approved by Engineer and backfill with Class I material or approved substitute material at unit price bid as indicated in Section 01270, Unit Prices.

K. Rock and Hard Material
   1. Excavate rock and hard material to a minimum depth of 6 inches below the pipe. Excavation shall be backfilled with Class I material.

2. Mechanical removal of rock (i.e., no blasting) may be necessary along portions of the project, as noted on the Drawings or as required by the applicable regulatory agencies, where blasting could result in complications with surrounding infrastructure. This method of rock excavation will be used only when approved by the Owner, as the blasting method shall be the typical method.

L. Pressure Lines:
1. Provide a minimum 3 feet of cover, unless indicated otherwise on the Drawings.
2. Excavate trenches to provide vertical curve chords that will not exceed the pipe manufacturer's recommended joint deflection.
3. Provide concrete thrust blocks having a compressive strength of 3,000 psi at 28 days at change in horizontal and vertical direction and reduction in the pipe size, unless other restraint systems are indicated otherwise on the Drawings. Cut trench sides vertical and square to receive concrete. Provide bearing area against trench wall as indicated on the Drawings.

M. Gravity Lines:
1. Excavate trench to the alignment and grade indicated on the Drawings.

N. Utility Structures: Provide a minimum of 9 inches below subgrade and backfill with Class I compacted to 95 percent maximum density. If the soil conditions are found to be unsuitable for structural stability of the structure, Engineer may require additional depth of Class I material. The additional Class I material will be paid for under the appropriate bid item as indicated in the Bid Form.

3.09 BACKFILLING

A. Weather Limitations: Proceed with backfill operations based on the following weather conditions:
1. Temperature must be above freezing and rising.
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.
4. Do not place material on surfaces that are muddy, frozen, or contain frost.

B. General
1. Maintain backfill operation within 100 feet from pipe laying operation.
2. Backfill trench to existing ground surface with select excavated material at the specified compaction.
3. If excavated material is unsuitable to obtain specified compaction, provide suitable off-site borrow material for backfill as approved by Engineer.
4. Re-excavate trenches improperly compacted. Backfill and compact as specified.
5. Provide appropriate tamping equipment, and water to obtain proper moisture content, to achieve specified compaction of backfill.
6. Conduct operation of heavy equipment above pipe installation in such a manner as to prevent damage to pipe.
7. Install warning / identification tape over utilities. Bury tape one foot below finished grade above the utility.
8. Install tracer wire for non-metallic pressure pipe. Bury tracer wire one foot below finished grade over the pipe. Wire shall be looped into valve boxes and indication posts to allow access for direct contact location.

C. Backfill in pipe embedment zone (bedding, haunching, and initial backfill).
   1. General:
      a. Backfill with material as specified below. Material shall be free from objects larger than 2 inches.
      b. Where rock and hard material has been excavated below pipe bottom, backfill and compact bedding with Class I material. Class II or III material may be used for bedding with Engineer's approval unless specified otherwise below.
      c. Place backfill material to assure placement of material under pipe haunches.
      d. Take care during placement and compacting of material to avoid movement of pipe.
   2. Place backfill in bedding and haunching zones in 6 inch maximum lifts in traffic areas and 12 inch maximum lifts in non-traffic areas and compact to 90 percent density. Provide backfill material in pipe embedment zone as specified below.
      a. Pressure Lines (Flexible and Rigid Pipe)
         1) Excavation in Class I, Class II, Class III, and stable Class IV soils suitable for bedding, the bedding surface shall provide a firm foundation of uniform density. Backfill with select excavated material.
         2) Excavation in Class V, unstable Class IV soils, running water, and other unstable soil conditions, excavate a minimum of 6 inches below pipe bottom and provide Class I material for bedding and haunch zone. Backfill with Class I, II, or III material in initial backfill.
      b. Gravity Sewer Lines, Rigid pipe (ductile iron)
         1) Excavation in Class I, Class II, Class III, and stable Class IV soils suitable for bedding, the bedding surface shall provide a firm foundation of uniform density. Backfill with select excavated material.
         2) Excavation in Class V, unstable Class IV soils, running water, and other unstable soil conditions, excavate a minimum of 4 inches below pipe bottom and provide Class I material for bedding and haunch zone. Backfill with Class I, II, or III material in initial backfill.
      c. Gravity Sewer Lines, Flexible (CCFRPM)
         1) Depth of cover 0 to 40 ft:
            i) Provide Class I material for bedding and through embedment zone to 12” above the top of pipe.
      d. Gravity Sewer Lines, Flexible (PVC SDR 35)
         1) Depth 0 to 12 ft: Provide Class I material for bedding and haunching. Backfill with Class I, II, or III material in initial backfill.
      e. Gravity Sewer Lines, C900/C905
         1) Refer to Drawings.

D. Final Backfill
   1. Backfill with materials free of stones and debris larger than 6 inches in dimension. Place backfill in lifts not exceeding the thickness and compacted to the minimum density specified below.
   2. Lifts and density:
      a. Undeveloped areas (i.e., forests, fields, and, croplands): Trench may be filled with bulldozer blade provided material fall will not damage pipe. Mound soil over the trench area sufficiently to settle level over time. Degree of compaction shall be 85 percent.
      b. Lawns: Backfill in 12-inch lifts and compact to 90 percent. Top 12 inches shall be free of material with a dimension over 2 inches.

c. Roads (including Rights-of-way), drives, parking areas (including areas within 20 feet), and adjacent to existing utilities: Backfill in 6 inch lifts compact to 95 percent. Compact the final 8 inches below finished subgrades beneath pavements/sidewalks to at least 100% of the soil's Standard Proctor maximum dry density within 2% of optimum moisture.
d. Within 20 feet of foundations: Backfill in 6-inch lifts compacted to 95 percent.

E. Utility Structures: Bring backfill to grade in even lifts on all sides. Lift depths and compaction densities shall be as specified according to area of installation for pipe above. Backfill against cast-in-place concrete structure only after concrete has attained the specified 28-day compressive strength.

3.10 ANTI-SEEP COLLARS

A. Anti-seep Collars: Provide anti-seep collars to prevent groundwater flow along pipe in wetlands as indicated on the Drawings. Collars shall extend past trench walls and bear against undisturbed soils. Dimension of collars shall be as indicated on the Drawings. Do not place stone in area of anti-seep collars.

B. Concrete Collar: Provide Class B concrete with minimum cement content of 5 sacks per cubic yard (5.5 sacks for angular course aggregate); 6.8 gallons of water per sack water-cement ratio; 2-4 inch slump range; and 28-day strength of 2,500 psi.

C. Clay Collar: Provide clay of medium to high plasticity with a soil classification of CL or CH and a permeability of 10-5 cm / second. Place clay in 6-inch lifts and compact by use of a mechanical hydraulic tamper to 95 percent.

3.11 SOIL TESTING

A. Provide services of a soil-testing firm as specified in Section 01450, Quality Control.

B. Testing laboratory soil specialist shall be at the project site, upon request of the Owner, to perform inspection and in-place density testing as specified in Section 02300 Earthwork.

C. Density tests shall be made in accordance with ASTM D-698, Standard Proctor Method.

D. Submit test reports and soil specialist daily logs in accordance with Section 01450, Quality Control.

E. Allowance established in Section 01270, Unit Prices, shall be utilized to pay for costs of the initial tests.

F. For each test that fails the compaction requirements, the testing firm, at the direction of the Engineer, shall make two additional tests. Contractor shall pay for cost of additional tests due to failure of compaction/density test.

G. Based on test results, make corrections, adjustments, and modifications of methods, materials, and moisture content for proper trench compaction.

3.12 PAVEMENT REMOVAL AND PATCHING

A. Repair damaged pavement structure.

B. Cut existing pavement for utility installation in straight lines generally parallel to the utility. Properly dispose of removed pavement structure.

C. Extend pavement patch 1 foot beyond each side of trench on firm subgrade. Slope new surface to drain.

D. Asphalt Pavements: Replace asphalt pavement with a pavement structure equal to existing but no less than as detailed on the Drawings or as indicated in the Encroachment Agreement, whichever is more stringent.

E. Concrete Pavements: Replace concrete pavement with pavement structure equal to existing but no less than as detailed as Drawings. Concrete shall be minimum 3,000 psi. When existing concrete joint is within 5 feet of trench remove existing concrete to joint. Provide expansion joint at edge of existing concrete. Surface treatment shall match existing. For overlays, as indicated on Drawings, set new driveway elevation at overlay depth and transition to existing driveway elevation.

F. Curbs, Gutters, and Sidewalks: Replace curbs and gutters, and sidewalks removed or damaged with similar sections to match the existing. Remove to nearest existing joint.

G. Approval of Other Authorities: Pavements under the jurisdiction of the NC Division of Highways shall be subject to the approval of a representative of that Division.

H. For overlays, coordinate final limits with Owner, Engineer, and NC Division of Highways. Perform in accordance with NCDOT Encroachment Agreement.

I. For overlays, as indicated on Drawings, raise existing and new manholes and valve boxes to finished pavement grade. Excavate around top of existing manhole and valve box as necessary. Remove existing top ring, and install new grade ring(s) as necessary. Install existing cover. Raise existing valve box. Provide concrete collar around manhole ring and valve box per details on the Plans.

J. See Section 02700, Pavement and Appurtenances for additional requirements.

3.13 GRADING AND CLEAN-UP:

A. Provide for testing and clean up as soon as practicable, so these operations do not lag far behind the pipe installation. Perform preliminary clean up and grading as soon as backfill is complete.

B. Provide positive drainage of finished grade and drain away from structures. Finished grade shall be reasonably smooth, compacted, free from irregular surface changes and comparable to the adjacent existing ground surface.

C. Seed disturbed areas in accordance with Section 02920, Lawns and Grasses.

D. Upon completion of backfilling, remove and properly dispose of excess material and waste. Surplus materials shall be disposed in an Owner-approved facility. A list of approved facilities is available from City of Raleigh Public Utilities Department. The Contractor may submit an alternate facility for Owner approval, prior to utilization, in accordance with the Contract Documents.

END OF SECTION

SECTION 03000
CLEARING AND GRUBBING
(Revised 4-9-19)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Except as otherwise designated in this section, clearing and grubbing shall be performed in accordance with Section 200 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

B. The width of clearing for the project shall be limited to the right of way and temporary and permanent easements as noted on the drawings. The entire width of the permanent easement is to be cleared unless otherwise indicated by clearing limits noted on the drawings. Clearing and grubbing shall be conducted in a manner to prevent damage to vegetation that is intended to remain growing and also to prevent damage to adjacent property.

C. The Engineer will designate all areas of growth or individual trees inside the clearing limits, which are to be preserved due to their desirability. The trees to be preserved will be shown in the Contract Documents or designated by the Engineer.

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 16000 Sedimentation and Erosion Control
   2. Section 17000 Temporary and Permanent Grasses.

1.03 WARRANTY AND FINES

B. 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 erosion control devices in accordance with the approved erosion control plan and as may become necessary due to actual site conditions.

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 damage by equipment with a tree dressing.

B. Locate and protect property corners and survey control monuments and stakes prior to start of clearing operations. Disturbed property corners or survey control monuments shall be surveyed and reset by a Professional Land Surveyor licensed in the State of North Carolina. The Contractor shall be responsible for the cost to survey and reset.

C. Mark clearing limits (e.g., flag right-of-way, easements, etc.).

D. Provide tree protection fencing at the outer edge of easements and rights-of-way as indicated on the plans or as directed by the Engineer/Owner. Tree protection fencing along easements and rights-of-way shall be placed around individual vegetation or groupings of vegetation (e.g., large tree, flower bushes, etc.), and along entire easement (both sides) where clearing through woods. Tree protection fencing shall also be provided where vegetation, within easement and rights-of-way, is indicated as not to be disturbed on Drawings. Where silt fence is provided, it may serve as tree protection fencing if indicated as combination fencing on the drawings. The fencing shall be as detailed on the drawings.

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 16000, Sedimentation and Erosion Control.

3.03 STAGING, BORROW, AND DISPOSAL AREAS

A. Obtain and pay for erosion control permit for staging, borrow, and disposal areas as required by Contractor and not already permitted by Owner.

B. Install and maintain erosion control devices in accordance with Contractor’s approved plan.

3.04 CLEARING AND GRUBBING

A. Clear and grub the total width of permanent easement and right-of-way unless indicated otherwise on the Drawings. Clear and grub within temporary construction easement

only as necessary for construction. Avoid disturbance to vegetation in temporary construction easements where possible, and as noted on the Drawings.

B. Clearing shall consist of cutting, grinding and removal of vegetation to the existing ground surface and removal of debris. Debris shall include, but not be limited to, fences, steps, walls, chimneys, footings, foundation slabs, basements, signs, junked vehicles, and other rubble.

C. Grubbing shall consist of the removal of roots over 3 inches in diameter, matted roots, stumps, and other vegetable matter to 12 inches below existing grade.

D. For areas outside of the right of way and outside of residential yards, grinding of stumps and roots in place is acceptable.

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.

H. All material from clearing and grubbing shall be maintained within designated limits of disturbance/construction in accordance with the approved Erosion Control Plan until such material is removed and taken offsite for disposal or another use.

3.05 MEASUREMENT AND PAYMENT

A. Payment for “Clearing and Grubbing” shall be at the unit price per area basis or lump sum as indicated on the Itemized Proposal. If no line item is provided for clearing and grubbing, it shall be considered incidental to the project.

B. Payment for “Supplemental Clearing and Grubbing” shall be at the unit price per area basis as indicated on the Itemized Proposal.

C. Payment for “Select Tree Removal” shall be paid at the unit price per each for the select trees removed from the project.

END OF SECTION

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SECTION 04000
EARTHWORK
(Revised 4-9-19)

PART 1 - GENERAL

1.01 Except as otherwise stipulated in this specification, all earthwork shall be performed in accordance with Section 225 of the NCDOT Standard Specifications for Roads and Structures, latest edition. The work covered by this section consists of the excavation, placement, and compaction or satisfactory disposal of all materials encountered within the limits of the work necessary for the construction of the project in conformity with the lines, grades, and cross sections shown on the plans or established by the Engineer.

1.02 The Contractor shall fill areas that settle unevenly during the course of construction at no additional cost to the Owner.

PART 2 - UNCLASSIFIED EXCAVATION

2.01 GENERAL

A. All material excavated in order to achieve the site lines, grades, and cross sections shown on the plans shall be classified as Unclassified Excavation. Measurement and Payment shall be in accordance with Part 2.02.

B. Should hard rock be encountered requiring blasting for removal, a PERMIT FOR BLASTING must be obtained, for a fee, from the Town of Wake Forest Fire Marshall's Office or the appropriate jurisdiction a MINIMUM of 24 hours before any explosive material or blasting agents are transported into the Corporate Limits of the Town of Wake Forest. This work shall be included in the unit price of "Unclassified Excavation."

C. Whenever encountered during work, remove any trash and non-natural debris. Remove all roots and pieces of wood or debris larger than three (3) inches in diameter.

D. All suitable material removed in the excavation shall be used as far as practicable in the formation of embankments, subgrades, and shoulders, and at such other places as may be indicated on the plans or directed by the Engineer. Unsuitable material and excess excavated material not required for construction of embankments shall be properly disposed of offsite at no additional cost to the Owner.

E. The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded as shown on the plans or as may be directed by the Engineer. Concurrent with the excavation of cuts, the Contractor shall construct intercepting berm ditches or earth berms along and on top of the cut slopes at locations shown on the plans or designated by the Engineer. All slopes shall be finished to reasonably uniform surfaces acceptable for seeding and mulching operations. All protruding roots and other objectionable vegetation shall be removed from slopes.

F. The Contractor shall, as directed by the Engineer, cut off and plug all private utility lines, and remove all underground tanks encountered within the right of way or construction limits during construction in accordance with State requirements. This work shall be included in the unit price of "Unclassified Excavation."

G. As much as practicable, the Contractor shall perform the work covered by this subsection and the construction of embankments in such a manner that cut and fill slopes will be completed to final slopes and grade in a continuous operation. The operation of removing excavation material from any cut and the placement of embankment in any fill shall be a continuous operation to completion unless otherwise permitted by the Engineer.

H. If grading operations are suspended for any reason whatsoever, partially completed cut and fill slopes shall be brought to the required slope and the work of seeding and mulching or other required erosion control operations shall be performed.

2.02 MEASUREMENT AND PAYMENT

A. The quantity of excavation to be paid for will be the number of cubic yards of excavation, as computed by the Average End Area method based upon the plan cross sections and/or engineer's earthwork analysis computations, which are included with the Contract Documents. A 15% shrinkage factor shall be used unless otherwise directed by the Engineer. This information is provided so Contractor may fully understand any/all assumptions made by the engineer of record. The Contractor shall accept the quantities for Unclassified Excavation in the Contract unless further steps are taken as specifically outlined in Part 2.02B.

B. The Contractor has the option of providing a set of original cross sections to the Engineer for approval prior to the commencement of grading operations. The cross sections must be plotted to the same scale and using the same baseline and stationing as those provided with the bid documents. If the Contractor commences work without having a set of existing cross sections approved by the Engineer, then the Contractor fully accepts the accuracy of the existing cross section information provided with the bid documents. At the Engineer's option, final cross sections may be performed to determine if actual grading quantities are less than plan quantities.

PART 3 - BORROW EXCAVATION

3.01 GENERAL

A. Except as otherwise stipulated in this specification, all earthwork shall be performed in accordance with Section 230 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

3.02 MEASUREMENT AND PAYMENT

A. The quantity of borrow to be paid for will be the actual number of cubic yards of borrow, as computed by the Average End Area method based upon the plan

cross sections, which have been acceptably placed in accordance with the Contract Documents. A 15% shrinkage factor shall be used unless otherwise directed by the Engineer. Payment will not be made for borrow placed in excess of that shown on the plan cross sections unless authorized by change order. The approved quantity of borrow excavation will be paid for at the contract unit price for "Borrow Excavation" as indicated in the Itemized Proposal in the Contract Documents.

PART 4 - EMBANKMENT

4.01 GENERAL

A. Except as otherwise stipulated in this specification, all earthwork shall be performed in accordance with Section 235 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

B. Before embankment construction is begun, all vegetation, debris, deleterious and unsuitable material shall be removed from the area within the limits of the embankment. Upon completion of clearing and stripping, the subgrade area to receive embankment shall be uniformly proofrolled under the observation of the Engineer. Proofrolling shall be accomplished using a loaded dump truck or similar pneumatic-tired equipment of a minimum ten (10) ton static weight making at least four (4) passes over each area. Any areas, which pump or deflect under proofrolling or are otherwise deemed unsuitable by the Engineer shall be stabilized or bridged as directed by the Engineer. Should such stabilization become necessary, the amount of compensation due the Contractor for such work shall be a fair market value for these services, which shall be mutually agreeable to the Contractor and Owner prior to the execution of such work.

C. Embankment material and backfill material shall consist of clean, readily compactible earthen material with a maximum particle size of two (2) inches. Embankment material shall be free from debris, organic matter, frozen or deleterious material, and shall be approved for use by the Owner.

D. The embankment material shall be deposited and spread in successive, uniform, approximately horizontal layers of not more than eight (8) inches in depth, loose measurement, for the full width of the cross section, and shall be kept approximately level by the use of effective spreading equipment. Each layer of the embankment shall be thoroughly compacted as hereinafter specified. Hauling shall be distributed over the full width of the embankment, and in no case will deep ruts be allowed to form during the construction of the embankment. The embankment shall be properly drained at all times.

E. Backfill materials placed around and over pipe culverts, box culverts, and arch culverts, and embankment materials placed around other structures, shall be clean select material. The material shall be placed and compacted in a manner, which will avoid unbalanced loading and will not produce undue stress on the structure. Such embankments shall be placed in loose layers not to exceed six (6) inches in depth and each layer shall be thoroughly compacted as hereinafter specified. All pipe culverts, box culverts, and arch culverts, after being backfilled as specified in this subsection, shall be protected by a three (3) foot cover of fill at any time that heavy hauling equipment is permitted to cross during

construction of the roadway. Any damage or displacement to culverts or other structures due to the Contractor's operation shall be corrected or repaired by the Contractor prior to final acceptance at no cost to the Owner.

F. During construction and until final acceptance, the Contractor shall construct temporary or permanent earth berms along the outer edges of the top surface of the embankment, construct temporary ditches, shape the embankment surface to provide for the drainage of surface runoff along and throughout the length of the embankments, and use any other methods necessary to maintain the work covered by this section so that the work will not contribute to excessive soil erosion.

G. The contractor shall replace, at no cost to the Owner, any portion of embankments, which have become displaced or damaged due to carelessness or neglect on the part of the Contractor. Where the work has been properly constructed, completely drained, and properly maintained, and damage occurs due to natural causes, the Contractor will be paid at the contract unit price for the excavated material required to make necessary repairs to such damage. Measurements of quantities must be performed and approved prior to commencement of work.

H. All embankments shall be brought to the grade and cross section shown on the plans, or established by the Engineer, prior to final inspection and acceptance by the Engineer.

I. The Borrow Excavation pay item shall not be used in conjunction with Part 5-Undercut Excavation as backfill material is included in the Undercut Excavation pay item.

4.02 MEASUREMENT AND PAYMENT

A. The quantity of embankment shall be determined from proposed plan cross sections using the Average End Area method. There will be no separate payment for embankment. The price for placement of embankment shall be included in the contract price for “Unclassified Excavation”, “Comprehensive Grading”, “Borrow Excavation”, and/or “Drainage Ditch Excavation”.

PART 5 - UNDERCUT EXCAVATION

5.01 Except as otherwise stipulated in this specification, all earthwork shall be performed in accordance with Section 225-4 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

5.02 MEASUREMENT AND PAYMENT

A. The quantity of material excavated in accordance with this subsection shall be paid for at the Contract unit price per cubic yard for “Undercut Excavation” as indicated in the Itemized Proposal. This payment shall be full compensation for all work covered by this section, including but not limited to excavation, removal

of undesirable material, disposal of materials, replacement with suitable backfill material, compaction of backfill material, and maintaining the work.

PART 6 – FINE GRADING

6.01 Performance of all work, including measurement and payment related to any fine grading of subgrade in paved areas shall be in accordance with Section 500 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

PART 7 - DITCH EXCAVATION

7.01 GENERAL

A. Except as otherwise stipulated in this specification, all ditch excavation shall be performed in accordance with Section 240 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

7.02 MEASUREMENT AND PAYMENT

A. The quantity of ditch excavation to be paid for will be the actual number of cubic yards of ditch excavation, as computed by the Average End Area method based upon the plan cross sections, which have been acceptably placed in accordance with the Contract Documents. A 15% shrinkage factor shall be used unless otherwise directed by the Engineer. Payment will not be made for ditch excavation placed in excess of that shown on the plan cross sections unless authorized by change order. The approved quantity of ditch excavation will be paid for at the contract unit price for “Drainage Ditch Excavation” and/or “Berm Ditch Construction” at a unit price as indicated in the Itemized Proposal in the Contract Documents.

PART 8 – BLASTING

8.01 GENERAL

A. Except as otherwise stipulated in this specification, all ditch excavation shall be performed in accordance with Section 220 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

B. Blasting is allowable for the removal of rock, as defined herein unless specifically prohibited by the Owner, Engineer or a Utility Owner with an existing utility within the proximity of the proposed blast site. The contractor shall review the Drawings for specific areas where blasting is prohibited..

C. Obtain required permits for blasting (e.g., from Town of Wake Forest Fire Marshall’s Office) prior to blasting, 24 hours minimum.

D. Store, handle, and use explosives in accordance with all applicable local, state, and federal regulations and in accordance with the provisions of the "Manual of Accident Prevention and Construction" of the Associated General Contractors of America, Inc. Federal regulations include, but are not limited to, Title 27, Chapter 11, Part 555 of the Code of Federal Regulations (CFR) and OSHA Standards – Part 1926, Subpart U.

E. Provide seismographic monitoring during progress of blasting operations.

F. Take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden. Keep the explosive materials that are on the job site in specially constructed boxes provided with locks. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within 500 feet of a utility, structure, or property which could be damaged by vibration, concussion or falling rock, keep a blasting log containing the following information for each and every shot. This log shall be kept in an orderly manner and made available to the Engineer and Owner upon request.

1. Date of shot
2. Time of shot
3. Crew supervisor
4. Number and depth of holes
5. Approximate depth of overburden
6. Amount and type of explosive used in each hole
7. Type of caps used (instant or delay)
8. The weather
9. Seismograph instrument and readings

G. Use explosives in such a way to minimize vibration to existing utilities and structures.

H. Provide only experienced personnel for blasting in accordance with accepted practices.Contractor is responsible for safety of life and damage to property resulting from the use of explosives.

I. The Owner and Engineer shall be made aware of all blasting activities prior to their occurrence.

J. The Owner reserves the right to require the removal of rock by other means if blasting operations result in possible hazardous conditions.

8.02 MEASUREMENT AND PAYMENT

A. There will be no payment for blasting as this work shall be considered incidental to unclassified evcavation and/or other earthwork line items in the itemized proposal.

PART 9 COMPREHENSIVE GRADING

9.01 GENERAL

A. Comprehensive grading may be utilized in lieu of the previous line items at the discretion of the Engineer. Comprehensive grading shall be in accordance with Section 226 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

END OF SECTION

SECTION 05000
GEOTEXTILE FABRIC
(revised 4-9-19)

PART 1 - GENERAL

A. Except as otherwise designated in this section, geotextile fabric shall be performed in accordance with Section 1056 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

B. Geotextile Fabric shall be used for soil stabilization, foundation conditioning for storm drainage, subsurface drainage, erosion control, filtration, and other applications in accordance with the Contract.

C. Geotextile for pavement stabilization may be required to prevent pavement cracking and provide separation between the subgrade and pavement section at locations shown in the plans and as directed.

PART 2 - SUBMITTAL

D. The Contractor shall submit manufacturer's technical data and a sample of the fabric to be used for approval by the engineer prior to actual use. Submittals shall be in accordance with Section 02000 of the Contract Documents.

PART 3 - MATERIAL

A. The geotextile fabric shall be in accordance with Table 1056-1 of the NCDOT Standards and Specifications.

B. The Type used shall be based on the application as shown in Table 1056-1, with the exception of geotextile for pavement stabilization, which should be in accordance with the following criteria:

Provide Type 5 geotextile for geotextile for pavement stabilization that meets the following requirements:

GEOTEXTILE FOR PAVEMENT STABILIZATION REQUIREMENTS		
Property	**Requirement (MARV[A])**	**Test Method**
Wide Width Tensile Strength @ 5% Strain (MD & CD[A])	1,900 lb/ft	ASTM D4595
Wide Width Tensile Strength @ Ultimate (MD & CD[A])	4,800 lb/ft	ASTM D4595
Melting Point	300° F	ASTM D276

A. Define “minimum average roll value” (MARV), “machine direction” (MD) and “cross-machine direction” (CD) in accordance with ASTM D4439.

PART 4 - INSTALLATION

A. The fabric shall be free of defects or flaws, which may significantly affect its physical properties. The fabric shall be overlapped a minimum of 24 inches where necessary. Aggregate shall be back dumped and spread in a uniform lift maintaining the design aggregate thickness at all times. Construction vehicles will not be allowed to traffic directly on the fabric.

B. The soil shall not be overstressed. Equipment shall be utilized in spreading the dumping that exerts only moderate pressures on the soil. Severe rutting at the time of placement shall be corrected by increasing the aggregate depth at no additional cost to the Town. Any ruts shall be filled with additional aggregate rather than from aggregate bladed from surrounding areas.

C. Construct embankments to subgrade elevations in accordance with the contract. The Engineer and Geotechnical Engineer will determine if geotextile for pavement stabilization is required at locations shown in the plans and other locations as directed based on testing subgrade soils for quality. For subgrades without stabilization, allow 24 days to determine if geotextile for pavement stabilization is required. For stabilized subgrades with geotextile for pavement stabilization, stabilize subgrade soils to 12" beyond the base course as shown in the plans.

D. Place geotextile for pavement stabilization on subgrades immediately below pavement sections as shown in the plans and in slight tension free of kinks, folds, wrinkles or creases. Install geotextiles with the MD perpendicular to the roadway centerline. The MD is the direction of the length or long dimension of the geotextile roll. Do not splice or overlap geotextiles in the MD so splices or overlaps are parallel to the roadway centerline. Extend geotextile for pavement stabilization 12" beyond the base course as shown in the plans.

E. Completely cover subgrades with geotextile for pavement stabilization so geotextiles are adjacent to each other in the CD, i.e., perpendicular to the MD. The CD is the direction of the width or short dimension of the geotextile roll. Overlapping geotextiles in the CD is permitted but not required. Overlap geotextiles in the direction that base course will be placed to prevent lifting the edge of the top geotextile.

F. Do not damage geotextile for pavement stabilization when constructing base courses. Place and compact base course in accordance with the NCDOT Standard Specifications, latest edition. Do not operate heavy equipment on geotextiles any more than necessary to construct pavement sections. Replace any damaged geotextiles to the satisfaction of the Engineer.

PART 5 – MEASUREMENT AND PAYMENT

A. "Geotextile for Soil Stabilization" shall be measured and paid at a contract unit price per square yard. No allowance will be made for material in laps and seams. The contract unit price and payment shall constitute full compensation for furnishing all labor, material, equipment, and performing all operations in connection with placing the geotextile fabric as shown on the contract plans or as directed by the Engineer.

B. "Foundation Conditioning Geotextile" shall be measured and paid at a contract unit price per square yard. No allowance will be made for material in laps and seams. The contract unit price and payment shall constitute full compensation for furnishing all labor, material, equipment, and performing all operations in connection with placing the geotextile fabric as shown on the contract plans or as directed by the Engineer.

C. "Geotextile for Subsurface Drains" shall be measured and paid at a contract unit price per square yard. No allowance will be made for material in laps and seams. The contract unit price and payment shall constitute full compensation for furnishing all labor, material, equipment, and performing all operations in connection with placing the geotextile fabric as shown on the contract plans or as directed by the Engineer.

D. "Geotextile for Pavement Stabilization" shall be measured and paid at a contract unit price per square yard. Geotextiles will be measured along subgrades as the square yards of exposed geotextiles before placing base course. No measurement will be made for overlapping geotextiles. The contract unit price for Geotextile for Pavement Stabilization will be full compensation for providing, transporting and placing geotextiles.

END OF SECTION

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SECTION 06000
STORM DRAINAGE
(Revised 4-9-19)

PART 1 - GENERAL

A. Except as otherwise stipulated in this specification, all storm drainage shall be performed in accordance with Divisions 3 and 8 of the NCDOT Standard Specifications for Roads and Structures, latest edition. The work of furnishing and installing storm sewer shall consist of performing all work and services necessary to complete the construction of the storm sewer pipe, drainage structures, and outlet dissipation measures in accordance with the provisions of the Contract Documents.

B. Where proposed storm sewers are to be installed under existing roadways, the construction shall be performed in such a way that half of the roadway will be maintained and available to traffic in accordance with the plans, Contract Documents, the NCDOT "Roadway Standard Drawings," and the MUTCD.

PART 2 - SUBMITTALS

A. The Contractor shall submit shop drawings to the Engineer for all storm drainage materials to be used on this project. Submittals shall be in accordance with Section 02000 of the Contract Documents.

PART 3 - QUALITY STANDARDS AND MATERIALS

A. Procedures for handling, laying, protection and use of pipe shall be in accordance with the pipe manufacturer's recommendations and these specifications. Procedures for construction of drainage structures shall be in accordance with these specifications.

B. Reinforced Concrete Pipes and Flared End Sections shall conform to Section 1032-6(B) of the NCDOT Standard Specifications for Roads and Structures, latest edition. Joints shall be sealed with a flexible plastic joint material meeting Federal specification SS-S-00210, such as Ram-Nek or a butyl rubber sealant.

C. Corrugated Steel Pipe shall conform to Section 1032-3 and 1032-4 of the NCDOT Standard Specifications for Roads and Structures, latest edition. Bands for connecting pipe shall be corrugated with a minimum of 2 corrugations for each pipe. The pipe shall be fully bituminous coated in accordance with the requirements of AASHTO M190. The pipe shall have an asphalt-paved invert.

D. Concrete Block or Brick shall conform to Section 1040-2 of the NCDOT Standard Specifications for Roads and Structures, latest edition. The block or brick shall be embedded in a mortar bed to form a one-half (1/2) inch mortar joint.

E. Mortar used in brick masonry and joints shall conform to Section 1040-9 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

F. Precast Concrete Units shall conform to Section 1077 of the NCDOT Standard Specifications for Roads and Structures, latest edition. The standard joint shall be sealed with a flexible joint material meeting Federal specification SS-S-00210 such as Ram-Nek or a butyl rubber sealant.

G. Foundation Conditioning Material shall conform to Section 300-9 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

H. Manhole Frames and Covers shall be in accordance with the Town of Wake Forest Standard Details.

I. Manhole Steps shall be in accordance with the Town of Wake Forest Standard Details. Steps shall be placed at fifteen (15) inches O.C. for the full depth in all structures when they are greater than three (3) feet in depth. Steps shall be designed for a vertical load of 400 pounds and a horizontal pull out load of 1,000 pounds.

J. Yard Inlets, Catch Basins, and Curb Inlets shall be in accordance with the Town of Wake Forest Standard Details.

   i. Frame & Hood (Town streets) shall be in accordance with the Town of Wake Forest Standard Details as directed by plans.
   ii. Drop Inlet Grates (Town streets) shall be in accordance with the Town of Wake Forest Standard Detail as directed by plans.
   iii. Frame, Grates, & Hoods (NCDOT streets) shall be cast iron and conform to Section 1074-7 in the latest edition of the NCDOT "Standard Specifications for Roads and Structures" and the dimensional requirements set forth in the latest edition of the NCDOT "Roadway Standard Drawings." Grates shall be stamped with the appropriate NCDOT specification number as evidence of satisfying the above requirements. Hoods shall be stamped with "Drains to Neuse River" or other wording as confirmed by the Engineer. Lettering shall be ¾" height and shall be clean, crisp, and free of defects.

K. Endwalls and Reinforced Endwalls shall be installed in accordance with Section 838.08 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

PART 4 - CONSTRUCTION

A. All storm sewers shall be laid to provide a "true line" between manholes or structures, and they shall be installed at each deflection of line and/or grade.

B. The mortar for brick masonry shall conform to the requirements herein set forth. Excavation shall be made to the required depth and the foundation on which the

brick masonry is to be laid shall be approved by the Inspector. The brick shall be laid so that they will be thoroughly bonded into the mortar joints by means of the "shove joint" method: (buttered or plastered joints will not be permitted). The headers and stretchers shall be so arranged as to thoroughly bond the mass. Brickwork shall be of alternate headers and stretchers with consecutive courses in thickness. The joints shall be completely filled with mortar. No spalls or bats shall be used except for shaping round irregular openings or when unavoidable to finish out a course. Competent bricklayers shall be employed on the work and all details of construction shall be in accordance with approved practice and to the satisfaction of the Engineer.

C. Manhole steps shall be set in the masonry as the work is built up, thoroughly bonded, and accurately spaced and aligned.

D. Inverts in storm drainage structures shall be shaped to form a smooth and regular surface free from sharp or jagged edges. They shall be sloped adequately to prevent sedimentation.

E. The castings shall be set in full mortar beds. All castings when set shall conform to the finished grade as established by the Engineer. Any castings not conforming shall be adjusted to the correct grade without extra compensation.

F. All pipes entering catch basins or junction boxes shall enter through a wall and not through a corner of the structure. The pipe shall not project into the drainage structure, but shall be finished flush with the inside of the structure.

G. When necessary, the contractor shall provide for the temporary diversion of water or dewatering in order to maintain the storm sewer foundations in a dry condition, and shall continue to maintain trenches in a dry condition until backfill and compaction activities are complete.

H. The Contractor shall maintain all storm sewers in a condition such that they will function properly from the time the storm sewers are installed until the Town accepts the project. The Contractor shall thoroughly clean out all storm sewers at no expense to the owner throughout construction.

PART 5 – MEASUREMENT AND PAYMENT

A. Storm drainage pipe shall be paid at the unit price per linear foot of the size and type of pipe installed as indicated in the Itemized Proposal and shall include any washed stone necessary for stabilization, required paved inverts, pipe coating and shall be full compensation for all labor, equipment and materials necessary to install the pipe.

B. "Pipe Removal" shall be paid at the unit price per linear foot as indicated in the Itemized Proposal (including flared end sections). No measurement for pipe removal will be made when a new pipe is placed back in the same trench.

C. “Flowable Fill” will be measured and paid as the item for which it was substituted. In no case will payment for the use of flowable fill as a substitute be made for more than one deleted item of work.

D. “Pipe Clean Out” shall be paid at the unit price per each as indicated in the Itemized Proposal

E. “Masonry Drainage Structures”, such as catch basins, drop inlets, junction boxes, and manholes exceeding a height of 5’ will be measured and paid at a price per vertical linear foot for the portion of the drainage structure that exceeds a height of 5 feet (measured to the nearest 0.1 foot from the top of the bottom of slab to the top of wall). For that portion of height exceeding 10 feet, payment will be made at 1.3 times the contract unit price per vertical linear foot for Masonry Drainage Structure. This 1.3 factor should be already included in the quantity calculated for the Itemized Proposal.

F. “Foundation Conditioning Material” will be paid at the contract unit price per ton and shall be full compensation for all labor, equipment and materials necessary to install the material.

G. “Flared End Sections” shall be paid at the contract unit price per each for all pipes 48” diameter and less.

H. “Reinforced Endwalls” shall be paid at the contract unit price per cubic yard for pipes 54” diameter and greater as indicated in the Itemized Proposal and shall be full compensation for all labor, equipment, and material to furnish and install these structures including excavation and backfill.

I. “Pipe Collars” and “Pipe Plugs” shall be paid at the contract unit price per cubic yard as indicated in the Itemized Proposal and shall be full compensation for all labor, equipment, and material to furnish and install these structures including excavation and backfill.

END OF SECTION

SECTION 06100
SECONDARY STORM DRAINAGE AND UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Cleanouts.
3. Drains.
4. Catch basins.
5. Stormwater inlets.
6. Pipe outlets.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
1. Catch basins, drop inlets, and area drains: Include plans, elevations, sections, details, frames, covers, and grates.
2. Stormwater structures and trench drains: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.
3. Sewer service cleanouts, manhole connection, fittings and sewer service piping.

C. Field quality-control reports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and drop inlets according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Engineer and Town (Owner) no fewer than two (2) days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Engineer’s or Town of Wake Forest written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Cellular-Core Piping:

1. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.

B. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F 477, elastomeric seals.

C. High Density Polyethylene Pipe (HDPE): AASHTO Designation M252 Type S, M294 Type S and MP7-97 Type S, smooth interior/annular exterior. Only permitted when specifically indicated on Drawings. Pipe shall be installed in accordance with pipe manufacturer's installation Guidelines for Culvert Storm Drainage Applications.
1. Pipe Joints and fittings shall conform to AASHTO M252 and M294.
2. Acceptable manufacturers: Advanced Drainage Systems, Inc. "ADS N-12", HANCOR, INC. "Hi-Q", or approved equal.

Subdrains: Perforated, PVC or flexible corrugated plastic pipe as specified herein of the size indicated on the drawings

2.2 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements of local governing authority. Available manufactures offering products that may be incorporated into the Work include, but not limited to, the following:

    a. Josam Company.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.
    d. Tyler Pipe.
    e. Watts Water Technologies, Inc.
    f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Light Duty in non-traffic areas and Heavy Duty in vehicle traffic areas.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. Plastic Cleanouts:

1. Manufacturers: Subject to compliance with requirements of local governing authority. Available manufactures offering products that may be incorporated into the Work include, but not limited to, the following:

    a. Canplas LLC.
    b. IPS Corporation.
    c. NDS Inc.
    d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
    e. Sioux Chief Manufacturing Company, Inc.
    f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.

2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.3 DRAINS

A. Cast-Iron Area Drains:

1. Manufacturers: Subject to compliance with requirements of local governing authority. Available manufactures offering products that may be incorporated into the Work include, but not limited to, the following:

    a. Josam Company.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.
    d. Tyler Pipe.
    e. Watts Water Technologies, Inc.
    f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.6.3 gray-iron round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
3. Top-Loading Classification(s): Heavy Duty.

B. Cast-Iron Trench Drains:

1. Manufacturers: Subject to compliance with requirements of local governing authority. Available manufactures offering products that may be incorporated into the Work include, but not limited to, the following:

    a. Josam Company.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.
    d. Tyler Pipe.
    e. Watts Water Technologies, Inc.
    f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.6.3, 6-inches wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular secured grate. Include units of total length indicated and quantity of bottom outlets with inside calk or spigot connections, of sizes indicated.
3. Top-Loading Classification: Heavy Duty.

C. Area Drains:

1. Description: 12 by 12 inch square cast iron grate, with black powder coating. Open surface area of 59.9 square inches. ADA compliant.
2. Top-Loading Classification: Heavy Duty, H-20 rated.

2.4 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch minimum thickness for floor slab and 6-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 6-inch (102-mm) minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match diameter frame and grate.
8. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 15-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches.
9. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Designed Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.

1. Joint Sealants: ASTM C 990, bitumen or butyl rubber.
2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match diameter frame and grate.
4. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 15-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches
5. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches minimum unless otherwise indicated on Drawings.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

2.5 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening as shown on Drawing and according to local governing authority.

B. Frames and Grates: Heavy duty as shown on Drawing and according to local governing authority.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 02210 – *Trenching, Backfilling, and Compaction of Utilities.*

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping at invert elevations as specified on Drawings.

3. Install ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
5. Install PVC water-service piping according to ASTM D 2321 and ASTM F 1668.
6. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105:

1. Ductile-iron pipe and fittings.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:
1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
2. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
3. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
4. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
5. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops per local governing authority.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.6 STORMWATER INLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Install outlets that spill onto grade, anchored with concrete, where indicated.

C. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

D. Construct energy dissipaters at outlets, as indicated.

3.7 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.8 CONNECTIONS

A. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.9 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 48 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 02210 – *Trenching, Backfilling, and Compaction of Utilities.*

3.10 IDENTIFICATION

A. Materials and their installation are specified in Section 02315 – *Trenching, Backfilling, and Compaction of Utilities.* Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use identification tape or non-detectable warning tape over all underground lines outside building footprint in the backfill approximately 18” to 30” above the service pipe, but a minimum of 10” and a maximum of 24” below finished grade. Refer to Town of Wake Forest Construction Guidelines for tape and installation criteria.
2. Use detectable warning tape over ferrous and nonferrous piping and over edges of underground manholes tape for all underground lines outside

building footprint directly on top of the pipeline and permanently secured to the pipeline at 10’ intervals. Refer to Town of Wake Forest Construction Guidelines for tape and installation criteria.

3. Use insulated copper tracer wire or other approved conductor installed adjacent to underground nonmetallic piping. Access shall be provided to the tracer wire or the tracer wire shall terminate aboveground at the end of the nonmetallic piping. The tracer wire size shall not be less than 10AWG and the insulation type suitable for direct burial. Refer to Town of Wake Forest Construction Guidelines for additional wire and installation criteria.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    b. Option: Test plastic piping according to ASTM F 1417.
    c. Option: Test concrete piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

PART 4 - MEASUREMENT AND PAYMENT

4.01 The quantity of these items as described in this special provision section will be paid for at the contract unit price per each, completed and accepted site furnishing. Price will be full compensation for providing and installing each site furnishing, all labor, materials, concrete, equipment, excavation, finishing, mounting footings, tools, and any incidentals for attaching the furnishings in their locations per the plans.

4.02 Payment will be made under:

Pay Item	Pay Unit
6" PVC Roof Drain Pipe (<7-Ft)	Linear Foot
6" HDPE Roof Drain Pipe (<7-Ft	Linear Foot
8" PVC Roof drain Pipe (<7-Ft)	Linear Foot
Storm Cleanouts	EA
4" PVC Sewer Service (<7-Ft)	Linear Foot
Sewer Cleanouts	EA

END OF SECTION

SECTION 07000
CAST IN PLACE CONCRETE
(4-9-19)

PART 1 – GENERAL

1.01 SCOPE

A. Except as otherwise stipulated in this section, all cast in place concrete shall be in accordance with section 1000 of the NCDOT "Standard Specifications for Roads and Structures", latest edition.

B. Contractor shall provide all labor, equipment, and materials required for placement of cast in place concrete.

PART 2 - MATERIALS

2.01 Portland cement concrete for curb and gutter, driveways, driveway aprons, wheelchair ramps, sidewalks, traffic islands, paved ditches, or concrete transitional sections for drainage structures and other items as specified on the plans shall have a minimum 28 day compressive strength of 2,500 psi in accordance with Class B concrete as described in Section 1000 of the NCDOT "Standard Specifications for Roads and Structures" unless otherwise specified in the Contract Documents. Portland cement concrete for structures, culverts and other items as specified on the plans shall be Class A or Class AA in accordance with NCDOT "Standard Specifications for Road and Structures." Dyed concrete is not allowed in construction of driveway aprons or public sidewalks unless otherwise specifically required in the Contract Documents.

2.02 Joint filler shall be a non-extruding joint material conforming to Section 1028-1 of the NCDOT Standard Specifications for Road and Structures, latest edition.

2.03 Aggregate for portland cement concrete shall meet the requirements for fine and course aggregate of Section 1014 of the NCDOT Standard Specifications for Road and Structures, latest edition.

2.04 Portland Cement and admixtures shall meet the requirements of Section 1000 of the NCDOT Standard Specifications for Road and Structures, latest edition.

2.05 Water for mixing or curing the concrete shall be free from injurious amounts of oil, salt, acid, or other products injurious to the finished product.

2.06 Detectable warnings for proposed curb ramps shall consist of integrated raised truncated domes. The description, size and spacing shall conform to the Town of Wake Forest Standard Details.

Use material for detectable warning systems as shown herein. Material and coating specifications must be stated in the Manufacturers Type 3 Certification and all Detectable Warning systems must be on the NCDOT Approved Products List.

Install detectable warnings created from one of the following materials: precast concrete blocks or bricks, clay paving brick, gray or ductile iron castings, mild steel, stainless steel, and engineered plastics, rubber or composite tile. Only one material type for detectable warning will be permitted per project, unless otherwise approved by the Engineer.

(A) Detectable Warnings shall consist of a base with integrated raised truncated domes, and when constructed of precast concrete they shall conform to the material requirements of Article 848-2 of the NCDOT Standard Specifications, latest edition.

(B) Detectable Warnings shall consist of a base with integrated raised truncated domes, and may be comprised of other materials including, but not limited, to clay paving brick, gray iron or ductile iron castings, mild steel, stainless steel, and engineered plastics, rubber or composite tile, which are cast into the concrete of the curb ramps. The material shall have an integral color throughout the thickness of the material. The detectable warning shall include fasteners or anchors for attachment in the concrete and shall be furnished as a system from the manufacturer.

Prior to installation, the Contractor shall submit to the Engineer assembling instructions from the manufacturer for each type of system used on the project. The system shall be furnished as a kit containing all consumable materials and consumable tools, required for the application. They shall be capable of being affixed to or anchored in the concrete curb ramp, including green concrete (concrete that has set but not appreciably hardened). The system shall be solvent free and contain no volatile organic compounds (VOC). The static coefficient of friction shall be 0.8 or greater when measured on top of the truncated domes and when measured between the domes in accordance with ASTM C1028 (dry and wet). The system shall be resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to degradation by motor fuels, lubricants and antifreeze.

(C) When steel or gray iron or ductile iron casting products are provided, only products that meet the requirements of Subarticle 106-1(B) of the NCDOT Standard Specifications (latest edition) may be used. Submit to the Engineer a Type 6 Certification, catalog cuts and installation procedures at least 30 days prior to installation for all.

PART 3 - QUALITY ASSURANCE

3.01 Concrete shall be only plant-mixed, transit-mixed or ready-mixed concrete. **The time elapsing from mixing to placing the concrete shall not exceed ninety (90) minutes**. Concrete shall not be deposited on frozen subgrade and shall not be poured when the air temperature is falling and below 40° F, and the predicted low temperature for the succeeding 24 hour period is less than 32° F.

3.02 All concrete when placed in the forms shall have a temperature of between 50° F and 90° F and shall be maintained at a temperature of not less than 50° F for at least 72 hours for normal concrete and 24 hours for high early strength concrete, or for as much time as is necessary to secure proper rate of airing and designed compressive strength. The use of admixture, retarders, and accelerators shall be used as directed by the Engineer.

PART 4 - CONSTRUCTION METHODS

4.01 Proportioning of Concrete: The concrete shall be mixed in proportions discussed herein and approved by the Engineer.

4.02 Mixing Concrete: The concrete shall be mixed by machine on the job or at a central mixing plant. A batch mixer of any approved type may be used. The method of measuring the materials for the concrete, including water, shall be one which will insure separate and uniform proportions of each of the materials at all times. The mixing shall continue at least 1-1/2 minutes after all ingredients have been emptied before receiving material for the succeeding batch.

4.03 A central mixing plant shall not be used until approved by the Engineer and shall be certified by the NCDOT. The concrete from a central plant shall be delivered and deposited at the consistency specified without segregation. **The time elapsing from mixing to placing the concrete shall not exceed ninety (90) minutes.**

4.04 Concrete shall be mixed only in such quantities as are required for immediate use and all such material shall be used while fresh and before initial set has taken place. Any concrete in which set has begun shall not be used in the work. Retempering of concrete will not be allowed.

4.05 Subgrade: The subgrade shall be excavated to the required depth below the finished surface in accordance with the plans to the lines and grades established by the Engineer. All soft yielding material or other unsuitable material shall be removed and replaced with suitable material and the subgrade shall be compacted thoroughly and finished to a firm, smooth surface. **No curb and gutter, driveways, driveway aprons, wheelchair ramps, sidewalks, or traffic islands shall be poured until the subgrade is approved by the inspector.**

4.06 Forms: The forms shall be of metal and of the necessary dimensions to construct the combined curb and gutters specified in the plans. Wood forms may be used where conditions make the use of metal forms impractical. **The use of wood forms must be approved by the Engineer.** The forms shall be set true to the line and grade established by the Engineer and held rigidly in position, so as to prevent leakage of mortar and springing out of line when the concrete is placed in them. The forms shall be true in line, free from warping or bending. **No concrete shall be placed until the forms and subgrades have been approved by the Inspector.**

4.07 Placing of Concrete: The subgrade shall be moistened and the concrete shall be placed in the forms and tamped sufficiently to bring the mortar to the surface, after which it shall be finished smooth and even by means of a wooden float.

4.08 Curb and gutter shall be constructed in place in uniform sections ten (10) feet in length. The joints between sections shall be formed by steel templates one-sixth (1/6) inch in thickness and of the width and depth of the curb and gutter. The templates shall be left in place until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place.

4.09 Machine poured concrete curb and gutter will be scored at 15 feet intervals with expansion joints located at intervals no greater than 50 feet.

4.010 Expansion joints shall be one-half (1/2) inch in width and shall be placed between all rigid objects at a distance of no more than fifty (50) feet apart and shall extend the full depth of the concrete with the top of the filler one-half (1/2) inch below the finished surface.

4.011 Finishing: The edges of the curb and gutter shall be finished with an approved edging tool of one-half (1/2) inch radius. Joints shall be similarly finished immediately after the templates have been removed.

4.012 Curing: Contractor may select method of curing provided that the method is approved by the Engineer and that the means and methods of curing conform to standards specified by current AASHTO or ASTM specifications.

4.013 Removing Forms: Forms shall not be removed from freshly placed concrete until it has set for at least 12 hours. Forms shall be carefully removed in such a manner as to prevent damage to the edges of the concrete. Any honeycombed areas along the sides shall be filled promptly with mortar composed of one part cement and two parts of fine aggregate.

4.014 Cold Weather and Night Concreting: Concreting shall be done when weather conditions are favorable unless otherwise directed by the Engineer. Concrete operations shall be discontinued when a temperature of 40° F is reached on a falling thermometer and may be continued when temperature reaches 35° F on a rising thermometer. **No concreting shall be attempted when local weather**

bureau indicates temperature below freezing within the ensuing 24 hours unless proper precautions are made to protect the concrete by covering with thermal insulation satisfactory to the Engineer. The Contractor shall be responsible for the quality and strength of the concrete laid during cold weather and any concrete damaged by frost action or freezing shall be removed and replaced as directed by the Engineer at the Contractor's expense.

4.015 The Contractor may be permitted by the Engineer to proceed with concrete operations during cold weather in temperatures of not less than 25° F at placing time provided that the Contractor furnishes an approved admixture and uses an amount per batch not to exceed two percent (2%) by weight of the total amount of cement, and further provided that he takes other precautions deemed necessary by the Engineer to prevent concrete from freezing during curing period.

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

4.017 Protection of Concrete: Immediately after the forms have been removed and all honeycombed areas repaired, the back of the curb shall be backfilled to prevent underwash. Traffic shall be excluded from crossing the concrete for a period of approximately fourteen (14) days, by erection and maintenance of suitable barricades, unless otherwise specified in the Contract Documents or by the Engineer. Contractor shall be responsible for any damage resulting from traffic or vandalism until accepted by the Engineer, and he shall remove and replace any concrete damaged as directed by the Inspector.

PART 5 - CONSTRUCTION METHODS - CURB & GUTTER, DRIVEWAYS, DRIVEWAY APRONS, WHEELCHAIR RAMPS, SIDEWALKS, AND TRAFFIC ISLANDS

A. Areas of concrete to be removed shall be sawcut before removing. The sawcut shall provide a smooth, straight edge approximately two (2) inches deep before breaking away the adjacent concrete. There will be no direct payment for the work covered by this section.

B. Concrete shall be constructed in accordance with Section 825 of the NCDOT Standard Specifications for Road and Structures (latest edition) and shall be given a “sidewalk finish,” except as otherwise noted herein.

C. Brooming of the concrete surface shall be done transverse to the direction of traffic. Joint spacing shall not be less than 5 feet. Where existing sidewalks are being widened, transverse joints shall be located so as to line up with existing joints in the adjacent existing sidewalk. Grooved joints shall not be sealed.

D. **No backfill** shall be placed adjacent to the curb & gutter, driveways, driveway aprons, wheelchair ramps, or sidewalks **until at least 3 curing days have elapsed**, as defined in Section 825-9 of the NCDOT Standard Specifications for

Road and Structures, latest edition. However, all backfill shall be placed within 4 calendar days after the completion of this 3 curing day time period. Backfill shall clean earthen material free of all debris and shall be compacted to a degree comparable to the adjacent undisturbed material or as directed by the inspector.

E. Prior to placing detectable warnings in proposed concrete curb ramps, adjust the existing subgrade to the proper grade and in accordance with Article 848-3 of the 2012 Standard Specifications. Prior to placing detectable warnings in existing concrete curb ramps, saw cut to the full depth of the concrete, for other material remove as necessary, and adjust the existing subgrade to the proper grade and in accordance with Article 848-3 of the 2012 Standard Specifications.

F. Install all detectable warning in proposed concrete curb ramps or to retrofit existing curb ramps in accordance with the manufacturer's recommendations.

PART 6 - MEASUREMENT AND PAYMENT

A. Payment for "Concrete Curb and Gutter" shall be paid at the unit price bid per linear foot for the type as indicated in the Itemized Proposal and in accordance with the Town of Wake Forest Standard Details. The aggregate base course or asphalt concrete placed under the concrete curb and gutter shall be in accordance with the Town of Wake Forest Standard Details and shall be included in the unit price bid for curb and gutter. Unit price shall be full compensation for all labor, equipment and materials to furnish and install curb and gutter, and aggregate base course or asphalt concrete under the curb and gutter. Payment for this item shall not be made until work is complete, including backfilling, and has been inspected and accepted by the inspector.

B. Payment for "Concrete Sidewalk" shall be paid at the unit price bid per square yard at the thickness designated in the Itemized Proposal and in accordance with the Town of Wake Forest Standard Details. Unit price shall be full compensation for all labor, equipment and materials to furnish and install concrete sidewalk. Payment for this item shall not be made until work is complete, including backfilling, and has been inspected and accepted by the inspector.

C. Payment for "Concrete Curb Ramps" shall be paid at the unit price bid per each item as designated in the Itemized Proposal and in accordance with the Town of Wake Forest Standard Details. Unit price shall be full compensation for all labor, equipment and materials to furnish and install concrete wheelchair ramps, including, but not limited to excavating and backfilling, sawing the existing sidewalk or driveway, furnishing and placing concrete, curb and gutter, constructing and sealing joints. The measurement area will also include the area for the detecetable warnings and any 6" x 12" concrete curb that is required within the limits of the curb ramps. Payment for this item shall not be made until work is complete, including backfilling and has been inspected and accepted by the inspector.

D. Payment for “Retrofit Existing Ramp with Detectable Warnings” shall be paid at the unit price bid per each item as designated in the Itemized Proposal and in accordance with the Town of Wake Forest Standard Details. Unit price shall be full compensation for all labor, equipment and materials to furnish and install the retrofit ramp with detectable warnings, including, but not limited to sawing the existing curb ramp, furnishing and placing detectable warnings, constructing and sealing joints, repairing and replacing portions of the existing curb ramp within the pay limits for retrofit shown on the detail, pavement repairs, and disposal of the portion of existing curb ramp removed. Payment for this item shall not be made until work is complete, including final inspection and acceptance by the inspector.

E. Payment for “Concrete Driveway Aprons” shall be paid at the unit price bid per square yard as designated in the Itemized Proposal and in accordance with Town of Wake Forest Standard Details. Unit price shall be full compensation for all labor, equipment and materials to furnish and install concrete driveway aprons. Payment for this item shall not be made until work is complete, including backfilling, and has been inspected and accepted by the inspector.

F. Payment for “Concrete Driveways” shall be paid at the unit price bid per square yard at the thickness specified in the Itemized Proposal. Unit price shall be full compensation for all labor, equipment and materials to furnish and install the concrete.

G. Payment for other “Miscellaneous Concrete” shall be paid at the unit price bid per cubic yard at the class designated or as indicated in the Itemized Proposal. Unit price shall be full compensation for all labor, equipment and materials to furnish and install the concrete.

END OF SECTION

SECTION 08000
ASPHALT PAVEMENT
(revised 4-9-19)

PART 1 - GENERAL

A. Except as otherwise stipulated in this specification, all asphalt pavement production, installation, and compaction shall be performed in accordance with Division 5 & 6 of the NCDOT Standard Specifications for Roads and Structures, latest edition. The work covered by this section consists of the installation and/or removal of aggregate base course, asphalt concrete surface course, asphalt concrete intermediate course, asphalt concrete base course, asphalt tack coat, asphalt prime coat, Geotextile Interlayer, Asphalt Surface Treatments, and utility adjustments.

B. No base material shall be placed on a roadway until the storm sewer, subgrade, utilities and all appurtenances have been inspected and approved by the Inspector.

C. Before the asphalt surface course is placed on the road, the aggregate base course shall be inspected and approved by the Inspector.

PART 2 - MATERIALS

A. AGGREGATE BASE COURSE

1. The base course shall consist of an approved coarse aggregate produced in accordance with Section 520 in the NCDOT “Standard Specifications for Roads and Structures.” All materials, construction requirements and other provisions in Section 520 shall apply. The subgrade for the coarse aggregate base course shall be constructed in accordance with the requirements of these Specifications.

2. The subgrade shall be thoroughly compacted and constructed to the line, grade, and cross section on the plans or as directed by the Engineer. Before placing the base course, the subgrade shall be inspected and approved by the Inspector, and backfilling behind the curb shall be complete.

3. The base course material shall be placed in lifts **not to exceed eight (8) inches**. Each layer shall be graded to the required section and compacted to at least one hundred percent (100%) of the density as determined by AASHTO T180. The base material shall be compacted at a moisture content which is approximately that required to produce the maximum density.

4. After final shaping and compacting, the Inspector will check the surface of the base for conformance to grade and typical section. The thickness of the base shall be within a tolerance of plus or minus 1/2 inch of the base thickness required by the plans.

B. SUPERPAVE - ASPHALT CONCRETE SURFACE COURSE: TYPE S 9.5 B, S 9.5 C:

1. The Superpave surface course shall be Asphalt Concrete Surface Course, Type S 9.5 B, S 9.5 C shall be produced, delivered, placed, tested, compacted, and accepted in accordance with Sections 609 and 610 of the most current version of the NCDOT "Standard Specifications for Roads and Structures."

2. Sections of the newly finished pavement shall be protected from traffic until they have become properly hardened. Finished surfaces of the base shall be checked with a 10-foot straightedge, applied parallel to the center of the pavement, and any places that vary more than one-eighth (1/8) of an inch as measured from the bottom of the straightedge to the finished course shall be corrected.

C. SUPERPAVE - ASPHALT CONCRETE INTERMEDIATE COURSE: TYPE I 19.0 C

1. The Superpave intermediate course shall be Asphalt Concrete Intermediate Course, Type I 19.0 B, I 19.0 C, or I 19.0 D shall be produced, delivered, placed, tested, compacted, and accepted in accordance with Sections 609 and 610 of the most current version of the NCDOT "Standard Specifications for Roads and Structures."

D. SUPERPAVE - ASPHALT CONCRETE BASE COURSE: TYPE B 25.0 C

1. The Superpave base course shall be Asphalt Concrete Base Course, Type B 25.0 C or shall be produced, delivered, placed, tested, compacted, and accepted in accordance with Sections 609 and 610 of the most current version of the NCDOT "Standard Specifications for Roads and Structures."

E. PAVEMENT REPAIR PATCH

1. Where it is necessary to open cut along or across streets with asphalt surfaces, the pavement shall be replaced in accordance with the Town's Asphalt Pavement Patch Detail or the NCDOT encroachment agreement, whichever is more strict. The replacement surface and/or base shall extend a minimum of 1 foot on each side of the excavated opening. The thickness of the replacement material shall be sufficient to provide a base and surface of equivalent strength to the undisturbed base and surface. The replaced pavement shall meet all applicable material and installation specifications outlined elsewhere in the Contract Documents.

F. ASPHALT TACK COAT

1. The tack coat shall be asphalt or asphalt cement and shall meet the general, material, and construction specifications as specified in Section 605 of the NCDOT "Standard Specifications for Roads and Structures." There will be no direct payment for the work covered by this section.

G. ASPHALT PRIME COAT

1. Asphalt Prime Coat is not required unless otherwise directed by the plans or Engineer.

H. ASPHALT PLANT MIX

1. The production, delivery, and placement of all types of asphalt plant mixed bases, intermediate, and surface courses shall conform to Sections 609 and 610 of the most current version of the NCDOT "Standard Specifications for Roads and Structures." **There will be no direct payment for this work and all asphalt plant mix shall be considred incidental to asphalt line items unless otherwise directed by the Itemized Proposal.**

PART 3 – MEASUREMENT AND PAYMENT FOR ASPHALT CONCRETES

A. Payment for "Aggregate Base Course" will be made under the contract unit price bid per square yard at the specified thickness for the actual amount of "Aggregate Base Course" used to construct the roadway base to the line, grade, and cross section indicated on the plans.

B. Payment of Asphalt Concrete Surface Course (Type S 9.5 B, S 9.5 C), Asphalt Concrete Intermediate Course (TypeI 19.0 C), and Asphalt Concrete Base course (Type B 25.0 C) shall be paid at the contract unit price bid per square yard at the thickness designated or as otherwise indicated in the Itemized Proposal. The bid price shall be full compensation for all furnishing, mixing, hauling, placing and compacting all materials, and for all labor, equipment and incidentals necessary to complete the work.

C. Pavement repair patches shall be paid at the contract unit price bid per square yard for "Pavement Repair Patch" as indicated in the Itemized Proposal. The unit price for pavement repair shall be full compensation for all work necessary to repair the pavement and maintain the roadway. The unit price shall include all pavement repair(s) both temporary and permanent, furnishing, hauling, placing, and shaping the asphalt pavement to produce a uniform, smooth driving surface. No additional payments will be issued to replace pavement damaged by the Contractor outside of the standard trench opening as defined by the Contract Documents.

D. If the thickness of the asphalt concrete is suspected to be less than specified on the plans and Itemized Proposal, the Engineer shall have corings performed to determine the thickness in place. Corings shall be made at five-hundred (500) foot intervals or as determined by the Engineer. If the Contractor desires additional corings, the Engineer's material testing firm shall perform additional corings at the Contractor's expense. If the asphalt concrete is found to be thicker than specified, the Contractor shall not be compensated for asphalt concrete placed to a thickness above and beyond the specified thickness. If the asphalt concrete is found to be thinner than specified, the Engineer shall determine if: 1) more asphalt concrete must be placed to bring the thickness to the specified thickness or 2) the unit price shall be adjusted down to compensate the Owner for material which was not placed. The method of adjustment will be based on the ratio of thickness installed to the thickness specified.

E. Payment for "Asphalt Wedging" will be made under the contract unit price bid per ton. The contract price shall include all types of asphalt used (Surface Course, Intermediate Course, and Base Course) as needed to construct the roadway to the line, grade, and cross section on the plans, and shall include all asphalt binder for plant mix unless otherwise directed by the Itemized Proposal.

PART 4 - CONSTRUCTION METHODS

A. SUBGRADE

1. This subgrade shall be prepared and compacted in accordance with Section 500 in the NCDOT “Standard Specifications for Roads and Structures”, latest edition.

B. PROOFROLLING

1. Equipment: The equipment shall consist of a loaded tandem-axle dump truck or similar pneumatic-tired equipment of a minimum ten (10) ton static weight. The Contractor is responsible for providing the equipment necessary in order to perform proofrolling at no additional cost to the Owner.

2. Method: After the roadbed has been completed within five hundredths (0.05) feet of final grade, the roadbed shall then be compacted and tested with two (2) or more coverages unless otherwise directed by the Owner, using a heavy pneumatic-tired roller meeting the requirements listed above. A coverage is considered that stage in the rolling procedure when the entire width of the area being proofrolled has been in contact with the pneumatic tires of the roller. The roller shall be operated in a systematic manner so that the number of coverages over all areas to be proofrolled can be readily determined and recorded.

    a) The equipment shall be operated at a speed between two and one-half (2-1/2) and three and one-half (3-1/2) miles per hour. All proofrolling procedures shall be followed to the satisfaction of the Inspector on site during the proofrolling.

3. Corrective Action: If it becomes necessary to take corrective action, such as, but not limited to, underdrain installation, undercut and backfill of unsuitable materials, and aeration of excessively wet material in areas that have been proofrolled, these areas shall be proofrolled again following the completion of the necessary corrections. If the corrections are necessary due to the negligence of the Contractor or weather, the corrective work and additional proofrolling shall be performed by the Contractor at no cost to the Owner.

C. WEATHER, TEMPERATURE, AND SEASONAL LIMITATIONS FOR PRODUCING AND PLACING ASPHALT

1. All weather and seasonal limitations shall be in accordance with Sections 610-4 of the most current version of the NCDOT “Standard Specifications for Roads and Structures.”

2. Should rain begin during paving operations, the Owner assumes no responsibility for asphalt left on the trucks at the time that the paving operation is halted.

D. PROTECTION OF MATERIAL

1. The Contractor shall provide and have ready for use at all times enough tarpaulins or covers for use in case of rain, chilly wind, or other delay, for the purpose of covering or protecting any material dumped but not spread.

E. COMPACTING ASPHALT CONCRETE MIXTURE

1. After placing, the mixture shall be thoroughly and uniformly compacted with tandem rollers of eight (8) or ten (10) ton model weighing not less than 250 pounds per inch width of roller tread. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

2. Each roller shall be operated by a competent, experienced operator and must be kept in continuous operation as nearly as practicable. Rolling shall start longitudinally at the outer edges and proceed toward the center of the pavement, overlapping on successive trips by at least one half (1/2) the width of the roller.

3. The speed of the roller shall be at all times slow enough to avoid displacement of the hot mixture as a result of reversing. Any displacement shall be immediately corrected. Rolling shall proceed at a rate not in excess of 500 square yards per hour per roller and shall continue until no further visible compaction is obtainable and all roller marks have been eliminated.

4. Rolling shall be started as soon as the mixture will bear the roller without undue misplacement or hairline cracking. Delays in rolling hand raked mixture will not be tolerated.

5. To prevent adhesion of the mixture to the roller, the wheels shall be kept moistened with water. Places not accessible to the roller shall be thoroughly compacted with hot tamps.

F. COMPACTED DENSITIES

1. Unless otherwise noted compaction and density control of Asphalt Pavements shall be in accordance with the requirements of Sections 609 and 610 of the most current version of the NCDOT “Standard Specifications for Roads and Structures.” There will be no direct payment for the work covered by this section.

2. The Contractor shall allow time for the inspections and testing of areas, as needed, by the Town of Wake Forest or their qualified testing firm, as directed by the Engineer.

G. PLANT TICKETS

1. The number of batches and total weight of all loads of mixture shall be recorded in duplicate upon plant ticket forms. With each load delivered to the work, the truck driver shall present one copy of the plant ticket to the Inspector. The driver shall retain one copy for the Contractor. Should the Engineer decide to provide a plant inspector, he/she shall keep the stub copy. The weights to be included in the estimate shall be the total of the tickets delivered by the truck driver to the Inspector at the work site. At any time, for the purpose of checking the weighing equipment at the plant, the Owner may direct the Contractor to weigh or cause to be weighed on tested and approved platform scales at the Contractor's expense the contents of any truckload that is to be delivered to the work site.

H. PROTECTION OF PAVEMENT

1. When edges are not protected, planks of the same thickness shall be placed adjacent to longitudinal or transverse joints until the surface course is completed. Sections of newly finished pavements shall be protected from traffic until they have become properly hardened by temperature cooling.

PART 5 - REMOVAL OF EXISTING PAVEMENT

A. The measurement and payment for removal of existing pavement shall be in accordance with Section 250 in the NCDOT "Standard Specifications for Roads and Structures." **The work covered by this section shall not include the removal and disposal of sidewalks, driveways, and curb and gutter, which are covered under "Unclassified Excavation".**

B. Milling asphalt pavement shall be in accordance with Section 607 of the latest version of the NCDOT "Standard Specifications for Roads and Structures."

C. All materials, which cannot be used in the work, shall be disposed of off site of the right of way in waste areas provided by the Contractor.

PART 6 - ASPHALT RESURFACING

A. GENERAL

1. Asphalt Resurfacing shall meet all applicable material and installation specifications outlined elsewhere in the Contract Documents.

2. Should construction take place near signalized intersections of a state maintained roadway, the Contractor shall contact the NCDOT Division Traffic Engineer to schedule the field location of any traffic signal conflicts. The Contractor shall notify the Engineer of any potential conflict prior to construction. The Contractor shall be responsible for coordinating the conflict relocation with NCDOT during construction.

3. The Contractor shall prepare a weekly schedule detailing the construction activities planned for the following week. This schedule shall be presented to the Inspector before Friday, 12:00 noon of the week preceding the effective date of the schedule. Weekly meetings may be required to review construction activities as directed by the Engineer.

4. In the event that all vehicles are not removed from the construction area despite timely delivery of the construction notice letter, the Contractor shall attempt to contact vehicle owners by other means in an effort to find the vehicle's owner to have the vehicles relocated. If the Contractor is unsuccessful they shall contact the Engineer and provide the make, model, and license plate number of the vehicle as well as the vehicle location. The Engineer shall try contacting the vehicle owner and if unsuccessful shall contact a designated towing company to move the vehicle out of the construction area, to a neighboring street as directed by the Engineer, at the Town of Wake Forest's expense. The towing company shall attach a standard letter to the vehicle upon towing. The Engineer will provide the standard letter.

5. Construction traffic control shall be provided on each street by the Contractor in strict conformance with NCDOT "North Carolina Supplement to the MUTCD," the MUTCD, the Contract Documents, or as directed by the Engineer. No work shall begin on any street without the proper traffic control measures in place.

6. Construction traffic control shall be installed and practiced as a means to inform drivers that asphalt tack coat is being placed on the road surface.

7. The Contractor shall be responsible for spraying or burning all weeds growing on and in the streets. The Contractor shall be responsible for removing and properly disposing of the dead weeds and carefully cleaning each street before beginning asphalt concrete construction operations.

8. Asphalt resurfacing projects shall have a maximum acceptable elevation difference, between the top of the resurfacing layer and the gutter, of 1.25 inch. The Owner shall not accept any newly resurfaced streets exceeding this maximum elevation difference. Should it be determined that the resurfacing layer is more than 1.0 inch higher than the gutter elevation the resurfacing shall be removed and replaced or remedied as directed by the Engineer at the Contractor's expense.

9. The Contractor shall allow time for the inspection of areas, as needed, by a qualified testing firm as directed by the Engineer.

10. The Contractor shall construct all improvements so as to create and/or maintain positive drainage.

11. The above listed requirements of this sub-part are considered incidental to the cost of the asphalt concrete surface course specified in the Itemized Proposal and Contract Documents.

B. MATERIALS

1. GEOTEXTILE INTERLAYER INSTALLATION

a) The geotextile interlayer shall be a needlepunched, nonwoven engineering fabric made of polypropylene and staple fiber; calendared on one side. It shall be resistant to ultraviolet degradation and have the following properties:

	Typical	**Test**
Grab Tensile Strength (lbs)	101	ASTM D 4632
Grab Elongation (%)	50	ASTM D 4632
Puncture Strength (lbs)	65	ASTM D 4833
Mullen Burst (psi)	220	ASTM D 3786
Trapezoidal Tear (lbs)	45	ASTM D 4533
Mass Per Unit Area (oz/sq yd)	4.1	ASTM D 5261
Thickness (mils)	35	ASTM D 5199
Melting Point (°F)	Greater than 150	ASTM D 276
UV Resistance (%)	70 at 500 hrs	ASTM D 4355

b) For the tack coat, uncut asphalt cements are preferred, however, cationic or anionic emulsions may be used. For asphalt cements the minimum temperature shall be 150° C, but to avoid damage to the fabric the distributor tank temperatures shall not

exceed 160° C. When asphalt emulsions are used, the emulsion shall be cured prior to placing the fabric.

c) The engineering fabric shall be placed onto the asphalt sealant, calendared side up, prior to the time the asphalt has cooled and lost tackiness. Wrinkles or folds in excess of 1 inch shall be slit and laid flat. In order to maximize fabric contact with the pavement surface, blooming or pneumatic rolling will be required. The fabric joints shall be overlapped sufficiently to ensure full closure of the joint, but should not exceed 6 inches. To prevent edge pickup by the paver, transverse joints shall be lapped in the direction of paving. A second application of sealant to the fabric overlaps will be required as directed by the Engineer.

d) Quickly following the fabric installation, the hot-mix overlay should be placed evenly. Should the asphalt bleed through the fabric causing construction problems prior to overlay placement, the affected areas shall be blotted by spreading sand. Turning the paver and other vehicles shall be gradual and kept to a minimum to avoid movement of, or damage to the sealant saturated fabric.

2. ASPHALT SURFACE TREATMENT:

a) Chip seal shall be “straight seal” with 78M stone in accordance with Section 660 of the NCDOT “Standard Specifications for Roads and Structures.” Careful attention shall be given to surface preparation (as specified in Section 660) under chip sealing.

b) Cleanup: Excess aggregate resulting from straight seal shall be collected and removed from the construction site either before resurfacing occurs or one (1) week after the straight seal is applied, whichever occurs first.

3. LEVELING COURSE

a) In asphalt resurfacing projects a leveling course of Superpave - Asphalt Concrete Surface Course (Type S 9.5 B, S 9.5 C), as directed by the Engineer, shall be hand-placed in areas where the pavement is depressed, sunken or uneven, and its surface grade varies from surrounding elevation by one (1) inch or greater. Leveling asphalt shall be placed prior to chip seal applications or as designated by the Engineer.

C. MEASUREMENT AND PAYMENT

1. Payment for “Geotextile Interlayer” shall be made under the contract unit price bid per square yard for the actual amount of “Geotextile Interlayer” as indicated in the Itemized Proposal and shall constitute full compensation for furnishing all labor, material, equipment, and performing all operations in connection with placing the geotextile interlayer as shown on the plans, Contract Documents, or as directed by the Engineer.

2. Payment for “Asphalt Surface Treatment” shall be made under the contract unit price bid per square yard at the specified type of seal coat for the actual amount of “Asphalt Surface Treatment” as indicated in the Itemized Proposal and shall constitute full compensation for furnishing all labor, material, equipment, and performing all operations

in connection with the placement and cleanup of the asphalt surface treatment as shown on the plans, Contract Documents, or as directed by the Engineer.

3. Payment for “Asphalt Leveling Course” shall be included in the unit price per ton for “Asphalt Leveling Course” as indicated in the Itemized Proposal. Plant tickets should be submitted with the pay request, and each ticket should include a date, time of delivery, signature of recipient and street name. Only those tickets with the above information will be approved.

PART 7 - SPEED HUMPS AND RAISED CROSSWALKS

A. GENERAL

1. Speed hump and raised crosswalk construction shall meet all applicable material and installation specifications outlined elsewhere in the Contract Documents.

2. In the event that all vehicles are not removed from the construction area despite timely delivery of the construction notice letter, the Contractor shall attempt to contact vehicle owners by other means in an effort to find the vehicle’s owner to have the vehicles relocated. If the Contractor is unsuccessful they shall contact the Engineer and provide the make, model, and license plate number of the vehicle as well as the vehicle location. The Engineer shall try contacting the vehicle owner and if unsuccessful shall contact a designated towing company to move the vehicle out of the construction area, to a neighboring street as directed by the Engineer, at the Town of Wake Forest’s expense. The towing company shall attach a standard letter to the vehicle upon towing. The Engineer will provide the standard letter.

3. Construction traffic control shall be provided on each street by the Contractor in strict conformance with NCDOT “North Carolina Supplement to the MUTCD,” the MUTCD, the Contract Documents, or as directed by the Engineer. No work shall begin on any street without the proper traffic control measures in place.

4. The maximum acceptable height of speed humps and/or raised crosswalks shall be as indicated in the Contract Documents or as designated by the Engineer. The Owner shall not accept any newly constructed speed humps and/or crosswalks exceeding the maximum specified elevation. Should it be determined that the height exceeds the maximum elevation, the speed humps and/or raised crosswalks shall be removed and replaced or remedied as directed by the Engineer at the Contractor's expense.

5. The Contractor shall construct all improvements so as to create and/or maintain positive drainage.

B. MEASUREMENT AND PAYMENT

1. Payment for “Speed Humps” and/or “Striped Crosswalks” shall be paid at the contract unit price bid per each item or lump sum as indicated in the Itemized Proposal. The unit price shall be full compensation for furnishing all labor, material, equipment, and performing all operations in connection with placing the asphalt concrete and pavement markings as indicated in the Contract Documents or as directed by the Engineer.

PART 8 – UTILITY ADJUSTMENTS

A. GENERAL

1. No manholes or water valve boxes shall be raised and left for a period of time greater than fourteen (14) days before the street is resurfaced. Should this period of time be exceeded, all work shall be stopped until the resurfacing of such streets has been completed. Immediately after utility adjustments take place the sides of the utility shall be painted bright orange for visibility and if directed by the Engineer 36" (minimum) reflective orange traffic cones or other devices shall also be added for visibility. There will be no separate compensation for this work and shall be considered incidental to the cost of the items as defined under "Basis of Payment."

2. Cast iron risers will not be allowed for adjustment of manholes and water valve boxes.

3. If any existing broken manholes or water valve boxes are discovered, the Owner shall furnish new manhole rings and covers or new water valve boxes for replacement of the broken ones by the Contractor at no additional cost to the Owner. Replacements will be the same as stocked by the Town of Wake Forest or approved as acceptable alternate by the Engineer.

4. Adjustment of water meters, valve boxes, cleanouts, and/or fire hydrants shall include vertical adjustments only to leave the appurtenances positioned in the same horizontal location in accordance with the plans and standard City of Raleigh Public Utilities Details.

5. Relocation of water meters, cleanouts, and/or fire hydrants shall include both horizontal and vertical adjustments necessary to relocate the appurtenances to a different horizontal and vertical location in accordance with the plans and standard City of Raleigh Public Utilities Details.

B. MEASUREMENT AND PAYMENT

1. Payment for these items shall be at the respective contract unit prices for "Adjustment of Water Valve Boxes," "Adjustment of Water Meters", "Adjustment of Cleanouts", "Adjustment of Manholes", "Adjust Fire Hydrant", "Relocate Fire Hydrant", "Relocation of Cleanouts", "Relocation of Water Meters" as indicated in the Itemized Proposal and shall be full compensation for all labor, equipment, materials, and incidentals necessary to complete the work.

END OF SECTION

SECTION 09000
UTILITY WORK ALONG ROADWAYS
(Revised 4-9-19)

PART 1 - GENERAL

1.01 The Contractor shall provide all labor, materials, tools, and equipment to perform all work and services necessary for, or incidental to, the furnishing, complete installation, and testing of all work along roadways in accordance with the Construction Drawings, Contract Documents, Town of Wake Forest Standard Details, and City of Raleigh Public Utilities Handbook/Standard Details.

1.02 Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a secure, complete, and compatible installation shall be furnished and installed as part of this section.

1.03 All work within the North Carolina Department of Transportation (NCDOT) right of way is done under permit. The Contractor shall secure the necessary permits, notify NCDOT of proposed construction, and be responsible for any damage due to construction. In addition, the Contractor shall obey all traffic laws and comply with all NCDOT and local requirements, rules, and regulations.

1.04 The Contractor shall provide adequate warning signs, lights, barriers, railing, flaggers, etc., and shall conduct all work in accordance with the latest versions of the NCDOT “Standard Specifications for Roads and Structures,” NCDOT “Roadway Standard Drawings Manual,” Manual on Uniform Traffic Control Devices (MUTCD), and the NCDOT Supplement to the MUTCD (NCSMUTCD). The Contractor shall possess one copy of each of the above referenced publications. Any conflicts found between the NCSMUTCD and the MUTCD shall be resolved in favor of the MUTCD.

1.05 The Contractor shall conduct operations so as to maintain and protect access for vehicular and pedestrian traffic, to and from all properties affected by operations.

1.06 Unless otherwise stated in the Encroachment Agreement, construction within 10-ft from the edge of pavement on a NCDOT maintained roadway shall be limited to the hours of 9:00 a.m. to 4:00 p.m.

1.07 The Contractor shall schedule “on the site” inspection prior to beginning work at highway bridges and/or box culverts by contacting the NCDOT Head of Bridge Maintenance.

1.08 Lines installed under major roadways shall be constructed by boring or tunneling as may be required by the NCDOT, the Contract Documents, and the Standard Specifications.

1.09 Any unpaved road, side road, dwelling entrance road, commercial entrance, road shoulder, or other area stabilized by rock material shall be protected from erosion during construction and shall be stabilized by the use of crusher run stone after backfilling. This stone stabilization shall be approximately 4-inches thick unless otherwise directed by the Engineer.

PART 2 - OPEN CUTTING OF ROADWAYS

2.01 GENERAL

A. Open cuts within the roadway shall have vertical faces where soil and depth conditions permit and shall be shored where necessary. All excess excavated material shall be removed and disposed of at a location provided by the Contractor outside the limits of the right of way unless otherwise approved by the NCDOT Division.

B. A trench made in the travel portion of the roadway shall not be left open overnight except in an emergency and only then when adequate barricades, signs, and torches or lights are prominently displayed to protect the traveling public.

C. The Contractor shall backfill and replace all pavement cuts. The Contractor shall also maintain ditches cut along and across roadways in accordance with the permits received from the NCDOT and as required by the Contract Documents and the Standard Specifications. Shoulders, side ditches and cut or fill slopes shall be repaired to the satisfaction of the Engineer.

D. Trench installations that may be vulnerable to damage due to precipitation, or which may be hazardous to traffic shall be closed without delay. A trench shall not remain open longer than 24 hours except with the approval of the NCDOT Division Engineer.

E. Where utility lines pass under culverts on the NCDOT right of way, the Contractor shall fill the void from the bottom of the utility line to the spring line of the culvert with #57 stone. Where the distance between the bottom of the culvert and the top of the utility line exceeds the radius of the culvert, the Contractor shall compact soil around and above the utility line to at least 95% of maximum dry density as measured by AASHTO Method T99 and place #57 stone from the spring line of the culvert to a depth below the bottom of the culvert at least equal to the culvert radius. There shall be no separate or additional payment for this work.

F. Excavation material shall not be stored on the pavement if it can reasonably be handled otherwise. In cases where storing of excavated material on pavement is absolutely necessary, it shall be moved as quickly as practical, and the pavement shall be thoroughly cleaned. Sand or screenings shall be placed on the pavement before the excavated material to allow for better clean up.

G. Excavation in the immediate vicinity of drainage structures shall be made with special care so as not to damage or interfere with the use of the existing drainage facilities. Drainage facilities that are damaged by the Contractor shall be repaired immediately at no additional expense to the Owner.

2.02 PERPENDICULAR TRENCHING

A. Where a trench is cut perpendicular to the road, only one-half of the road width shall be obstructed at one time in order to maintain traffic. Before the other half is cut, the initial trench shall be made usable, safe, and maintained for traffic.

2.03 PARALLEL TRENCHING

A. Where a trench is cut parallel to the road, adequate barricades and warning signs shall be placed and, if necessary, flaggers shall be employed to control traffic. If trenches are left open overnight, a sufficient number of barricades, signs and torches or lights shall be prominently displayed so that the traveling public will be adequately protected.

B. Where space permits, the trench bottom shall not be nearer the edge of the pavement (measured in a horizontal plane) than the depth of the excavation so that the theoretical slope from the edge of the pavement to the bottom of the ditch is no steeper than a one-to-one slope. On paved sections under 24-ft in width, consideration shall be given for future widening and paving of shoulders. Where, in the opinion of the Engineer, soil conditions are such that sheet pilings or other shorings are necessary, they shall be placed by the Contractor. The trench shall not be closer than 3-ft to the edge of the pavement unless approved by the Engineer.

2.04 COMPACTION

A. The backfill around and under pipes or other utility installations on all open-cut sections across or parallel to roadways shall consist of approved material free from rocks compacted in 6-inch lifts to at least 95% maximum dry density as measured by AASHTO Method T99. Trench backfill above the pipe shall be placed in lifts of 8-inches or less of uncompacted soil. Each lift shall be thoroughly tamped by a mechanical tamp before the next lift is placed. A pneumatic tamp, a gasoline ram type tamp, or a vibrating tamp will be required to meet the specifications of a “mechanical tamp.”

PART 3 – MEASUREMENT AND PAYMENT

3.01 There is no direct payment associated with this section. All utilty work shall be in accordance with other line items in the Itemized Proposal related to this work.

END OF SECTION

SECTION 10000
UTILITY TRENCHES
(revised 4-9-19)

PART 1 - GENERAL

A. The Contractor shall provide all labor, materials, tools, and equipment to perform all work and services necessary for, or incidental to, the excavation, shaping, and backfill of utility trenches in accordance with the Construction Drawings, Contract Documents, and the latest editions of the City of Raleigh Public Utilities Handbook

B. Existing Utilities: The Contractor shall be completely and solely responsible for locating all existing buried utilities and preventing damage to those utilities.

C. Pavement Removal: Where trenches are excavated in paved areas, the pavement shall be saw-cut prior to removal. All pavement cuts shall be repaired within a maximum of three (3) calendar days from the date the cut is made. If conditions do not permit a permanent repair within the given time limit, permission to make a temporary repair must be obtained from the Engineer.

D. Trench Excavation: Trenches for all buried utility installations, such as water distribution lines, sanitary sewer lines, force mains, and storm sewer lines shall be excavated to the required depth to permit installation of the pipe along the lines and grades as specified by the Contract Documents. **Storm sewer trenching shall be prepared in accordance with the Town of Wake Forest Standard Details. Water and sanitary sewer trenches shall be prepared in accordance with the City of Raleigh Public Utilities Handbook and Public Utility details.** Where excavation is in rock, the rock shall be removed to a depth of at least 6-inches below grade and the void shall be backfilled with #67 stone and thoroughly compacted to the sub-grade level. Wet or unstable trenches shall be stabilized with #67 stone or at no additional cost to the Owner.

E. Dewatering: The Contractor shall dewater the trench throughout construction by pumping in a manner that all pipe jointing may be made under dry conditions. Water shall be disposed of in a manner not detrimental to the public health or to public or private property.

F. Rock Blasting and Excavation: Blasting procedures shall conform to all applicable local, state, and federal laws and ordinances. A blasting permit shall be obtained by the Town of Wake Forest Frie Marshall's Office, prior to any blasting. The application shall be obtained 24-hours before any blasting takes place, and the Fire Marshall may specify the hours of blasting. The contractor shall take all necessary precautions to protect life and property, including use of an approved blasting mat where there exists the danger of throwing rock or over-burden. The contractor shall keep the explosive materials that are on the job site in specially ocnstructeed boxes provided with locks. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting

takes place within five hundred feet of a utility, structure, or property which could be damaged by vibration, concussion, or falling rock, the contractor shall be required to take seismograph readings and to keep a blasting log containing the following information for each and every shot.

1) Date of shot
2) Time of shot
3) Crew Supervisor
4) Number and depth of holes
5) Approximate depth of overburden
6) Amount and type of explosive used in each hole
7) Type of caps used (instant or delay)
8) The weather
9) Seismograph instrument and readings

This blasting log shall be made available to the Engineer upon request and shall be kept in an orderly manner. It shall be the Contractor's responsibility to have adequate insurance to cover any damages resulting from blasting so to save the Town of Wake Forest harmless from any claims.

G. Pipe Laying: All pipe shall be laid in accordance with its manufacturer's recommendations and the Contract Documents and Standard Specifications. The subgrade at the bottom of the trench shall be shaped to secure uniform support throughout the length of the pipe. A space shall be excavated under the bell of each pipe to provide space to relieve bearing pressure on the bell and to provide room to adequately make the joint. Open ends of pipe shall be plugged with a standard plug or capped at all times when pipe laying is not in progress. Trench water shall not enter the pipe.

H. Trench Backfill: **All trenches shall be properly backfilled at the end of each working day.** Backfill material shall be free of construction debris, frozen material, organic material, or unstable material. The upper 2-ft of backfill material shall be free from stones greater than 4-inches in diameter. In the event that unsuitable backfill is discovered as determined by the Engineer, the Engineer may direct the Contractor to replace all or portions of the unsuitable backfill with suitable backfill materials approved by the Engineer. The Contractor shall be prepared to remove unsuitable material from the site at no additional expense to the Owner.

I. Compaction: Backfill shall be compacted to a density of no less than 95% maximum dry density as measured by AASHTO method T99. Backfill shall be placed in lifts of 8-inches or less of the uncompacted soil. When compacting in layers, each layer must be thoroughly tamped by a mechanical tamp, such as "Rammax Sheepsfoot" or equivalent, before the next layer is placed.

J. Clean-up: The Contractor shall remove all excess excavation materials, earth, debris, etc. and shall clean up and leave all affected property, streets, roads and highways in a neat, clean and orderly condition as required throughout construction and upon completion of the work specified under this section. Unless directed by

the Engineer, all affected areas shall be returned to the contour that existed prior to construction – mounding of the easement or right-of-way shall not be allowed. If so directed by the Engineer, the Contractor shall deposit all or a part of the excess earth at such point or points as may be designated. Excess earth from trenches along state controlled highways or roads shall be disposed of in a manner satisfactory to the State Department of Transportation. All temporary pipes and ditching used during construction to carry surface water shall be removed.

PART 2 – MEASUREMENT AND PAYMENT

A. Direct payment shall not be issued for preparation, excavation, disposal, dewatering, sheeting, shoring and backfilling of utility trenches unless otherwise indicated by the Contract Documents.

END OF SECTION

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SECTION 11000
WATER DISTRIBUTION SYSTEM
(REVISED 4-9-19)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Except as otherwise stipulated in this section, all work shall conform to Division 15 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

B. Work under this section includes, but is not limited to, piping, valves, fire hydrants, water service line, and appurtenances for a complete potable water distribution system.

1.02 REFERENCES

A. Publications are referred to in the text by basic designation only.
   1. American Society of Sanitary Engineering (ASSE) Standards
      a. 1013 Reduced Pressure Principle Backflow Preventers
      b. 1015 Double Check Backflow Prevention Assembly
      c. 1069 Outdoor Enclosures for Backflow Prevention Assemblies
   2. American Society for Testing and Materials (ASTM)
      a. C443 Flexible Watertight Joints for Precast Manhole Sections
      b. C478 Precast Reinforced Concrete Manhole Sections
      c. C890 Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
      d. C923 Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
   3. American Water Works Association (AWWA)
      a. B300 Hypochlorites
      b. B301 Liquid Chlorine
      c. C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
      d. C105 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
      e. C110 Ductile-Iron and Gray-Iron Fittings, 3 inch through 48 inch, for Water and Other Liquids
      f. C115 Flanged Ductile-Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges
      g. C150 Thickness Design of Ductile Iron Pipe
      h. C151 Ductile-Iron Pipe, Centrifugally Cast, for Water
      i. C153 Ductile-Iron Compact Fittings, 3 inch through 24 inch and 54 inch through 64 inch, for Water Service
      j. C502 Dry-Barrel Fire Hydrants
      k. C504 Rubber-Seated Butterfly Valves
      l. C508 Swing-Check Valves for Waterworks Service, 2 inch Through 24 inch NPS
      m. C509 Resilient Seated Gate Valves for Water and Sewerage Systems
      n. C510 Double Check Valve Backflow-Prevention Assembly
      o. C511 Reduced-Pressure Principle Backflow-Prevention Assembly
      p. C512 Air-Release, Air / Vacuum, and Combination Air Valves for Waterworks Service
      q. C550 Protective Epoxy Interior Coatings for Valves and Hydrants
      r. C600 Standard for Installation of Ductile Iron Water Mains and Their Appurtenances

s. C651 Disinfecting Water Mains
t. C800 Underground Service Line Valves and Fittings
u. C909

4. National Sanitation Foundation (NSF) Standards
   a. 14 Plastic Piping Components and Related Materials
   b. 60 Drinking Water Treatment Chemicals – Health Effects
   c. 61 Drinking Water System Components - Health Effects

1.03 SUBMITTALS

A. Submit the following in accordance with Section 02000 - Contractor 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 and Fittings
      1) Ductile iron
      2) Copper pipe and tubing
      3) Mechanical Joint Wedge Action Restraint, i.e. “Megalug”

   b. Valves
      1) Gate
         i) Resilient-Seated
         ii) Tapping
      2) Butterfly
      3) Check
      4) Air release

   c. Fire hydrants

   d. Pre-cast concrete manholes

   e. Service valves and fittings
      1) Corporation valves
      2) Meter setter with meter valve and check valve

   f. Backflow prevention assembly

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 and Fittings
      1) Ductile iron
      2) Copper pipe and tubing
      3) Mechanical Joint Wedge Action Restraint, i.e. “Megalug”

   b. Valves
      1) Gate
         i) Resilient-Seated
         ii) Tapping

2) Butterfly
3) Check
4) Air release

c. Pre-cast Concrete Manholes and appurtenances
1) Manhole steps
2) Pipe connectors
3) Joint material

d. Castings
e. Tapping sleeves
f. Valve boxes
g. Fire hydrants
h. Service valves and fittings
1) Service saddles
2) Corporation valves
3) Meter setter with meter valve and check valve
4) Meter box
i. Backflow prevention assembly and enclosure
j. Blowoff assembly

3. Reports:
a. Field test report for each section of pipe for the following:
1) Measured chlorine residual
2) Bacteriological test
3) Pressure test

b. Field test report for each backflow prevention device.

4. Operation and Maintenance Instructions: Submit complete operation and maintenance manual for the following:
a. Valves
b. Fire hydrants
c. Backflow prevention assembly

1.04 DELIVERY, STORAGE, AND HANDLING

A. Provide a suitable pipe hook or rope sling when handling the pipe. 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 the bell and spigot ends.

B. Deliver pipe in the field as near as practicable to the place where it is to be installed. In road right-of-way, distribute pipe daily along the side of the trench opposite to the spoil bank. Stringing pipe in road right-of-way except on a daily basis is not allowed. In easements, distribute pipe along the side of the trench opposite to the spoil bank. Stringing pipe in easements is allowed. Where necessary to move the pipe longitudinally along the trench, it shall be done in such a manner as not to injure the pipe or coating.

C. Shield PVC pipe and fittings stored on site from the sun's ultraviolet rays by suitable cover, or indoor storage.

PART 2 PRODUCTS

2.01 GENERAL

A. Products with surfaces intended to be in contact with the drinking water shall be certified and listed in accordance with NSF 61 for potable drinking water.

2.02 DUCTILE IRON PIPE

A. Pipe and fittings 3-inch to 64-inch shall conform to AWWA C150 and C151 and the following requirements:

1. Size shall be as indicated on the Drawings.
2. Minimum pipe pressure class shall be 350 for pipes 6-inch to 12-inch diameter, and pressure class 250 for pipes 16-inch and larger.
3. Suitable for a system working pressure of 250 psi and surge pressure of 300 psi at the depth indicated on the Drawings with a laying condition as indicated in Section 10000, Utility Trenches.
4. Interior lining to be used in a drinking water system shall be certified and listed in accordance with NSF 61.
5. Interior shall be lined with cement-mortar with seal coat in accordance with AWWA C104.

B. Ductile-iron pipe for below ground service shall have push-on or mechanical joints, unless noted otherwise on the Drawings, conforming to AWWA C150 and C151, and to the following requirements:

1. Provide mechanical joint fittings for push-on or mechanical joint pipe, unless noted otherwise on the Drawings.

C. Ductile-iron pipe for above ground service shall have flanged joints, unless noted otherwise on the Drawings, conforming to AWWA C115.

1. Pipes to be painted shall have only a shop primer on the outside by the manufacturer. Verify that proposed manufacturer's primer is compatible with the proposed paint system.

D. Fittings for ductile-iron pipe shall conform to AWWA C110, or C153 and to the following requirements:

1. Joint type shall be as specified above for the supplied ductile-iron pipe.
2. Fittings shall be made of ductile-iron.

E. Ductile iron pipe on piers shall have Mech-Lok™ rigid restrained joint by Griffin Pipe Products Co. or approved substitute.

1. Restrained
   a. Provide restrained joint pipe where called for on the drawings. Length of restrained pipe shall be as indicated on the Drawings. Restrained joints shall be Snap-Lok (Griffin Pipe), Flex Ring and Lok-Ring (American), TR Flex (U.S. Pipe) or approved equal.
   b. Restrained joint pipe and fittings shall meet all AWWA standards and other requirements as specified above for standard ductile iron pipe and fittings unless addressed herein.

c. Field made joints are allowable but should be avoided where possible. Careful planning to locate field cuts in standard pipe sections is preferred. For field made joints in restrained piping, use field weldments or an insert equal to TR Flex Gripper Rings or approved equal. Gasket type field made joints will not be allowed.
d. Restrained joint fittings shall be provided by the restrained joint pipe manufacturer where located within restrained joint pipe sections. Fittings shall be of the same model and type as the pipe supplied from the pipe manufacturer.
e. Restrained joint fittings may be push-on joint type.
f. Megalugs, Series 1100, as manufactured by EBAA Iron Sales shall be allowable for restraint where fittings or valves are not available with restrained joints.
g. Where additional fittings/valves are required for pipes not shown on Drawings, consult with Engineer for length of restrained joint pipe necessary each side of fittings/valve prior to installation of pipe/fitting.
h. Tees for hydrants do not have to be restrained along the main line except where they are within required restrained length of nearby fittings or valves.
i. Contractor shall develop a field layout schedule and drawing for restrained joint pipe installations.
j.

2.03 COPPER PIPE AND TUBING

A. Copper pipe and tubing shall conform to ASTM B-88 Type K and Type L standard specification for seamless copper water tube with copper or brass fittings. Type K to be used underground. Type L to be used above ground.

B. Soldered joint fittings shall conform to NSI B-16.22. Fittings to be of same manufacturer as pipe.

C. Screw joint fittings to be provided where required and indicated.

D. Screw joint unions shall be provided at each in-line valve, pressure regulator, pressure reducer and/or where indicated.

2.04 TAPPING SLEEVE

A. Tapping Sleeve: Sleeves shall be flanged for the tapping valve and manufactured for a working pressure of 150 psi. Sleeve shall have a full body 360-degree gasket. Sleeve shall have a 3/4-inch test plug. Bolts and nuts shall be stainless steel. Tapping Sleeve shall be Mueller mechanical joint, Mueller Outlet Seal, American Uniseal, Kennedy Square Seal, or Clow F5205 or F5207. 100% stainless steel sleeves may be used, as manufactured by Rockwell, Romac, Ford, or JCM, provided that all metallic parts of the sleeves shall be 100% stainless steel including bolts. Ductile iron flanges may be included on sleeves or saddles.

B. Tapping saddles may be used on mains 16-inches and larger. In 16 and 24 inch saddles as manufactured by Mueller, American, Kennedy and Clow tapping saddles shall be manufactured of ductile iron providing a factor of safety of 2.5 at a working pressure of 250 psi. In main sizes of 30-inch and larger, ductile iron tapping saddles as manufactured by American Pipe Company or U.S. Pipe Company shall be utilized. Saddles shall be equipped with a standard AWWA C-110-98 flange connection. Sealing gaskets shall be “O” ring type, high quality molded rubber having an approximate seventy durometer hardness, placed into a groove on the curved surface of the tapping saddle. Straps shall be of alloy steel. Saddles may be used for taps one-half the size of the main or less (i.e. 8-inch tapping saddle for use on a 16-inch main).

2.05 VALVES

A. General: Valves shall meet the following requirements:

1. Size shall be as required for the pipe size and material as indicated on the Drawings and specified.
2. Open by counterclockwise rotation.
3. Provide an interior protective epoxy coating in accordance with AWWA C550 on ferrous surfaces in contact with the liquid.
4. Components in contact with the liquid shall be in compliance with NSF 61.
5. Standard system working pressure is 175 psi.
6. Equip valves with a suitable means of operation.
7. Ends shall be mechanical joint for underground location and flanged joint for above ground location/underground utility vaults.
8. For buried valves over 5 feet deep, provide extension stems of cold rolled steel to bring the operating nut to within 2 feet of the ground surface. Extension stems shall also be provided as required for floor stands and to floor valve box.
9. Provide valve accessories as required for proper valve operation for valve locations as indicated on the Drawings and as recommended by valve manufacturer.
10. Similar valve types shall be of one manufacturer. Valves shall be manufactured by Mueller, Kennedy, Pratt, or American.

B. Gate Valves, Resilient-Seated: Gate valves 3-inch to 20-inch shall conform to AWWA C509 for and to the following requirements:

1. O-ring stem seal on non-rising (NRS) stem valves.
2. Shall be cast iron or ductile iron.
3. Valves shall be non-rising stem (NRS) with wrench nut for underground locations and Outside Screw and Yoke (OS&Y) with handwheel for above ground locations unless noted otherwise on the Drawings.
4. Valves shall be as manufactured by American, Mueller, Kennedy, AVK, Clow, M&H, or Waterous.
5. Valves 16-inch and larger shall be equipped with gearing to facilitate opening. Gear cases shall be enclosed type. Geared valves shall be equipped with indicators to show the position of the gate in relation to the water.
6. Valves 20-inch and larger shall be equipped with a by-pass.

C. Tapping Valves: Tapping valves shall conform to the specifications for the gate valves as indicated in this Section and the following:

1. Valve shall be specifically modified for the passage and clearance of the tapping machine cutter.
2. The mating end to the tapping sleeve shall be raised male surface to provide true alignment to the sleeve and tapping machine. The valve shall be compatible with the tapping sleeve.

D. Butterfly Valves: Butterfly valves 3-inch through 72-inch shall conform to AWWA C504 for potable water and to the following requirements:

1. Valve body shall be ductile iron and mechanical joint for below ground locations and flanged short body in underground vaults and above ground locations. End mechanical joints shall conform to ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11. End flanges shall conform to ANSI B16.1, class 125 and ANSI/AWWA C110/21.10.

2. Valves shall be class 150B.
3. Rubber seats shall mate with stainless steel, bronze mating or resilient material surfaces.
4. Valve shafts shall consist of one-piece unit extending completely through the valve disc for valves under 12-inches. Above this size, shaft shall be one piece or the stub-shaft type. Shafts shall be type 304 stainless steel.
5. Valve discs shall be cast iron, ductile iron, or stainless steel.
6. Valve Actuator
   a. Manual Actuator: Manual actuator shall be of the traveling nut type. Valves for buried service shall have a standard AWWA nut. Valves for above ground shall have a handwheel, or chain wheel as indicated on the Drawings.
   b. Shall be as manufactured by Philadelphia Gear Works or EPI.
7. Valve shall be manufactured by Mueller, Kennedy, Pratt, or American.

E. Swing-Check Valves: Swing-check valves 2 to 24-inch shall conform to AWWA C508 and to the following requirements:

1. Provide lever and weight for swing check control.
2. Metal to Metal seat construction.
3. Ends shall be flanged.

2.06 AIR VALVES

A. Provide air valves in conformance with AWWA C512 and the following:

1. Valve type shall be an Air Release valve.
   a. Inlet size: 2 inch
   b. Small orifice minimum: 1/8 inch
2. Valve shall be designed for the following automatic operation:
   a. Release accumulated air while the main is in operation and under pressure.
3. Valve shall be designed for a system pressure 150 psi.
4. Provide threaded inlet.
5. Provide stainless steal ball float and internal trim.
6. Provide isolating bronze ball valve for connection to main line.
7. Valve shall be Crispin Pressure Air Valve, Model PL 20, or two-inch Val-Matic Model VM-45 with a vacuum check unit or equal as approved by Public Utilities Director.

2.07 MANHOLES

A. Provide manholes made of precast concrete sections in conformance with ASTM C478, NC Department of Transportation, and the following requirements:

1. General
   a. Provide manholes to the depth as indicated on the Drawings. Manhole inside diameter shall be 4 feet unless noted otherwise on the Drawings.
   b. Precast concrete manholes shall be as manufactured by Adams Concrete, Hanson Pipe and Precast, Inc., D & M Concrete Specialties, Inc., N. C. Products Corp., Stay Right Tank, Tindall Concrete Products, Inc. or approved substitute.

2. Precast Concrete Sections
   a. Minimum wall thickness shall be 5-inches.
   b. Base: Cast monolithically without construction joints or with an approved PVC waterstop in the cold joint between the base slab and the walls. The width of the base extensions on Extended Base Manholes shall be no less than the base slab thickness.
   c. Riser: Minimum lay length of 16 inches.
   d. Eccentric Cone: Top inside diameter shall be 24 inches. Width of the top ledge shall be no less than the wall thickness required for the cone section.
   e. Precast or core holes for pipe connections. Diameter of hole shall not exceed outside diameter of pipe by more than 3-inches.
   f. Grade Rings: May be used to adjust ring and covers to finished grade. No more than 12 vertical inches of grade rings will be allowed per manhole. Grade Rings shall be no less than 4 inches in height.
   g. Lifting Devices: Devices for handling precast components shall be provided by the precast manufacturer and comply with OSHA Standard 1926.704.

3. Joints
   a. Manufacturer in accordance with tolerance requirements of ASTM C 990 for butyl type joints.
   b. Minimize number of joints. Do not use riser section for manholes up to 6 feet tall and no more than one riser for each additional 4 feet in height.
   c. Flexible Joint Sealants: Provide preformed butyl rubber based sealant material conforming to Federal Specification SS-S-210A, Type B - Butyl Rubber or O-ring rubber gasket conforming to ASTM C443.

4. Flexible Pipe Connectors: Provide flexible connectors for pipe to manhole that conform to ASTM C923. Location of connectors shall vary from Project Drawings no more than 1/2-inch vertically and 5 degrees horizontally.

5. Manhole Steps:
   a. Steps shall be made of 1/2-inch grade 60 steel encapsulated by co-polymer polypropylene and have serrated tread and tall end lugs.
   b. Secure steps to the wall with compression fit in tapered holes or cast-in-place. Align steps along a vertical wall and shall not be located over a pipe opening. First step shall be a maximum of 26 inches from the bottom.
   c. Steps shall be by American Step Co., Inc., Bowco Industries, Inc., M. A. Industries, Inc. or approved substitute.

2.08 CASTINGS

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., Vulcan Foundry, or approved equal.

B. Manhole Ring and Cover:

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 3/8-inch anchor bolt holes equally spaced.
4. "Water" 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 unless noted as watertight on the Drawings.
6. Provide the following where indicated on the Drawings:
   a. Ring and cover shall be watertight.
   b. Bolt down cover. Bolt down covers shall be provided with four (4) 3/8-inch stainless steel hex head bolts at 90 degrees.

2.09 VALVE ACCESSORIES

A. Valve Box, Below Ground: Boxes shall be high strength cast iron, class 35, of the screw or telescopic type. Box shall consist of a flare base section, center extension as required, and a top section with the word “WATER” cast in the cover. Length of box shall be such that full extension of box is not required at the depth of water main cover.

B. Extension Stem (if necessary): Stem shall be sized so as to transmit full torque from the operating mechanism to the valve stem without binding, twisting, or bending. Stem shall be made from extra heavy steel pipe. Stem shall be complete with couplings for connection to valve and floor stand where required. When valve extension kits are used they must be as recommended by the valve manufacturer.

2.10 SERVICE VALVES AND FITTINGS

A. Water service valves and fittings shall conform NSF 61 and AWWA C800 for normal pressure and the following requirements:

1. Service saddle: Provide service saddle for service pipe connection to main pipe material. Saddles shall meet the following requirements:
   a. Bronze body to conform to the outside dimension of the main.
   b. O-ring, Buna N rubber gasket to provide watertight connection.
   c. Hinged, double bottom strap design.
   d. Threaded outlet to match threads on corporation valve.

2. Corporation valve
   a. Stop size shall be the same as service line.
   b. Inlet thread shall be as per AWWA C800.
   c. Outlet thread shall be as required for the pipe material specified.

3. Curb Stop
   a. Installed in approved valve box
   b. Bronze ball valve material
   c.

4. Pressure reducing valve
   a. Shall meet ASSE 1003.
   b. Bronze body, renewable stainless steel seat.
   c. Suitable for reducing from an inlet pressure range of 100 – 150 psi to an outlet pressure of 40 psi.

5. Meter boxes
   a. Boxes and cover shall be cast iron, precast concrete, concrete block, high density polyethylene or cast in place concrete as shown on standard details.
   b. Minimum 18 inches deep.
   c. Sized for required water meter.

6. Meter setter
   a. Setter shall be made of copper.
   b. Shall be 5/8" and 12" in height.
   c. Setter shall have a meter valve on the public side of the meter. Valve shall be O-ring sealed and capable of being locked in the closed position. Setter shall have an ASSE approved dual check valve on the private side of the meter.

2.11 FIRE HYDRANTS

A. Fire hydrants shall conform to AWWA C502 and to the following requirements:

1. Nozzles: Two (2) 2-1/2-inch hose and One (1) 5-inch Storz pumper connections.
2. Storz connector shall have following characteristics:
   a. brass hydrant nozzle connection
   b. hard anodized aluminum Storz ramps and lugs (hydrant and cap side)
   c. require high-torque Storz spanner wrench in order for cap to be removed.
3. Nozzle threads: NST
4. All nozzles require cap and
5. Main valve diameter: 5-1/4.
6. Minimum depth of bury: 42-inches.
7. Inlet connection: 6-inch mechanical joint.
8. Open counterclockwise.
9. Close with water pressure.
10. O-ring seals
11. All hydrants to include cast or ductile epoxy lined shoe, rubber drain seals, and positive, protective valve stop device.
12. Traffic model with frangible sections near the ground line designed to break on impact.
13. Provide extension for hydrant standpipe as required to set centerline of hydrant nozzle a minimum of 15-inches and a maximum of 24-inches.
14. Exterior color above ground line shall match Owners.
15. Fire Hydrant shall be as manufactured by Kennedy, Mueller, Clow, American Darling, M&H, AVK, East Jordan Iron Works, U.S. Pipe, or Waterous.
16. All hydrants of one manufacturer.

2.12 BACKFLOW PREVENTION ASSEMBLY

A. A list of approved assemblies for backflow preventers (BFP) is included in the Public Utilities Handbook and the list is updated on a regular basis.

2.13 BACKFLOW PREVENTER ENCLOSURES

A. A list of approved enclosures for backflow preventers (BFP) is included in the Public Utilities Handbook and the list is updated on a regular basis.

2.14 METERS

A. All meters shall be provided and installed by the City of Raleigh Public Utilities Department.

2.15 THRUST BLOCKING

A. Provide concrete thrust blocking in accordance with the detail on the Drawings.

B. Thrust blocking is not required where restrained joint fittings and equivalent length of restrained joint pipe are used unless shown otherwise on the Drawings.

2.16 DISINFECTANT

A. The following products may be used as the disinfectant:
   1. Chlorine, liquid: AWWA B301.
   2. Hypochlorite, calcium and sodium: AWWA B300.

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. Take particular care not to damage pipe coatings.
   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. Do not lay pipe in water or when the trench or weather conditions are unsuitable for the work.
   7. Provide tight closure pipe ends when work is not in progress.
   8. Keep pipe interior free of foreign materials.
   9. Clean bell and spigots before joining. Make joints and lubricate gasket in accordance with pipe manufacturer recommendation.
   10. Disinfection of pipe during installation:
      a. Soak gaskets for minimum of one hour in a 50 - 100 ppm hypochlorite solution prior to installation.
      b. Mop bells and spigots of pipe, fittings and valves with a 50 - 100 ppm hypochlorite solution immediately prior to making joints.
   11. Block fittings with concrete or restrain as indicated on the Drawings.

3.02 RELATION OF WATER MAINS TO SEWERS

A. Lateral Separation: Lay water mains at least 10 feet laterally from existing and proposed sewers. Where existing conditions prevent a 10-foot lateral separation, the following shall be followed with approval of the Engineer:

   1. Lay water main in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.

2. Lay water main in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.

B. Crossing Separation: Lay bottom of water main at least 18-inches above the top of the sewer. Where existing conditions prevent an 18-inch vertical separation, construct both the water main and sewer of ferrous materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.

C. Crossing a Water Main Under a Sewer: When it is necessary for a water main to cross under a sewer, construct both the water main and the sewer of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

3.03 WATER SERVICE

A. Water service lines shall extend from the main distribution line to a meter box located at the right-of-way or to a point approximately 5 feet outside the building face, whichever is appropriate..

B. 3/4-inch water service lines may be direct tapped to ductile iron pipe. Water service taps larger than 3/4-inch shall be made using a service saddle.

C. Taps shall be located at 10 or 2 o'clock on the circumference of the pipe.

D. Service taps shall be staggered, alternating from one side of the water main to the other and at least 12 inches apart.

E. Taps on the same side of the main shall be a minimum of 24 inches apart.

F. Install meter boxes and water service components so top of meter will be within 6 inches of the surface.

G. Owner will provide and install water meter.

3.04 DUCTILE IRON PIPE

A. Install pipe in conformance with AWWA C600 and the following:

1. For laying pipe in a vertical or horizontal curve, each full length pipe may be deflected by the following offset distance unless the pipe manufacturer's recommended distances are less:

    a. Push-on joint
        1) 3 to 12-inch pipe: 14-inch offset
        2) 14 to 36-inch pipe: 8-inch offset
    b. Mechanical joint
        1) 3 to 6-inch pipe: 20-inch offset
        2) 8 to 12-inch pipe: 15-inch offset
        3) 14 to 20-inch pipe: 8-inch offset
        4) 24 to 36-inch pipe: 6-inch offset

2. For laying restrained joint pipe in a vertical or horizontal curve, except for horizontal directional drills (HDD), each full length pipe may be deflected by the following offset distance:

    a. 6 to 12-inch pipe: 11-inch offset
    b. 16 to 20-inch pipe: 7-inch offset

c. 24 to 30-inch pipe: 5-inch offset
d. 36-inch pipe: 4-inch offset
e. 42 to 48-inch pipe: 1 ¼ -inch offset

3. The Contractor shall verify the offset distances specified are acceptable with the pipe manufacturer prior to installation.

3.05 VALVES AND FITTINGS

A. Install buried valves on top of an 18-inch square, 3-inch thick, solid concrete pad (minimum dimensions). The concrete pad may be provided by a pre-cast manufacturer or cast-in-place in the field above grade. Concrete used for the pads shall be a minimum 3,000 psi mix. The pads may not be cast-in-place in the pipe trench. Connection to pipe shall be such that there shall be no stress at the joint caused by misalignment or inadequate support of pipe or valve.

B. Valve Box: Set a valve box over each buried valve. Support box so that no stress shall be transmitted to the valve or pipe line. Install box plumb and set top flush with finished grade. Operating nut shall be centered in box. Provide a 24-inch x 24-inch wide by 6-inch thick concrete pad at top of valve boxes outside paved areas. In paved areas, the top of the valve boxes shall be set in the finished paved surfaces matching the paved surface elevation.

C. Valve operation nut shall be within 30 inches of the top of box. Provide stem extension if necessary to bring operating nut to within 30 inches of the top of box.

D. Install fittings as recommended by the manufacturer. Fittings shall be blocked or otherwise restrained from movement.

E. Install valves, gates, and accessories indicated on the Drawings and in complete accordance with the manufacturer's recommendations.

F. Install air / vacuum valve inside a manhole.

3.06 MANHOLES

A. Provide 12 inches of No. 67 stone base to extend a minimum of 6 inches beyond the manhole base.

B. Set base plumb and level. Align manhole invert with pipe invert.

C. Secure pipe connectors to pipe in accordance with manufacturer's recommendation.

D. Clean bells and spigots of foreign material that may prevent sealing. Unroll the butyl sealant rope directly against base of spigot. Do not stretch. Follow manufacturer's instructions when using O-ring seals.

E. Set precast components so that steps align.

F. Plug lift holes using a non-shrink grout. Cover with a butyl sealant sheet on the outside and seal on the inside with an application of an epoxy gel 1/8-inch thick extending 2 inches beyond the opening.

G. Set manhole frames to grade with grade rings. Seal joints between cone, adjusting rings, and manhole frame with butyl sealant rope and sheet.

H. Encase manhole rings in a concrete collar 18-inches wide by 6-inches thick of 3,000 psi concrete beneath paved surfaces.

I. Finish the interior by filling fractures greater than 1/2 inch in length, width or depth with a sand cement mortar. Do not fill the joints between the precast components.

J. Clean the interior of the manhole of foreign matter.

3.07 METERS

A. Install meter boxes and water service components so top of meter will be within 6 inches of the surface.

B. The Owner will install water meter.

3.08 HYDRANT

A. Set hydrant in accordance with detail on Drawings.

3.09 PAINTING

A. Equipment shall receive the manufacturer's standard coating for the intended application. Coatings shall be suitable for the intended application.

B. Repaint damaged paint services.

C. Above ground piping and piping within vaults shall be painted in accordance with Section, Painting.

3.10 PIGGING

A. All new mains, unless otherwise noted in the Contract Documents, shall be pigged with a polyethylene “pig”, 5#/cubic foot density a the conclusion on installation.

B. Pigs shall be blown at the end of the main by either fire hydrant or blow-off assembly.

3.11 BACKFLOW PREVENTION TESTING

A. Install and test Backflow prevention devices in accordance with the requirements of the City.

3.12 PRESSURE TESTING

A. Pressure test in accordance with AWWA C600 for ductile iron pipe and AWWA C605 and M23 for PVC pipe and as specified herein

B. General:
   1. The Engineer shall approve the source, quality, and method of disposal of water to be used in test procedures.
   2. Obtain Owner's permission 48 hours prior to filling or flushing of pipe system with water from Owner's water system. Owner shall operate valves connected to the existing water system. Where large quantities of water may be required for flushing, Owner reserves the right to require that flushing be done at periods of low demand.
   3. Clean and flush pipe system of foreign matter prior to testing.
   4. Provide air vents at the high points in the line section to be tested for releasing of air during filling. Service corporation stops may be used for air vent when located at a high point. Include cost of air vents in price of testing. Leave corporation stops in place after testing and note locations on As-Built Drawings.
   5. Allow concrete blocking to reach design strength prior to pressure testing.
   6. Test main prior to installation of service taps.
   7. Repair defects in the pipe system. Make repairs to the same standard as specified for the pipe system.
   8. Retest repaired sections until acceptance.

9. Repair visible leaks regardless of the test results.
10. Pipe sections shall not be accepted and placed into service until specified test limits have been met.

C. Testing
1. Notify Owner and Engineer a minimum of 48 hours prior to testing.
2. Perform tests in the presence of Engineer.
3. Make pressure tests between valves. Furnish suitable test plugs where line ends in "free flow."
4. Upon completing a section of pipe between valves, test pipe by maintaining for a two hour period a hydrostatic pressure of 150 psig.
5. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.
6. No length of line shall be accepted if the leakage is greater than that determined by the following formula based on the appropriate test pressure:
L = Allowable leakage per 1,000 feet of pipe in gallons per hour.
D = Nominal diameter of the pipe in inches.
100 psi: L = D x 0.07
150 psi: L = D x 0.08
200 psi: L = D x 0.09
250 psi: L = D x 0.10

3.13 DISINFECTION

A. After satisfactory completion of the pressure test, disinfect new potable water mains and existing mains that have required repair in accordance with AWWA C651 and as specified herein. Disinfect water mains in a maximum length per day of 2,000 feet.

B. General:
1. Provide a superintendent experienced in the required procedures for disinfecting with chlorine.
2. Obtain Owner's permission 48 hours prior to filling, flushing, and chlorinating of the water mains. Owner shall operate valves connected to the existing water system.
3. Do not allow highly chlorinated water into the existing distribution system.
4. A reducing agent shall be applied to the water to neutralize the residual chlorine. Federal, state, or local environmental regulations may require special provisions or permits prior to disposal of highly chlorinated water.
5. Perform disinfection and testing in presence of Engineer.

C. Connection to Existing System: Notify Owner 48 hours prior to making connections to the existing system. Thoroughly clean the existing water main exterior prior to the installation of tapping sleeves and corporation stops. Lightly dust with calcium hypochlorite powder the water main exterior and the interior surface of the tapping sleeve, and corporation stops.

D. After satisfactory flushing of the main, disinfect by the injection of a chlorine solution. Induce chlorine in sufficient quantity to maintain a chlorine residual of at least 50 ppm throughout the system to be tested. Maintain the chlorine solution in the system for at least 24 hours.

E. Valves and Fire Hydrants: Open and close valves on the mains being disinfected a minimum of three times during the chlorine contact period and a minimum of three times during flushing. Fire hydrants and other appurtenances should receive special attention to insure proper disinfection.

F. For Cut-In Construction: Use the following procedures for disinfecting of the new installation and the existing main at the cut-in point in accordance with AWWA C651, Section 9:

1. Apply liberal quantities of hypochlorite, in the form of tablets, to the open trench.

2. Interior of new pipe and fittings and the ends of the existing mains shall be swabbed or sprayed with a one percent hypochlorite solution before installation.
3. Install a 2-inch tap downstream of the work area. Tap shall be used for blowing off the main, or use the next fire hydrant downstream of the work area for blowing off the main.
4. Install a 2-inch tap just upstream of the new installation. Control Water from the existing system so as to flow slowly into the work area during the application of chlorine. After the line is thoroughly flushed, add chlorine solution at a concentration of 100 ppm by the continuous feed method and hold in the main for one (1) hour.

G. Prior to flushing, the free chlorine residual shall be a minimum of 10 ppm. Flushing of the lines shall not proceed until the lines contain the normal chlorine residual of the system.
   1. Dechlorination: No discharge or heavily chlorinated water into a storm sewer or stream will be permitted unless the discharge is first treated by a neutralizing chemical applied to the water to be wasted to neutralize thoroughly the residual chlorine. A declorinating device is required. Disposal of chlorinated water shall meet the applicable sections of AWWA C651, and the NC NPDES General Permit NCG03000 or more current general permit if effective at the time of construction.

H. Test in the field for free chlorine residual:
   1. Sample location shall be the same as required for the bacteriological test samples.
   2. Immediately after injection of the chlorine solution. Sample shall have a chlorine residual as specified.
   3. Prior to flushing of the highly chlorinated water from the potable water system and a minimum of 24-hours after the initial injection of the chlorine. Sample shall have a minimum chlorine residual as specified.

3.14 BACTERIOLOGICAL TESTING

A. Coordinate sampling and testing with the Owner. Follow procedure as outlined in the Public Utilities Handbook and below.

B. Required location for obtaining water samples:
   1. Between Main Line valves
   2. End of each main.
   3. A minimum of one from each branch.
   4. Mains at cut-in locations: Each side of work area. Time between samples to be determined by Engineer in field.

C. Notify the City of Raleigh Public Utilities Department when the system is ready to sample. The Public Utilities Department will take water samples at each specified location for the bacteriological and turbidity testing.

D. Recommended additional samples. During the required sampling of water from the new system, it is recommended that samples be taken from the existing potable water source to determine if coliforms are present.

E. Care in sampling. No hose or fire hydrant shall be used for the collection of samples. Take samples from an approved sample tap consisting of a corporation stop installed in the main with a copper tube gooseneck assembly. Operation shall be such as to ensure that the sample collected is actually from water that has been in the new system. Copper tube gooseneck assembly shall be removed and sample tap corporation stop shut off upon completion of testing bacteriological testing is requirements.

F. Samples will be tested by the Owner for turbidity in accordance with the Public Utilities Handbook. If it passes then the bacteriological test will be performed by Public Utilities.

G. Test samples for the presence of coliform organisms in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater. Testing method used shall be the multiple-tube fermentation technique, the membrane-filter technique, or presence/absence.

H. Test for odor. The water in the new system should also be tested to assure that no offensive odor exists due to chlorine reactions or excess chlorine residual.

I. If samples show the presence of coliform, procedure 1 or 2 described below shall be followed, with the approval of the Owner, before placing the unit or facility in service.
   1. Take repeat samples at least 24 hours apart until consecutive samples do not show the presence of coliform.
   2. Again subject the system to chlorination and sampling as described in this section.

J. If samples are free of coliform, and with the approval of the Owner, the potable water system may be placed in service.

K. Contamination: If, in the opinion of the Engineer, possible contaminants have entered the existing water system, or water samples show the water in the existing system to be unsafe on completion of the work, the existing water system shall be disinfected as specified herein and shall include all contaminated components. Disinfection of the existing system shall be coordinated with the Owner.

3.14 VALVE OPERATION

A. Prior to final acceptance provide competent personnel to operate each valve in presence of Owner and Engineer. Verify that valves are left in the open position.

PART 4 MEASUREMENT AND PAYMENT

4.01 Water Distribution Pipe: Payment shall be paid at the contract unit price bid per linear foot installed as indicated by the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials to furnish and install pipe, sheeting, shoring, concrete reaction blocking, rodding, and backfill materials including excavation, rock excavation, removal of existing blowoff assemblies or caps, connection to existing mains, disposal, disinfection, sampling, testing and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications.

4.02 Fire Hydrant Assembly: Payment for “Fire Hydrant Assembly” shall be paid at the contract unit price bid per each fire hydrant assembly installed as indicated by the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials to furnish and install the hydrant, the 6-inch ductile iron hydrant leg, 6-inch gate valve, tee, required restraint, hydrant extension(s), washed stone, backfill and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications.

4.03 Gate Valve: Payment for "Gate Valve" shall be paid at the contract unit price bid per each valve assembly installed as listed in the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials to furnish and install the valve, valve box or manhole, required restraint, and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications.

4.04 Insertion Valve: Payment for "Insertion Valve" shall be paid at the contract unit price bid per each valve assembly installed as listed in the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials to furnish and install the valve and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications.

4.05 Pipe Fittings: Payment for "Pipe Fittings" shall be paid at the contract unit price bid per pound as listed in the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials to furnish and install the fitting, mechanical joint accessories, concrete reaction blocking, rodding, required restraint, and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications.

4.06 Blowoff Assembly: Payment for "Blowoff Assembly" shall be paid at the contract unit price bid per each blowoff assembly installed as listed in the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials to furnish and install the concrete thrust collar, concrete reaction blocking, threaded rod, tapped pipe cap, gate valve, valve boxes, brass pipe, couplings and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications.

4.07 Combination Air Valve Assembly: Payment for "Combination Air Valve Assembly" shall be paid at the contract unit price bid per each combination air valve assembly installed as listed in the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials to furnish and install the combination air valve, corporation stop with tapping saddle when required, brass valve, brass fittings, brass piping, manhole with ring and cover, washed stone and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications.

4.08 Tapping Sleeve and Valve Assembly: Payment for "Tapping Sleeve and Valve Assembly" shall be paid at the contract unit price bid per each tapping sleeve and valve assembly installed as listed in the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials to furnish and install the tapping sleeve, gate valve, concrete reaction blocking, valve box or manhole, accessories and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications.

4.09 Thrust Collar: Payment for "Thrust Collar" shall be paid at the contract unit price bid per each thrust collar installed as listed in the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials to furnish and install a concrete thrust collar and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications. Thrust collars required for proposed gate valves and fittings shall be paid as part of the "Gate Valve" or "Pipe Fittings" pay items with no separate or additional payment for the collar

4.010 Water Tap and Service: Construct residential service line tap from the City water main to the property line of selected residence. Provide complete leak free connection from City water main to right-of-way and property line of residence. This work to include taping, corporation stop, service line, excavation, curb stop, meter box, meter setter and testing in accordance with City of Raleigh standards. Work to be completed at the direction of the Engineer, as needed. The City's Public Utilities Department will furnish and set the water meter following completion of the Contractor's work and acceptance by the City Inspector.

4.011 Water Tap and Service, Bored: Payment for "Water Tap and Service, Bored" shall be paid at the contract unit price bid per each water service tap and service installed and bored from the City water main to the property line. The unit price shall include full compensation for "Water Tap and Service" as previously specified in addition to all work and incidental items required to bore the connection under the roadway as specified by the Contract Documents and Standard Specifications.

4.012 Water Service Connection: Payment for "Water Service Connection" shall be paid at the contract unit price bid per each water service connection installed from the meter at the right of way to the connection with the building or residence as indicated by the Itemized Proposal. The unit price shall include full compensation for all permits, labor, equipment and materials to furnish and install the water service connection, and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications.

END OF SECTION

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SECTION 12000
SANITARY SEWER SYSTEM
(REVISED 4-9-19)

PART 1 GENERAL

SECTION INCLUDES

A. Except as otherwise stipulated in this section, all work shall conform to Division 15 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

B. Work under this section includes, but is not limited to, piping, manholes, diversion structures, valves, and appurtenances for a complete sanitary sewer collection system.

RELATED SECTIONS

C. 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 10000 Utility Trenches
   2. Section 13000 Tunneling, Boring, and Jacking

REFERENCES

D. Publications are referred to in the text by basic designation only.
   1. American Society for Testing and Materials (ASTM)

      a. A126 Gray Iron Castings and Valves, Flanges and Pipe Fittings.
      b. B117 Operating Salt Spray (Fog) Apparatus
      c. C33 Concrete Aggregates
      d. C76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
      e. C150 Portland Cement
      f. C361 Reinforced Concrete Low-Head Pressure Pipe.
      g. C443 Flexible Watertight Joints for Precast Manhole Sections
      h. C478 Precast Reinforced Concrete Manhole Sections
      i. C497 Standard Methods Testing Concrete Pipe, Manhole Sections or Tile
      j. C618 Coal Fly Ash and Raw or Calcined natural Possolan for Use as a Mineral Admixture in Portland Cement Concrete
      k. C655 Reinforced Concret D-Load Culvert, Storm Drain and Sewer Pipe
      l. C822 Definition of Terms Related to Concrete Pipe and Related Products
      m. C890 Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
      n. C923 Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
      o. C1103 Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
      p. C1131 Least Cost (Life Cycle) Analysis of Concrete Culvert, Storm Sewer, and Sanitary Sewer Systems
      q. C1619 Elastomeric Seals for Joining Concrete Structures
      r. C2794 Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
      s. D638 Tensile Properties of Plastics
      t. D714 Evaluating Degree of Blistering of Paints
      u. D1244 Test Method for Concrete Sewer Manholes by the Negative Air Pressure
      v. D1248 Polyethylene Plastics Molding and Extrusion Materials

w. D1784 Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
x. D2241 Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)
y. D2310 Machine Made Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Pipe
z. D 2321 Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
aa. D2412 Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
bb. D2924 Standard Test Method for External Pressure Resistance of Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Pipe
cc. D2996 Filament Wound Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Pipe
dd. D2997 Centrifugally Cast Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Pipe
ee. D3034 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ff. D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
gg. D3262 “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
hh. D3350 Polyethylene Plastics Pipe and Fittings Materials
ii. D3567 Determining Dimensions of Fiberglass (Glass Reinforced Thermosetting Resin) Pipe and Fittings
jj. D3681 Chemical Resistance of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe in a Deflected Condition
kk. D3839 Underground Installation of “Fiberglass” (Glass Fiber Reinforced Thermosetting Resin) Pipe
ll. D4060 Abrasion Resistance of Organic Coatings by the Taber Abraser
mm. D4161 “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
nn. D4541 Pull-Off Strength of Coatings Using Portable Adhesion Testers
oo. D4258 Surface Cleaning Concrete for Coating
pp. D4259 Abrading Concrete
qq. E96 Water Vapor Transmission of Materials
rr. F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ss. F1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
tt. G95 Cathodic Disbondment Test of Pipeline Coatings

2. American Water Works Association (AWWA)
   a. C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
   b. C110 Ductile-Iron and Gray-Iron Fittings, 3 inch through 48 inch, for Water and Other Liquids
   c. C151 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
   d. C153 Ductile-Iron Compact Fittings, 3 inch through 16 inch, for Water and Other Liquids
   e. C504 Rubber-Seated Butterfly Valves
   f. C508 Swing-Check Valves for Waterworks Service, 2 inch Through 24 inch NPS
   g. C512 Air-Release, Air / Vacuum, and Combination Air Valves for Waterworks Service
   h. C550 Protective Epoxy Interior Coatings for Valves and Hydrants

i. C600 Standard for Installation of Ductile Iron Water Mains and Their Appurtenances
j. C900 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 12 inch, for Water Distribution
k. C905 Polyvinyl Chloride (PVC) Water Transmission Pipe, 14 inch through 36 inch, for Water Distribution
l. C950 Standard for Fiberglass Pipe
m. M23 PVC Pipe - Design Installation
n. M41 Ductile Iron Pipe and Fittings
o. M45 Fiberglass Pipe Design

3. National Sanitation Foundation (NSF) Standards
   a. 14 Plastic Piping Components and Related Materials

4. UNI-BELL Plastic Pipe Association (UNI)
   a. B-5 Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Sewer Pipe
   b. B-6 Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

5. Ductile Iron Pipe Research Association (DIPRA)
   a. 8-08/5M Design of Ductile Iron Pipe

6. Reinforced Concrete Pipe
   a. American Concrete Pipe Association (ACPA) Design Data 9 Standard Installations and Bedding Factors for the Indirect Design Method.

SUBMITTALS

E. 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 tests set forth in each applicable referenced publication have been performed and that test requirements have been met. Submit for each of the following materials:

      a. Pipe
         1) Ductile iron
         2) PVC Pressure Pipe
            i) C900
            ii) C905
         3) Polyvinyl Chloride (PVC) gravity sewer pipe
            i) SDR 35
            ii) Schedule 40, drain, waste, and vent (DWV) pipe
         4) Centrifugally Cast Fiberglass Reinforced Polymer Mortar (CCFRPM) Pipe
         5) Filament Wound Fiberglass Reinforced Polymer Mortar Pipe
         6) Reinforced Concrete HDPE Lined Pipe

      b. Pre-cast concrete manholes
         1) For T-base manholes the precast manufacturer shall provide detailed design calculations for each configuration, which shall include calculations for wall stresses, flotation, depth, reinforcement, and all other criteria necessary for a complete design.

c. Valves
   1) Plug
   2) Check
   3) Air Release
   4) Resilient-seated gate

d. Protecto 401 Ductile Iron Pipe Liner

2. Catalog Data and Calculations: Submit manufacturer's standard drawings or catalog cuts and calculations for pipe pressure/thickness class, concrete reinforcement and stiffness class for the appropriate type pipe based on the Drawings and Specifications for the following. Clearly indicate material to be furnished for the Project including options to be provided and indicate if a greater pipe pressure/thickness class, concrete reinforcment or pipe stiffness class will be necessary based on the manufacturer's calculations.

   a. Pipe
      1) Ductile iron
      2) Ductile Iron with restrained joints
      3) PVC Pressure Pipe
         i) C900
         ii) C905

      4) Polyvinyl Chloride (PVC) gravity sewer pipe
         i) SDR 35
         ii) Schedule 40, drain, waste, and vent (DWV) pipe
         iii) Composite (Truss)
         iv) Ribbed

      5) Centrifugally Cast Fiberglass Reinforced Polymer Mortar (CCFRPM) Pipe
      6) Filament Wound Fiberglass Reinforced Polymer Mortar Pipe
      7) Reinforced Concrete HDPE Lined Pipe

   b. Pre-cast Concrete Manholes and the following appurtenances:
      1) Manhole steps
      2) Pipe connectors
      3) Joint material
      4) Castings
      5) Interior Coating System

   c. Service saddles

   d. Valves
      1) Resilient-seated gate
      2) Plug
      3) Check
      4) Air Release

   e. Protecto 401 Ductile Iron Pipe Liner

3. Reports:

    a. Field test report for each section of pipe for the following:
        1) Pressure test for force mains.
        2) Low-pressure air test for gravity mains.
        3) Vacuum test for manholes.
        4) Deflection test for gravity mains.

4. Operation and Maintenance Instructions: Submit complete operation and maintenance manual for the following:

    a. Valves.

DELIVERY, STORAGE, AND HANDLING

F. Provide a rope sling when handling the pipe. 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.

G. 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 or coating.

H. Shield PVC pipe and fittings stored on site from the sun's ultraviolet rays by suitable cover, or indoor storage.

PART 2 PRODUCTS

DUCTILE-IRON PIPE

A. Pipe and fittings shall conform to the following requirements:
    1. Size shall be as indicated on the Drawings.
    2. Minimum pipe pressure class shall be 350 for pipes 6-inch to 12-inch diameter, and a minimum pressure class 250 for pipes 16-inch and larger.
    3. Suitable for a system working pressure of 250 psi minimum for gravity sewer, 150 psi for force mains.
    4. Pipe shall be supplied in nominal lengths of 18 or 20 feet.
    5. Cement-mortar lined with seal coat in accordance with AWWA C104 for pipes smaller than 12-inches.
    6. Interior of pipes and fittings for pipes 12-inches and larger shall be lined with PROTECTO 401 ceramic epoxy as described in paragraph in this section.
    7. Pipe pressure/thickness class shall be suitable for the type laying condition as provided in Section 02315, Trenching for Utilities, and at the depth indicated on the Drawings. The proper pressure/thickness class shall be at a minimum as shown on the Contract Drawings. Pipe manufacturer to verify pipe selection, and document to Engineer, prior to ordering and manufacture of pipe.

        Note: The pipe pressure classes shown on the Contract Drawings were determined with the use of the pipe liner as specified above. If this specified pipe liner is modified or changed for any reason, then the Engineer and Pipe Manufacturer, prior to the Contractor ordering the pipe, shall reevaluate the pressure class.

8. Provide mechanical joint fittings, unless noted otherwise on the Drawings.
9. Pipe class shall not transition between manholes and shall be the highest pressure/thickness class required for that reach with exception to sections between manholes including jacking pipe as indicated on the Drawings.
10. Ductile Iron may be used for gravity sewers and force mains.

B. Ductile-iron pipe for below ground service shall have push-on or mechanical joints, unless noted otherwise on the Drawings, conforming to AWWA C150 and C151, and to the following requirements:

1. Provide mechanical joint fittings for push-on or mechanical joint pipe, unless noted otherwise on the Drawings.

C. Ductile-iron pipe for above ground service shall have flanged joints, unless noted otherwise on the Drawings, and conform to AWWA C115.

1. Pipes to be painted shall have only a shop primer on the outside by the manufacturer. Verify that proposed manufacturer's primer is compatible with the proposed paint system.

D. Fittings for ductile-iron pipe shall conform to AWWA C110, or C153 and to the following requirements:

1. Joint type shall be as specified above for the supplied ductile-iron pipe.
2. Fittings shall be made of ductile-iron.
3.

E. Ductile iron pipe on piers shall have Mech-Lok™ rigid restrained joint by Griffin Pipe Products Co. or approved equal.

F. Special Pipe Joints

1. River Crossing (Ball Joint)
   a. Boltless
   b. Bolted

2. Restrained
   a. Provide restrained joint pipe at fittings and valves where indicated on the Drawings. Length of restrained pipe shall be as shown. Restrained joints shall be Snap-Lok (Griffin Pipe), Flex Ring and Lok-Ring (American), TR Flex (U.S. Pipe) or approved equal.
   b. Restrained joint pipe and fittings shall meet all AWWA standards and other requirements as specified above for standard ductile iron pipe and fittings unless addressed herein.
   c. Field made joints are allowable but should be avoided where possible. Careful planning to locate field cuts in standard pipe sections is preferred. For field made joints in restrained piping, use field weldments or an insert equal to TR Flex Gripper Rings or approved equal. Gasket type field made joints will not be allowed.
   d. Restrained joint fittings shall be provided by the restrained joint pipe manufacturer where located within restrained joint pipe sections. Fittings shall be of the same model and type as the pipe supplied from the pipe manufacturer.
   e. Restrained joint fittings may be push-on joint type.

f. Megalugs, Series 1100, as manufactured by EBAA Iron Sales or approved equal shall be allowable for restraint where fittings or valves are not available with restrained joints.
g. Where additional fittings/valves are required and not shown on Drawings, consult with Engineer for length of restrained joint pipe necessary each side of fittings/valve prior to installation of pipe/fitting.
h. Tees for hydrants do not have to be restrained along the main line except where they are within required restrained length of nearby fittings or valves.
i. Contractor shall develop a field layout schedule and drawing(s) for restrained joint pipe installations that are to be submitted for approval as outlined in Section 01330, Submittal Procedures.

PROTECTO 401 DUCTILE IRON PIPE LINER

G. General

1. The interior wall of ductile iron sewer pipe 12" and larger in diameter shall be protected by the Protecto 401 Ceramic Epoxy liner.
2. The lining shall meet the manufacturer's recommendations and the following requirements as a minimum.
3. The liner manufacturer shall have a minimum of ten (10) years of successful experience and be able to demonstrate successful performance on comparable projects.

H. Lining Material

1. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment.
2. Permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with a test duration of 30 days.
3. The following tests must be run on coupons from factory lined ductile iron pipe:
   a. ASTM B-117 Salt Spray (scribed panel) – Results to equal 0.0 undercutting after two years.
   b. ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5mm undercutting after 30 days.
   c. Immersion testing rated on using ASTM D-714-87.
      1) 20% Sulfuric Acid – No effect after two years.
      2) 140°F 25% Sodium Hydroxide – No affect after two years.
      3) 160°F Distilled Water – No effect after two years.
      4) 120°F Tap Water (scribed panel) – 0.0 undercutting after two years with no effect.
   d. An abrasion resistance of no more than 3 mils (0.075mm) loss after one million cycles using European Standard EN 598: 1994 section 7.8 Abrasion resistance.

POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

I. General

1. Pipe and fitting size shall be as indicated on the Drawings.
2. PVC materials shall comply with ASTM D1784 with a cell classification of 12454-B.
3. Pipe used for potable water systems shall comply with NSF 61.
4. PVC pipe is allowable only for gravity sewers.

J. AWWA C900: C900 PVC pipe 4-inch to 12-inch shall conform to AWWA C900 and the following requirements:

1. Outside diameter shall conform to ductile-iron pipe.
2. Pipe shall be pressure class **160** with a standard dimension ratio of DR **18**.
3. Pipe shall have plain end and elastomeric-gasket bell ends.
4. Fittings shall conform to AWWA C110 or C153 and have mechanical joints. Fittings shall be made of gray-iron or ductile-iron. Interior of fittings shall be cement-mortar lined with seal coat in accordance with AWWA C104.

K. AWWA C905: C905 PVC pipe 14-inch to 48-inch shall conform to AWWA C905 and the following requirements:

1. Outside diameter shall conform to ductile-iron pipe.
2. Pipe shall have a pressure rating of **160** with a standard dimension ratio of DR **18**.
3. Pipe shall have plain end and elastomeric-gasket bell ends.
4. Fittings shall conform to AWWA C110 or C153 and have mechanical joints. Fittings shall be made of gray-iron or ductile-iron. Interior of fittings shall be cement-mortar lined with seal coat in accordance with AWWA C104.

L. Schedule 40 & 80: Schedule 40 & 80 PVC pipe ½-inch to 12-inch shall conform to ASTM D1785 and the following requirements:

1. Outside diameter shall conform to iron pipe.
2. Pipe shall be schedule 40 or 80.
3. Pipe shall have an integral elastomeric-gasket bell end or solvent weld joints.
4. Fittings for the pipe shall conform to ASTM D2466 or D2467 as appropriate for the pipe schedule.

CENTRIFUGALLY CAST FIBERGLASS REINFORCED POLYMER MORTAR (CCFRPM) PIPE

M. Pipe and fittings shall conform to the following requirements:

1. Size stiffness class (SN) shall be as indicated on the Drawings.
2. Pipe shall be supplied in 20-foot nominal lengths.
3. Each length of pipe, fittings, couplings, specials to be used shall be plainly and permanently marked with the following: pipe class or strength designation, manufacturer's name or trademark, date of manufacture, and the nominal pipe size.
4. CCFRPM Pipe is allowable only for gravity sewers.

N. Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe shall conform to ASTM D3262, for CCFRPM pipe manufactured of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) materials, and to the following requirements:

1. CCFRPM pipe shall be as manufactured by HOBAS Pipe.
2. The pipe shall be manufactured in accordance with ASTM D3262 with a minimum nominal pipe stiffness of (SN) as shown on the Drawings. The pipe shall meet the following cell limits: Type 1, Liner 2, Grade 3, as described by Section 4.2 and Table 1 of ASTM D3262. The stiffness is to be measured in accordance with ASTM D2412.

The corrosion liner shall not be considered as contributing to the structural strength of the pipe.

3. The pipe shall be manufactured by the centrifugal casting process resulting in a dense, nonporous, corrosion-resistant, consistent, composite structure to meet the operating conditions as shown on the Drawings.
4. Pipe shall conform to ASTM D2412 for minimum stiffness and external loading characteristics.
5. Couplings, fittings and push-on joints shall be manufactured with flexible, elastomeric seals conforming to the requirements of ASTM D4161 and ASTM F477 and shall meet or exceed the pipe class at the location of its installation.
6. Pipe joint shall be push-on type couplings unless specified otherwise.
7. Pipe shall meet the minimum requirements of ASTM D3681 and ASTM D3262. Manufacturer shall provide complete 10,000-hour test results on pipe produced at the proposed location of manufacture. Results shall reflect that the pipe has a minimum allowable strain of no less than 0.9% at fifty years when tested in accordance with ASTM D3681 and D3262.
8. Normal production pipe for this project shall not incorporate raw materials that are not in compliance with ASTM D3681 and ASTM 3262.
9. Interior of pipe shall be manufactured using a nonstructural resin with a minimum allowable elongation of 50% when measured in accordance with ASTM D638. The liner nominal thickness shall be 40-mils.
10. Exterior pipe surfaces shall be comprised of a layer of sand and resin to provide UV protection to the exterior.

4.02 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

A. General

1. Shall only be used for 15-inch diameter and smaller gravity sewers.
2. Pipe and fitting size shall be as indicated on the Drawings.
3. PVC materials shall comply with ASTM D1784 with a cell classification of 12454-B.
4. Pipe shall have an integral elastomeric-gasket bell end. Gaskets shall be in conformance with ASTM F477.
5. See Section, Trenching for Utilities, for trench bedding and haunching requirements.

B. SDR 35: PVC SDR 35 gravity sewer pipe 4-inch to 15-inch and related fittings shall conform to ASTM D-3034 and the following requirements:

1. Pipe shall have standard dimension ratio of SDR 35.
2. Nominal pipe length shall be a minimum of 13 feet.

4.07 FILAMENT-WOUND FIBERGLASS REINFORCED POLYMER MORTAR PIPE

A. Pipe and fittings shall conform to the following requirements:

1. Size and stiffness class (SN) shall be as indicated on the Drawings.
2. Pipe shall be supplied in 20-foot or 40-foot nominal lengths.
3. Each length of pipe, fittings, couplings, specials to be used shall be plainly and permanently marked with the following: pipe class or strength designation, manufacturer's name or trademark, date of manufacture, and the nominal pipe size.
4. Filament-Wound Fiberglass reinforced Polymer Mortar Pipe is allowable only for gravity sewers.

5. Wall Thickness: The average wall thickness of the pipe shall not be less than the nominal wall thickness published in the manufacturer's literature, and the minimum wall thickness at any point shall not be less than 87.5% of the nominal wall thickness.
6. End Squareness: All points around each end of a pipe unit shall fall within +/-1/4 inch or +/-0.5% of the nominal diameter of the pipe, whichever is greater, to a plane perpendicular to the longitudinal axis of the pipe.
7. Stiffness: Each pipe shall have sufficient strength to exhibit the minimum pipe stiffness at 5% deflection as required by the Engineer. Stiffness shall be tested in accordance with the test method of ASTM D2412. A minimum of one pipe shall be tested every 100 lengths of each type, grade, and size pipe produced.

B. Filament-Wound Fiberglass Reinforced Polymer Mortar Pipe shall conform to ASTM D3262, for fiberglass reinforced polymer mortar pipe manufactured of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) materials, and to the following requirements:

1. The pipe shall be as manufactured by Flowtite Pipe and supplied by U.S. Composite Pipe South (USCPS), Inc.
2. The pipe shall be manufactured in accordance with ASTM D3262 with a minimum nominal pipe stiffness of (SN) as shown on the Drawings. The pipe shall meet the following cell limits: Type 1, Liner 2, Grade 3, as described by Section 4.2 and Table 1 of ASTM D3262. The stiffness is to be measured in accordance with ASTM D2412. The corrosion liner shall not be considered as contributing to the structural strength of the pipe.
3. The pipe shall be manufactured by the continuous advancing mandrel (filament wound) process resulting in a dense, nonporous, corrosion-resistant, consistent, composite structure to meet the operating conditions as shown on the Drawings.
4. Pipe shall conform to ASTM D2412 for minimum stiffness and external loading characteristics.
5. Couplings, fittings and push-on joints shall be manufactured with flexible, elastomeric seals conforming to the requirements of ASTM D4161 and ASTM F477 and shall meet or exceed the pipe class at the location of its installation.
6. Pipe joint shall be push-on type couplings unless specified otherwise.
7. Pipe shall meet the minimum requirements of ASTM D3681 and ASTM D3262. Manufacturer shall provide complete 10,000-hour test results on pipe produced at the proposed locaton of manufacture. Results shall reflect that the pipe has a minimum allowable strain of no less than 0.65% at fifty years when tested in accordance with ASTM D3681 and D3262.
8. Normal production pipe for this project shall not incorporate raw materials that are not in compliance with ASTM D3681 and ASTM 3262.
9. Interior of pipe shall be manufactured using a nonstructural resin with a minimum allowable elongation of 50% when measured in accordance with ASTM D638. The liner nominal thickness shall be 40-mils.
10. Exterior pipe surfaces shall be comprised of a layer of sand and resin to provide UV protection to the exterior.

C. Resin Systems: The manufacturer shall use only approved polyester resin systems with a proven history of performance of in this particular application.

D. Glass Reinforcements: The reinforcing glass fibers to be used to manufacture the components shall be of the highest quality commercial grade of glass filaments suitably treated with binder and sizing compatible with impregnating resins.

E. The internal liner shall be suitable for service in a sewer pipe, and shall be highly resistant to exposure to sulfuric acid as produced by biological activity from hydrogen sulfide gases. Pipe shall meet or exceed requirements off ASTM D3681.

F. Silica Sand: Sand shall be minimum 98% silica with a maximum moisture content of 0.2%

G. Additives: Resin additives, such as curing agents, pigments, dyes, fillers, thixotrophic agents, etc., when used, shall not detrimentally effect the performance of the product.

H. Elastomeric Gaskets: Gaskets shall be supplied by qualified gasket manufacturers and be suitable for the service intended.

REINFORCED CONCRETE HDPE LINED GRAVITY SEWER PIPE

I. All Pipe Reinforced Concrete HDPE Lined Sewer shall conform to the applicable ASTM Standard. The Class or D-Load strength of the pipe shall be as specified on the Drawings or Bid Form.

1. All pipe shall be manufactured using the Dri-cast or Wet Cast Method of manufacture. The manufacturing method shall be at the option of the pipe manufacturer but once a method is selected, it shall not be changed without the approval of the Engineer. Joint lengths shall be a minimum of 8' except where shorter lengths are needed for closures and connections.
2. All joints shall meet the requirements of ASTM C 361 Section 8. All gaskets shall meet the requirements of ASTM C361 Section 6.9 and ASTM C1619.
3. Non-air-entraining Portland cement conforming to ASTM C 150 Type II or Type V shall be used. Flyash conforming to ASTM C 618 Class F or Class C may be used. Total flyash content shall not exceed 25% by weight of total cementitious material.
4. The use of any admixture must be approved by the Engineer.
5. All coarse and fine aggregates shall meet the requirements of ASTM C 33 except for gradation.
6. The application of HDPE liner to forms and other surfaces is considered to be specialized work. Personnel performing such work shall be adequately trained in the methods of liner installation prior to commencing work.
7. To ensure adequate liner/pipe wall bond, all HDPE lined pipe shall pre-set for a minimum of two hours with the forming core left in the pipe. All pipe shall be cured in a fully enclosed curing chamber or have individual curing covers placed over each pipe.
8. Each pipe shall be clearly marked with the strength, date of manufacture, the name or trade mark of the manufacturer and the manufacturer's Quality Assurance stamp of approval.

J. HDPE Liner

1. Liner shall demonstrate minimum pull-out strength of 14,000 psf.
2. Embedded liner shall demonstrate its ability to withstand back pressure hydrostatic forces of 50 feet of hydrostatic head (20 psi). Test procedure shall be submitted to the engineer for approval.
3. Liner sheets shall be produced in rolls that are 8.0 ft (2.4 m) in width and a thickness of 80 mils (2.0 mm).
4. The locking studs shall be an integral part of the liner sheet. Stud spacing shall be on approximately 1.25 in (30 mm) centers, such that there are approximately 110 studs per square foot (1200 per square meter).

5. The liner and welding cap strips shall be made from 97-98% virgin high high density polyethylene and 1.5-3% carbon black or pigmentation for the purpose of an otherwise specified color.
6. Cap strips shall be approximately 4 inches wide but not greater than 6" and shall be equivalent to that of the liner.
7. Liner sheets shall have the physical properties as stated and when tested in accordance with Table 1.
8. Raw resin shall have the properties as tested and when tested in accordance with Table 2.
9. Liner sheets shall be supplied in pre-fabricated tubes and shall be manufactured by GSE Lining Technology, Inc. or approved equal.

Table 1: Liner Properties

TESTED PROPERTY	**TEST METHOD**	**FREQUENCY**				
NOMINAL VALUE						
Thickness, m(mil) Density,	ASTM D 5199 ASTM	Every 5th roll	2.00 (80) 0.94	3.00 (120) 0.94	4.00 (160) 0.94	5.00 (200) 0.94
Tensile Properties (each direction) Strength at	ASTM D 6693, Type IV Dumbell G.L. = 2.0	1/100,000 ft^2	2,200 (15.2) 500	2,200 (15.2) 500	2,200 (15.2) 500	2,200 (15.2) 500
Stud Pull-Out Strength[1], lb/ft^2		1/product	>14,000 (669.89)	>14,000 (669.89)	>14,000 (669.89)	>14,000 (669.89)
Carbon Black Content/Pigment Content, % Black	ASTM D 1603*/421 8 ASTM D	1/100,000 ft^2	2-3 1.5-2.5	2-3 1.5-2.5	2-3 1.5-2.5	2-3 1.5-2.5
Carbon Black	ASTM D	1/100,000 ft^2	Note 2	Note 2	Note 2	Note 2
Notched Constant Tensile Load, hours	ASTM D 5397	1/formulation	1,000	1,000	1,000	1,000
Coefficient of Linear Thermal Expansion,	ASTM D 696	1/product	1 .20E-04	1 .20E-04	1 .20E-04	1 .20E-04
Low Temperature Brittleness, °C	ASTM D 746	1/product	-77	-77	-77	-77
Dimensional Stability, % (each direction)	ASTM D 1204	1/product	±1.0	±1.0	±1.0	±1.0
Water Absorption, %	ASTM D 570	1/product	0.1	0.1	0.1	0.1
Water Vapor Transmission,	ASTM E 96	1/product	<0.01	<0.01	<0.01	<0.01
Roll Width, ft (m)			8 (2.44)	8 (2.44)	8 (2.44)	8 (2.44)
Roll Length, ft (m)			246 (74.97)	213 (64.91)	196 (	196 (59.73)
Roll Area, ft^2 (m^2)			1,968 (182.83)	1,704 (158.30)	1,568 (145.67)	1,568 (145.67)

Table 2: Raw Material Properties

Property	Test Method	Value	Testing Frequency
Density, g/cm3	ASTM D 1505	0.932	1/ resin lot
Melt Flow, g/10 min	ASTM D 1238 (190/2.16)	≤ 1.0	1/ resin lot
OIT, minutes	ASTM D 3895	100	1/ formulation

	(1atm/200°C)		

10. Welding procedure shall be submitted and approved as required in 5.01.B.2.
11. Joints shall be welded by the electrofusion process or a process approved by the Engineer.
12. Welding procedure shall include the following:
    a. Prior to the start of each days joint welding or if welding is stopped for more than 3 hours, sample cap strips will be welded and coupons cut and pull tested to verify the strength of the weld.
    b. Each weld shall be visibly inspected. In addition, all joint welds shall be probed with a trowel, putty knife, or similar tool approved by the Engineer.
    c. Each joint weld shall be fully vacuum tested immediately following the completion of the welding process.
    d. At the completion of each run of joint welds, a computer print-out of each weld shall be provided to the Engineer. Print-out shall include welder identification, weld/joint identification, weld time, cool time & power supply conditions, as a minimum.

MANHOLES

K. Provide manholes made of precast concrete sections in conformance with ASTM C478, the Drawings, the City of Raleigh Public Utilities Handbook, NC Department of Transportation, and the following requirements:

1. General

    a. Provide manholes to the depth as indicated on the Drawings. Manhole style, type, and inside diameter shall be as noted on the Drawings.
    b. Manholes on lines 12” and larger in diameter, as well as manholes that directly receive a force main discharge, shall be internally coated with a polyurea coating. Coating shall be Duramer 1030 as manufactured by SewerKote or approved equal. Coatings may be applied by brush, spray, or roller. Coating shall be provide in three separate parts; primer, intermediate coat, and top coat
        1) Primer coat shall be a 20% solids, deeply penetrating, dual-component polyurea primer applied to 0.5 – 1.0 mils dry film thickness (150 ft^2/gal).
        2) Intermediate coat shall be a dual component polyurea applied at 50 – 100 mils dry film thickness (50 ft^2/gal).
        3) Top coat shall be a 65% solids, two-part polyurea applied at 7.5 – 10 mils dry film thickness (125 ft^2/gal).
    c. Precast concrete manholes shall be as manufactured by Tindall Concrete Products, Inc., Adams Concrete, Hanson Pipe and Precast, D & M Concrete Specialties, Inc., N. C. Products Corp., Stay Right Tank, or approved substitute.
    d. T-series manholes as manufactured by Tindall Concrete Products or approved equal shall be an acceptable substitute to round manholes as specified herein. The T-series shall be the same size manhole as shown on the Drawings for round manholes (e.g., 6’ ID manhole, etc.) and shall meet all applicable requirements of the specifications. No reduction in size of the riser sections and top slab shall be allowable.

2. Precast Concrete Sections

    a. Minimum wall thickness shall be 5-inches.

b. Base: Cast monolithically without construction joints or with an approved PVC waterstop in the cold joint between the base slab and the walls. Minimum thickness of base shall be 6-inches.
c. The width of the base extensions on Extended Base Manholes shall be no less than the base slab thickness. Extended bases shall comply with the details on Drawings.
d. Riser: Minimum lay length of 16 inches.
e. Cone: Eccentric or concentric cones may be used on 8 through 12-inch mains. Concentric cones shall be used on all 15-inch and larger mains.
f. Transition Slab: Provide a flat transition from 60-inch and larger manholes to 48-inch diameter risers, cones, and flat slab top sections. The maximum height of manhole over the transition top section shall be 12 feet. Transition sections shall not be used in areas subject to vehicle traffic.
g. Flat Slab Top: Designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slab Tops (i.e. ring, cover, vent base) shall be sized to fit within the manhole ID and the top and bottom surfaces. Provide a float finish for exterior slab surface.
h. Precast or core holes for pipe connections. Diameter of hole shall not exceed outside diameter of pipe by more than 3-inches.
i. Lifting Devices: Devices for handling precast components shall be provided by the precast manufacturer and comply with OSHA Standard 1926.704.

3. Joints
   a. Manufacturer in accordance with tolerance requirements of ASTM C 990 for butyl type joints.
   b. Minimize number of joints. Do not use riser section for manholes up to 6 feet tall and no more than one riser for each additional 4 feet in height.
   c. Flexible Joint Sealants: Flexible Joint Sealants: Preformed butyl rubber based sealant material conforming to Federal Specification SS-S-210A, Type B and ASTM C990.
   d. External Seal: Polyethylene backed flat butyl rubber sheet no less than 1/16-inch thick and 8-inches wide.

4. Inverts
   a. Brick and mortar or precast concrete invert constructed to the width of the effluent pipe.
   b. Form and finish invert channel to provide a consistent slope from inlet(s) to outlet up to 6-inches.
   c. Channel walls shall be formed to the springline of the outlet pipe diameter.
   d. Finish benches at 60 degrees to manhole walls. Provide a 1/4-inch radius at the edge of bench and trough.
5. Flexible Pipe Connectors: Provide flexible connectors for pipe to manhole that conform to ASTM C923. Location of connectors shall vary from Drawings no more than 1/2-inch vertically and 5 degrees horizontally. Boot sleeves shall have stainless steel expansion bands and pipe clamps that meet or exceed ASTM C923 and A167.
6. Manhole Steps:
   a. Steps shall be made of 1/2-inch grade 60 steel encapsulated by co-polymer polypropylene and have serrated tread and tall end lugs.
   b. Secure steps to the wall with compression fit in tapered holes or cast-in-place. Align steps along a vertical wall and shall not be located over a pipe opening. First step shall be a maximum of 26 inches from the bottom.

c. Steps shall be provided inside manholes and shall be provided on the outside when the top of manhole elevation is greater than three (3) feet above the existing ground elevation.
d. Steps shall be as shown on the Drawings.
e. Steps shall be by American Step Co., Inc., Bowco Industries, Inc., M. A. Industries, Inc. or approved substitute.

CASTINGS

L. General

1. Made of gray iron, ASTM A-48 - class 30.
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

M. Manhole Frame and Cover:

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 3/8-inch anchor bolt holes equally spaced.
4. Cast “DANGER PERMIT REQUIRED – CONFINED SPACE DO NOT ENTER” on the cover. Casting shall bear the name of the manufacturer and the part number.
5. Provide camlocks on all manholes located in sanitary sewer easement.
6. Provide cover with one 1-inch perforated holes unless noted as watertight on the Drawings.
7. Provide the following where indicated on the Drawings:
   a. Ring and cover shall be watertight.
   b. Bolt down cover. Bolt down covers shall be provided with four (4) 3/8-inch stainless steel hex head bolts at 90 degrees.

SEWER SERVICE

N. Provide PVC wye sewer saddles for services on PVC mains. Saddles shall be solvent welded and fastened with double stainless steel bands.

O. Provide a cast or ductile iron wye sewer saddle for services on ductile iron main. Saddles shall be “Geneco E40” sewer saddles or approved equal consisting of a virgin SBR gasket compounded for sewer service, a ductile iron saddle casting, a 304 stainless steel adjustable strap for fastening the gasket and the saddle casting to the sewer main, and a 304 stainless steel adjustable circle clamp for securing the service line into the SBR gasket.

VALVES

P. General: Valves shall meet the following requirements:

1. Size shall be as required for the pipe size and material as indicated on the Drawings and specified.
2. Open by counterclockwise rotation.
3. Standard system working pressure is pressure 175 psi.
4. Equip valves with a suitable means of operation.
5. For buried valves over 5 feet deep, provide extension stems of cold rolled steel to bring the operating nut to within 2 feet of the ground surface.
6. Provide valve accessories as required for proper valve operation for valve locations as indicated on the Drawings and as recommended by valve manufacturer.
7. Valve accessories shall be compatible to proper valve operation.
8. Similar valve types shall be of one manufacturer.

Q. Gate Valves, Resilient-Seated: Gate valves 3-inch to 20-inch shall conform to AWWA C509 for and to the following requirements:

1. O-ring stem seal on non-rising (NRS) stem valves.
2. Ends shall be mechanical joint for underground locations and flanged joint for above ground locations.
3. Valves shall be non-rising stem (NRS) with wrench nut for underground locations and Outside Screw and Yoke (OS&Y) with handwheel for above ground locations unless noted otherwise on the Drawings.
4. Be of one manufacturer.
5. Valves 16-inch and larger shall be equipped with cast iron gearing to facilitated opening. Gear cases shall be extended or totally enclosed type. Geared valves shall be equipped with indicators to show the position of the gate in relation to the water.
6. Valves 16-inch and larger shall be equipped with a bypass.
7. Special material for bolts and nuts.

R. Plug Valves: Plug valves shall conform to the following requirements:

1. Plug valves shall be of the non-lubricated, eccentric type designed for a working pressure of 175 psi for valves 12 inch and smaller, 150 psi for vales 14 inch and larger.
2. Valves shall provide tight shut-off at rated pressure.
3. The plug valve body shall be cast iron ASTM A126 Class B with a welded-in overlay of not less than 90% nickel alloy content on all the surfaces contacting the face of the plug.
4. The valve plug shall be constructed of cast iron conforming to ASTM A126 Class B, with Buna N resilient seating surface to mate with the body seat.
5. Valve flanges shall be in accordance with ANSI B16.1 Class 125.
6. Shaft bearings shall be sleeve-type, sintered, oil impregnated, and permanently lubricated stainless steel.
7. Plug valve shaft seals shall be of the multiple V-ring type and shall be adjustable. Sealing system shall conform to AWWA C504 and C507 standards. All packing shall be replaceable without removing the bonnet or actuator and while valve is in service.
8. Valves 6” and larger shall be provided with gear actuators.
9. Provide levers or hand wheels to operate the valve as recommended by the manufacturer.

S. Swing Check Valves: Swing check valves from 2 to 24 inch shall conform to AWWA C508 and to the following requirements:

1. Provide lever and weight for swing check control.
2. Resilient material to Metal seat construction.
3. Ends shall be flanged.

AIR VALVES

T. Provide air valves in conformance with AWWA C512 and the following:

1. Valve type shall be a combination valve.
   a. Inlet size: 2 inch
   b. Large orifice minimum: 1 inch
   c. Small orifice minimum: 1/8 inch
2. Valve shall be designed for the following automatic operation:
   a. Release of large quantities of air during the filling of the main.
   b. Permit air to enter the main when it is being emptied.
   c. Release accumulated air while the main is in operation and under pressure.
3. Valve shall be designed for a system pressure 150 psi. Valve shall also operate at a minimum system pressure of 20 psi.
4. Provide threaded inlet.
5. Provide stainless steel ball float and internal trim.
6. Provide isolating bronze ball valve for connection to main line.
7. For sewage force mains provide tall body to minimize possibility of sewage plugging orifice or linkage.
8. Sewage force main valve shall include backwash accessories. They shall include bronze flushing ball valves and 5 feet of rubber hose with quick-connect coupling on each end.

VALVE BOX

U. Valve Box, Below Ground: Boxes shall be high strength cast iron of the screw or telescopic type. Box shall consist of a base section, center extension as required, and a top section with cover marked “SEWER.”

THRUST BLOCKING

V. Provide concrete thrust blocking for pressure lines in accordance with the detail on the Drawings.

W. Thrust blocking is not required where restrained joint fittings and equivalent length of restrained joint pipe are used unless shown otherwise on the Drawings.

PART 3 EXECUTION

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. Take particular care not to damage pipe coatings.
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. Block fittings with concrete, or restrained as indicated on the Drawings or as required to prevent movement.

B. Gravity 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.

RELATION OF WATER MAINS TO SEWERS

C. Lateral Separation: Lay water mains at least 10 feet laterally from existing and proposed sewers. Where existing conditions prevent a 10-foot lateral separation, the following shall be followed with approval of the Engineer:
   1. Lay water main in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
   2. Lay water main in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.

D. Crossing Separation: Lay bottom of water main at least 18 inches above the top of the sewer. Where existing conditions prevent an 18-inch vertical separation, construct both the water main and sewer of ferrous materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.

E. Crossing a Water Main Under a Sewer: When it is necessary for a water main to cross under a sewer, construct both the water main and the sewer of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

SEWER PIPE

F. Lay sewer pipe to true lines and grades by using laser beam equipment or other acceptable means.

G. Minimum Separation Distances:
   1. In general, 100-foot horizontal separation from wells or other water supplies. If sewer pipe is installed within 50 foot of a public well or water supply or 25 foot of a private well or water supply, ferrous pipe must be used. Manholes shall not be located within 50-foot of a public well or water supply or 25 foot from a private well or water supply.
   2. 24-inch vertical separation from storm sewers or ferrous pipe shall be used.
   3. For separation from water mains see paragraph 3.02 above.

DUCTILE IRON PIPE

H. Install pipe in conformance with AWWA C600 and the following:

1. For laying pipe in a vertical or horizontal curve, each full length pipe may be deflected by the following offset distance unless the pipe manufacturer's recommended distances are less:

   a. Push-on joint
      1) 3 to 12-inch pipe: 14-inch offset
      2) 14 to 36-inch pipe: 8-inch offset

   b. Mechanical joint
      1) 3 to 6-inch pipe: 20-inch offset
      2) 8 to 12-inch pipe: 15-inch offset
      3) 14 to 20-inch pipe: 8-inch offset
      4) 24 to 36-inch pipe: 6-inch offset

2. For laying restrained joint pipe in a vertical or horizontal curve, except for horizontal directional drills (HDD), each full length pipe may be deflected by the following offset distance:

   a. 6 to 12-inch pipe: 11-inch offset
   b. 16 to 20-inch pipe: 7-inch offset
   c. 24 to 30-inch pipe: 5-inch offset
   d. 36-inch pipe: 4-inch offset
   e. 42 to 48-inch pipe: 1 ¼ -inch offset

3. For laying restrained joint pipe in a vertical or horizontal curve, except for horizontal directional drills (HDD), each full length pipe may be deflected by the following offset distance:

   a. 6 to 12-inch pipe: 11-inch offset
   b. 16 to 20-inch pipe: 7-inch offset
   c. 24 to 30-inch pipe: 5-inch offset
   d. 36-inch pipe: 4-inch offset
   e. 42 to 48-inch pipe: 1 ¼ -inch offset

4. The Contractor shall verify the offset distances specified are acceptable with the pipe manufacturer prior to installation.

5. Carrier pipe of any joint type may not be deflected.

PROTECTO 401 DUCTILE IRON PIPE LINER

I. Application

1. The entire surface shall be inspected prior to receiving protective compound to ensure that no oil, grease, etc. exists on the surface. If any surface contains any of these items shall be solvent cleaned to remove said substances.

2. Once free of any oil, grease, etc., all surfaces shall be abrasive blasted using sand or grit abrasive media. No rust shall be present on surface at the time of application.
3. After surface preparation, the pipe interior shall receive 40 mils nominal dry film thickness of Protecto 401.
4. No lining shall take place when the substrate or ambient temperature is below 40°F.
5. The surface must be dry and dust free during application.
6. Bell Sockets and Spigot Ends shall be coated with 6 mils nominal, 10 mils maximum with Protecto Joint Compound 6 inches back from the end of the spigot end.
7. The joint compound shall be applied by brush to ensure full coverage.
8. No excessive buildup shall be present in the gasket seat or on the spigot ends.
9. Coating of the gasket seat and spigot ends shall be done after the application of the lining to the interior of the pipe.
10. The number of coats shall be as recommended by the lining manufacturer.
11. No material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.
12. Provide touch up, as necessary, using Protecto Joint Compound per manufacturer's recommendations.

J. Inspection and Certification

1. A magnetic film thickness gauge shall be used to confirm the thickness on all ductile iron pipe and fittings. Thickness testing shall be done in accordance with SSPC-PA-2 Film Thickness Rating.
2. The interior lining shall be tested using a non-destructive 2,500 volt test to check for pinholes. Repair defects prior to shipment.
3. Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work. These records shall be made available to the Engineer upon request.
4. The pipe/fitting manufacturer shall provide a certificate attesting that the applicator meets the requirements of this specification, and that the material used was as specified and applied as specified.

PVC PRESSURE PIPE

K. Install PVC C900/C905 pipe in conformance with AWWA C605.

L. Solvent Weld: Where indicated in these specifications or on the plans, solvent weld type joints shall be used. Field cut ends shall be sanded to roughing the surface. Joints shall be cleaned of foreign material. Solvent shall be applied to the joint and joint made as recommended by the manufacturer. Excess solvent shall be wiped off. The joint should not be moved until sufficiently set up.

M. Bell and Spigot Joints: Clean bell and spigot ends prior to jointing. Ends of field cut pipe shall be beveled with file. Gasket shall be clean and lightly lubricated. Joint shall be made as recommended by the manufacturer.

FIBERGLASS REINFORCED PIPE – CENTRIFUGALLY CAST AND FILAMENT WOUND

N. Install pipe in accordance with manufacturer's recommendations and the following requirements:

1. The bedding and burial of pipe and fittings shall be in accordance with the Drawings and Specifications and the Manufacturer's requirements.
2. Do not exceed forces recommended by the manufactuer when joining pipe.
3. Gasket shall be wiped clean prior to joining. Damaged, defective, or bulging gaskets shall be replaced with a new coupling.
4. Wipe the plain end of pipe clean prior to insertion in the coupling. The coupling components shall also be wiped clean prior to connection.
5. Apply joint lubricant, as approved by pipe manufacturer, to pipe end and elastomeric gaskets.
6. For handling pipe, use textile slings or other suitable materials or a forklift. Use of cables or chains is not permitted. Damaged pipe will be rejected.
7. Pipe shall be free of nicks, scratches and gouges at the time of installation. Visible gouges shall be cause for rejection of pipe.
8. Join pipe in straight alignment then deflect slightly if required. Do not allow the deflection angle to exceed the deflection permitted by the manufacturer.
9. No blocking under the pipe will be permitted.
10. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's recommendation and with approval of the Engineer.
11. Under no circumstances shall pipe or fittings be dropped either into the trench or during unloading. The interior of the pipe shall be kept clean of oil, dirt, and foreign matter; and the machined ends and couplings shall be wiped clean immediately prior to jointing.
12. Use a pipe cutter where necessary to cut and machine all pipe in the field. A "full insertion mark" shall be provided on each field-cut pipe end. Field-cut pipe shall be beveled with a beveling tool in accordance with the manufacturer's recommendations. Bevels shall be in accordance with the manufacturer's requirements.
13. If not integral to the bell or coupling, rubber gaskets shall be marked with manufacturer's identification sizes and proper insertion direction.
14. Before use, all pipe and specials shall be thoroughly examined for defects; and no piece shall be installed which is known to be defective. If any defective piece should be discovered after having been installed, it shall be removed and replaced with a sound on in a satisfactory manner at no additional cost to the Owner.
15. For open-trench construction, the laying of the pipe in finished trenches shall begin at the lowest point with the coupling/bell ends pointing opposite to the direction of flow. The interior of the pipe and the jointing seal shall be free from sand, dirt, and trash before installing in the line. Extreme care must be taken to keep the couplings of the pipe free from dirt and rocks so joints may be properly assembled without overstressing the coupling. The jointing of the pipe shall be done in strict accordance with the pipe manufacturer's instructions and shall be done entirely in the trench.

REINFORCED CONCRETE HDPE LINED SEWER PIPE

A. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe. All pipe shall be examined and approved by the Engineer or his appointed representative before laying and no piece shall be installed which is found to be defective.

B. Preparation of bedding and backfill shall be as specified on the Drawings and per the requirements of the American Concrete Pipe Association's Design Data 9. Pipe shall be laid with uniform bearing under the full barrel of the pipe.

C. Pipe shall be protected from lateral displacement by pipe embedment material installed as provided in the Drawings. Under no circumstances shall concrete pipe be laid in water and no pipe shall be laid in unsuitable weather or trench conditions. Pipe shall be laid with bell ends facing the direction of laying except when making closures.

D. Rubber gaskets shall be installed in strict conformance with the pipe manufacturer's recommendations.

E. Pipe shall be laid to line and grade as shown on the plans. Curves may be formed using fittings, specials, or unsymmetrical joint closure of straight pipe as required.

F. As the pipe line is being laid, and prior to welding of the HDPE liner, each joint shall be tested with a Go/No-Go joint air test to verify joint integrity. The test shall be conducted on the mated joint after two subsequent joints have been laid to confirm that the joint and gasket are assembled properly, i.e. no pinched or rolled gaskets or cracked bells. The test shall consist of using a Cherne Joint Tester (or approved equal) employing a modified test procedure. The modified test shall consist of pressurizing the sealing bladders to 80 psi and then pressurizing the joint to 5 psi. The pressure can not drop more than 1 psi in 5 seconds for the joint to be considered acceptable. Any problems with the joint (bell, spigot, or gasket) will be identified by the inability to pressurize the joint. If the joint fails this test, the joint shall be removed and replaced using new gaskets then re-tested. All joint tests shall be witnessed and approved by the Engineer or the designated representative.

VALVES AND FITTINGS

O. Install buried valves on top of an 18-inch square, 3-inch thick, solid concrete pad (minimum dimensions). The concrete pad may be provided by a pre-cast manufacturer or cast-in-place in the field above grade. Concrete used for the pads shall be a minimum 3,000 psi mix. The pads may not be cast-in-place in the pipe trench. Connection to pipe shall be such that there shall be no stress at the joint caused by misalignment or inadequate support of pipe or valve.

P. Install fittings as recommended by the manufacturer. Fittings shall be blocked or otherwise restrained from movement.

Q. Valve Boxes: Set valve boxes flush with finished grade. Box shall be supported so that no stress shall be transmitted to the valve. Operating nut shall be centered in box.

R. Install valves, gates, and accessories indicated on the Drawings and in complete accordance with the manufacturer's recommendations.

S. Valve boxes shall be set straight with the operating nut centered and supported on (2) 4" concrete blocks, to prevent load transfer onto valve body or pipe line. Set top of box at finished grade. Provide a 24-inch x 24-inch wide by 6-inch thick concrete pad at top of valve boxes outside paved areas.

AIR VALVES

T. Main shall be drilled for a two inch connection.

U. Valve shall be installed on the main line with a service saddle.

V. Install air valve in a flat top manhole.

MANHOLES

W. Set base plumb and level. If using precast inverts, then align manhole invert with pipe invert.

X. Secure pipe connectors to pipe in accordance with manufacturer's recommendation.

Y. Clean bells and spigots of foreign material that may prevent sealing. Unroll the butyl sealant rope directly against base of spigot. Do not stretch. Follow manufacturer's instructions when using O-ring seals.

Z. Set precast components so that steps align.

AA. Plug lift holes using a non-shrink grout. Cover with a butyl sealant sheet on the outside and seal on the inside with an application of an epoxy gel 1/8-inch thick extending 2 inches beyond the opening.

BB. Set manhole frames to grade with grade rings in paved areas. Grade rings are not allowable for manholes located in easements. Seal joints between cone, adjusting rings, and manhole frame with butyl sealant rope and sheet. Concrete collar as shown in detail on the drawings shall be installed for manholes located in pavement.

CC. Apply external seal to the outside of joint.

DD. Finish the interior by filling fractures greater than 1/2-inch in length, width or depth with a sand cement mortar.

EE. Clean the interior of the manhole of foreign matter.

SEWER CLEANOUTS

FF. Sewer cleanouts connected to ductile iron pipe shall also be ductile iron sewer pipe conforming to these specifications.

GG. Sewer cleanouts connected to PVC pipe shall also be PVC sewer pipe schedule 40 conforming to ASTM-D-3034 latest revision. Use elastomeric gaskets for pipe joints.

HH. PVC wye sewer saddles shall be used on new PVC pipe. Saddles shall be used on existing PVC, solvent welded to the main and fastened with double stainless steel bands.

II. Cleanouts shall be a minimum of 4-inch diameter unless noted otherwise on the Drawings. Provide sewer cleanouts with screw-in watertight cap. Installation shall be in accordance with the details as shown on the Drawings.

SERVICE CONNECTIONS

JJ. Make service connections in accordance with the standard detail(s) on the Drawings.

KK. Service connections to the main lines shall be perpendicular to the main line to the edge of the right-of-way or easement line.

LL. Four-inch lines shall have a minimum slope of 1.0 % and have cleanouts every 75 feet at a minimum in addition to a cleanout at the right-of-way line or at the edge of the easement.

MM. Six-inch lines shall have a minimum slope of 0.60 % and have cleanouts every 100 feet at a minimum in addition to a cleanout at the right-of-way line or at the edge of the easement.

NN. 6-inch service lines shall tie directly into a manhole.

OO. Wye sewer saddles shall be made only when the sewer main is 8-, 10-, or 12-inch diameter concrete, ductile iron, or PVC sewer pipe. This type connection cannot be used on truss sewer pipe. The opening in the sewer main for the saddle shall be cut with a hydraulically driven or pneumatically driven circular tapping saw of the same nominal diameter as the sewer service line.

PAINTING

PP. Equipment shall receive the manufacturer's standard coating for the intended application. Coatings shall be suitable for the intended application.

QQ. Repaint damaged paint services.

RR. Above ground piping and piping within vaults shall be painted in accordance with the specification section for each item.

TESTING

SS. 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 have been performed and approved.
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.

TT. Pressure Mains

1. The Engineer shall approve the source, quality, and method of disposal of water to be used in test procedures.
2. Obtain Owner’s permission 48 hours prior to filling or flushing of pipe system with water from Owner’s water system. Owner shall operate valves connected to the existing water system. Keep pipe interior clean during construction to minimize the amount of water required for flushing. Where large quantities of water may be required for flushing, Engineer reserves the right to require that flushing be done at periods of low demand.
3. Pressure test in accordance with AWWA C600 for ductile iron pipe and AWWA C605 and M23 for PVC pipe and the following.
4. Make pressure tests between valves. Furnish suitable test plugs where line ends in “free flow.”
5. Provide air vents at the high points in the line section to be tested for releasing of air during filling. Service corporation stops may be used for air vent when located at a high point. Include cost of air vents in price of testing. Leave corporation stops in place after testing and note locations on As-Built Drawings.
6. Allow concrete blocking to reach design strength prior to pressure testing.
7. Force main shall be completely filled with water, all air expelled from the pipe, and the discharge end of the pipeline shall be plugged and adequately blocked before hydrostatic test begins.
8. Upon completing a section of pipe between valves, test pipe by maintaining for a two hour period the following hydrostatic pressure for each main:
   a. Force main: **150** psig
9. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.

10. No length of line shall be accepted if the leakage is greater than that determined by the following formula based on the appropriate test pressure:
    L = Allowable leakage per 1,000 feet of pipe in gallons per hour.
    D = Nominal diameter of the pipe in inches.
    100 psi: L = D x 0.07
    150 psi: L = D x 0.08
    200 psi: L = D x 0.09
    250 psi: L = D x 0.10

UU. Gravity Sewer Mains

1. Test gravity lines between manholes.

2. Light Testing: Engineer will check for displacement of pipe as follows:

    a. A light will be flashed between the ends of the pipe section being tested.
    b. If the illuminated interior shows 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.
    b. Verify that maximum infiltration rate shall not be surpassed by air testing as follows.

4. Low Pressure Air Test:

    a. Air testing of sewer mains shall conform to UNI-B-6 and the following requirements:
    b. Perform initial air test when each section of main is complete including services to right of way. Test as construction proceeds.
    c. Wet interior surfaces of porous pipe material prior to testing.
    d. Safety
        1) Provide a superintendent who has experience in low pressure air testing of gravity sewer mains.
        2) Follow safety recommendations of air testing equipment manufacturer.
        3) Properly brace sewer plugs during testing. Test plugs prior to use in air testing.
        4) No one shall be allowed in manhole or trench when pipe is under pressure.
        5) Pressurizing equipment shall include a regulator and a pressure relief valve, which are set no higher than 9 psig. Monitor gauges continuously to assure that the pressure does not exceed 9 psig.

    e. Equipment
        1) Sewer plugs shall be specifically designed for low pressure air testing.
        2) Use two separate air hoses.
            i) One to connect the control panel to the sealed line for introducing the air.
            ii) One from the sealed line to the control panel to provide constant monitoring of the air pressure in the line.

iii) If Pneumatic plugs are used a separate line shall be used to inflate the plugs.

3) As a minimum the above ground air testing equipment shall include a shutoff valve, pressure regulating valve, pressure relief valve, input pressure gauge, and a continuous monitoring pressure gauge having a pressure range from 0 to at least 10 psig.

4) Continuous monitoring pressure gauge shall be at least 4 inches in diameter with minimum divisions of 0.10 psi and an accuracy of +/- 0.04 psi.

5) Monitoring gauges shall be subject to calibration as deemed necessary.
6) Air used for testing shall pass through a single above ground control panel.

f. Testing

1) Groundwater Determination: Immediately prior to each air test, determine groundwater level by a method acceptable to the Engineer. Adjust pressure used in air test in accordance with groundwater level.
2) Apply air slowly to the test section until the pressure reached is 4.0 psi plus an adjustment of 0.433 psi for each foot of ground water above the crown of the pipe. Internal air pressure, including adjustment for ground water, should never exceed 9.0 psi for ductile iron and concrete pipe and 5.0 psi for Fiberglass pipes. The Contractor may have to dewater trench to maintain ground water at or below crown of fiberglass pipe when testing. Cost for this shall be included in unit price for pipe installation.
3) When the above required pressure is reached, throttle air supply to maintain internal pressure for at least two minutes to permit stabilization.
4) When pressure has stabilized at required pressure, shut off air supply.
5) While observing the continuous monitoring pressure gauge, decrease pressure approximately 0.5 psi from required pressure.
6) At this reading timing shall commence with a stop watch and allowed to run until pressure has dropped 1.0 psi or allowable time has lapsed. Line shall be “Acceptable” if the pressure drop does not exceed 1 psig in the time prescribed for the test in Table 1, Low Pressure Air Testing for Gravity Sewer Mains, at the end of this section.

5. Deflection Test for SDR 35 and Ribbed (ASTM F 949) PVC pipe.

a. Measure for deflection of pipe no sooner than thirty days after installation and backfill.
b. Deflection shall not exceed 5 percent of pipe diameter. Maximum allowable long term deflection shall be 5 percent.
c. Measure deflection with an approved “GO-NO-GO GAUGE” method or by an approved recording deflectometer. Verify gauge on site prior to testing.

6. Deflection Test for Fiberglass Pipe.

a. Measure for deflection of pipe within 48 hours (initial test) after installation and backfill and again (final test) within thirty days.

b. Deflection shall not exceed 3 percent of pipe diameter for the initial test and 4 percent of pipe diameter for the final test. Maximum allowable long term deflection shall be 5 percent.
c. Measure deflection with an approved “GO-NO-GO GAUGE” method or by an approved recording deflectometer. Verify gauge on site prior to testing.

VV. Vacuum test each manhole in accordance with ASTM C1244 and the following:

1. No personnel shall be allowed in manhole during testing.
2. Test manhole after assembly and prior to backfilling.
3. Plug pipes with suitably sized and rated pneumatic or mechanical pipeline plugs. Brace plugs to prevent displacement.
4. Position vacuum test head assembly to seal against interior surface of the top of cone section in accordance with manufacturer’s recommendation.
5. Draw vacuum of 10 inches of mercury on manhole. Shut off the vacuum pump and close valve on vacuum line.
6. Measure time for vacuum to drop to 9 inches of mercury. Manhole shall pass if time meets or exceeds the following:

Manhole I.D. (inches)	48	60	72	84	96	120	T-series
Seconds	60	75	90	105	120	150	105

7. If manhole fails test, remove head assembly, coat interior with a soap and water solution, and repeat vacuum test for approximately 30 seconds. Leaking areas will have soapy bubbles. Make necessary repairs to the satisfaction of Engineer and repeat test until manhole passes.

CLEANING

WW. Upon completion of other testing, clean all newly installed sewer mains. This shall include all sewer main and lateral connections. This cleaning shall meet the following requirements:

1. The Engineer and Owner shall be present throughout the cleaning operations.
2. The sewer mains shall be cleaned with a high-velocity water jet. No debris of any kind shall be released into the sewer system.

XX. Upon completion of cleaning operations, within 2 hours, Owner shall televise all newly installed sewer mains.

1. Contractor shall coordinate cleaning and televising operations with Owner to ensure time schedules can be achieved.
2. If televising is not properly coordinated, Owner may request Contractor to clean sewer mains again at no additional cost to the Owner.

PART 4 MEASUREMENT AND PAYMENT

4.01 Sanitary Sewer Gravity Pipe: Payment for "Sanitary Sewer Gravity Pipe" shall be paid at the contract unit price bid per linear foot of sewer main installed as indicated by the Itemized Proposal for each pipe type and pipe diameter as specified. Payment for depth shall be as specified in the Itemized Proposal and shall be measured based on the depth from the existing ground surface (prior to construction) to the invert of the sewer main. The unit price shall include full compensation for all labor, equipment and materials necessary to furnish and install pipe, bedding, sheeting, and shoring including excavation, rock excavation and removal, bypass pumping and piping, cleaning, video survey and assessment, testing, and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications. There shall be no separate or additional payment to replace backfill materials deemed unsuitable by the Engineer unless specified as such by the Contract Documents.

4.02 Precast Concrete Manhole: Payment for "Precast Concrete Manhole" shall be paid at the contract unit price per each manhole installed based on the depth of installation or per lump sum basis as listed in the Itemized Proposal for each manhole diameter as specified. The depth to be used for payment purposes shall be the depth from the existing ground surface (prior to construction) to the invert of the manhole. The unit price shall include full compensation for all labor, equipment, and materials necessary to furnish and install a precast concrete manhole with the necessary frame, cover and flexible sleeves and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications. There shall be no separate payments for excavation, bedding, rock removal, bypass pumping and piping, coatings, joint seals, joint wraps, sheeting and shoring, vacuum testing, watertight rings and covers, vents, extensions above the ground surface, or any other incidental items necessary to install the manhole unless otherwise specified by the Contract Documents.

4.03 4-inch Cored Connection to Existing Manhole: Payment for 4-inch Cored Connection to Existing Manhole" shall be paid at the contract unit price bid per each cored connection installed as listed in the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials necessary to furnish and install a cored connection of the specified diameter, rebuild the bench and invert of the existing manhole, provide a smooth transition for the flow stream, and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications. Service connections cored directly into manholes shall be paid as part of the "Sanitary Sewer Service Connection" or "Sanitary Sewer Service Connection, Bored" with no separate payment for the core.

4.04 Sanitary Sewer Service Connection: Payment for "Sanitary Sewer Service Connection" shall be paid at the contract unit price bid per each service line installed as indicated by the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials necessary to furnish and install the service saddle, service line, wye, cleanouts, stand pipe, caps and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications. There shall be no additional payment for depth or diameter unless otherwise specified by the Contract Documents.

4.05 Sanitary Sewer Service Connection, Bored: Payment for "Sanitary Sewer Service Connections, Bored" shall be paid at the contract unit price bid per each connection that is installed as indicated by the Itemized Proposal. The unit price shall include full compensation for all labor, equipment and materials necessary to bore the service line under the roadway as well as furnish and install the service saddle, service line, wye, cleanout, stand pipe, caps and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications. There shall be no additional payment for depth or diameter unless otherwise specified by the Contract Documents.

END OF SECTION

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SECTION 13000
BORING, JACKING AND TUNNELING
(REVISED 4-9-19)

PART 1 - GENERAL

1.01 The Contractor shall provide all labor, materials, tools, and equipment to perform all work and services necessary for, or incidental to, the furnishing and complete installation of carrier pipe, encasement pipe and tunnel liner plates by means of boring and jacking, tunneling, or tunneling and jacking in accordance with the Construction Drawings, Contract Documents, and the latest edition of the City of Raleigh Public Utilities Handbook and City of Raleigh Standard Drawings.

1.02 Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a secure, complete and compatible installation shall be furnished and installed as part of this section.

1.03 The Contractor shall submit to the Engineer shop drawings for all products and materials specified under this section for the construction of this project.

1.04 All materials used on this project must have a preliminary inspection by the Inspector before being used for construction purposes. Rejected materials shall be immediately removed from the job site.

PART 2 – MATERIALS

2.01 Encasement Pipe: Encasement pipe shall be high strength spiral welded steel meeting ASTM A-252, Grade 2 steel, with minimum yield strength of 35,000 psi. Pipe length, and size shall be as indicated on the Drawings. The minimum wall thickness shall be as follows:

A. N.C. Department of Transportation

Pipe Size (O.D.-inches)	Wall Thickness (inches)
4 - 12-3/4	0.375
16 – 24	0.375
30	0.375
36	0.375
42	0.500

B. Railroad

Pipe Size (O.D.-inches)	Wall Thickness (inches)
24 & under	0.375
30	0.469
36	0.532
42	0.625
48	0.688
54	0.781
60	0.844

2.02 Carrier Pipe: Carrier pipe shall be of the type, size, and joints as indicated on the Drawings and specified in Section, Water Distribution System. Pipe shall be coated inside and outside in accordance with AWWA C203-97.

2.03 Pipe Support: Provide pipe supports designed and manufactured for the support of the carrier pipe size and material to be used for the Project within the encasement size indicated on the Drawings. Supports shall be designed to carry the pipe at the support spacing specified and meet the following minimum requirements:

A. Band Width: 8 inches for pipes 14 inches and under and 12 inches for pipes 16 inches and over.
B. Band, Riser, and Runner Material: 14 gauge steel for band and riser except if the riser is over 6 inches high the steel shall be 10 gauge for riser. Riser shall be of the channel shape. Band shall be bolted together with A325 steel bolts, nuts, and washers.
C. Runner shall be a minimum of 1 inch wide and not more then 1 inch shorter than the bandwidth. Provide 2 top and 2 bottom runners for pipe sizes through 12 inches and 2 top and 4 bottom runners for pipes over 12 inches.
D. Pipe position within casing: Centered and Restrained.
E. Support Spacing:
    1. General: Provide a support within one foot on each side of joints, and a spacer centered on every pipe segment/joint. Three supports per joint shall be provided.
    2. Provide additional supports needed per manufacturer's recommendations.
    3. Provide a support within one foot of each end of casing.

2.04 Casing End Seal: Provide mortared casing seal on each end of the casing.

PART 3 - INSTALLATION

3.01 BORING AND JACKING

The encasement pipe shall be sized in accordance with the Public Utilities Handbook and as described herein. The spoil material shall be removed through the encasement pipe by means of an auger. New sections of encasement pipe shall be butt-welded onto those previously jacked into place.

If voids are encountered while installing encasement pipe 30-inches and larger, grout holes shall be installed at 10-ft centers in the top section of the encasement pipe. The grout holes shall be used to fill the void spaces with 1:3 Portland cement grout at sufficient pressure to prevent settlement of the roadway, unless NCDOT approval stipulates otherwise. Other grout mixtures may be submitted for approval. The grouting operation shall take place immediately after completion of the bore.

3.02 TUNNELING AND JACKING

Tunneling and jacking is to be employed when the auger encounters refusal and the encasement pipe is sufficiently large to accommodate manual excavation from the inside. The encasement pipe shall be jacked through an opening created by hand working and/or blasting from inside of the encasement pipe. New sections of encasement pipe shall be butt-welded onto those previously jacked into place. Jacking of the pipe shall be done as rapidly as possible and excavation outside of the encasement pipe kept to a minimum. Lubricants may be used to prevent the pipe from freezing.

If voids are encountered while installing encasement pipe 30-inches and larger, grout holes shall be installed at 10-ft centers in the top section of the encasement pipe. The grout holes shall be used to fill the void spaces with 1:3 Portland cement grout at sufficient pressure to prevent settlement of the roadway, unless NCDOT approval stipulates otherwise. Other grout mixtures may be submitted for approval. The grouting operation shall take place immediately after completion of the bore.

PART 4 – MEASUREMENT AND PAYMENT

4.01 Boring and Jacking: Payment for “Boring and Jacking with ____ inch Encasement Pipe” shall be paid at the contract unit price per linear foot installed as indicated by the Itemized Proposal. The unit price shall include full compensation for all labor, equipment, and materials to complete the installation including preparation, excavation, shoring, grouting, backfill, and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications.

4.02 Tunneling and Jacking: Payment for "Tunneling and Jacking with _____ inch Encasement Pipe" shall be paid at the contract unit price per linear foot installed as indicated by the Itemized Proposal. The unit price shall include full compensation for all labor, equipment, and materials to complete the installation including preparation, excavation, shoring, grouting, backfill, and all other incidental items required for assembly and installation as specified by the Contract Documents and Standard Specifications.

END OF SECTION

SECTION 14000
CONSTRUCTION TRAFFIC CONTROL
(REVISED 4-9-19)

PART 1 - GENERAL

1.01 Except as otherwise stated in this specification, all construction traffic control shall be in conformance with the latest edition of the NCDOT "Standard Specifications for Roads and Structures," NCDOT "Roadway Standard Drawings Manual," MUTCD, and NCDOT Supplement to the MUTCD.

1.02 The work covered by this section consists of furnishing, erecting, maintaining, relocating, and removing traffic control devices in accordance with the Contract Documents.

1.03 All traffic control devices furnished by the Contractor shall remain the property of the Contractor, unless otherwise specified by the contract. Traffic control devices shall include, but are not limited to stationary and portable signs, drums, barricades, barriers, electronic variable message boards, cones, delineators, flashing arrow panels, temporary guardrails, temporary concrete median barriers, vehicle-mounted temporary impact attenuators, temporary and permanent pavement markings, raised reflective pavement markers, flaggers, and pilot vehicles.

PART 2 - MATERIALS

2.01 Unless otherwise required, materials used in the fabrication and installation of construction traffic control devices shall be in accordance with the applicable provisions of the MUTCD. When traffic control devices are no longer required for traffic handling in the initial phase of construction requiring their use, they may be reused at various locations throughout the project provided the device is not defaced, is structurally sound, clean and otherwise conforms to the above requirements.

2.02 All enclosed lens (Engineer's Grade) sheeting required for use on traffic control devices shall have an identification mark on the surface. This mark signifies that the sheeting meets the requirements of Federal Specification L-S-300C for Minimum Reflectivity 1 Sheeting and Tape. The identification mark shall not interfere with the function of the device, but shall be visible both day and under illumination at night without the use of special devices. No work on the project shall start until all the traffic control devices required for the particular work activity are inspected and approved by the Engineer.

2.03 Traffic control devices which do not meet the requirements of this section shall not be used. If a device ceases to meet the requirements of this section during the project, it shall be promptly removed and replaced with a conforming device at no additional compensation. The Engineer shall have the authority to determine the acceptability of the traffic control devices.

PART 3 - CONSTRUCTION METHODS

3.01 Existing public streets or highways shall be kept open to traffic at all times by the Contractor unless permission to close these streets, or portions thereof, is granted by the Engineer. A lane closure permit is required for all work inside a travel lane.

3.02 Traffic control devices shall be installed at the inception of construction operations, and shall be properly maintained, relocated as necessary, cleaned, and operated during the time they are in use. They shall remain in place only as long as they are needed and shall be immediately removed thereafter. Where operations are performed in stages, only those devices that apply to the conditions present shall be left in place.

3.03 The location, legends, sheeting, dimension, number of supports, and horizontal and vertical placement of warning signs, barricades, and other traffic control devices shall be as required by the plans or the MUTCD or as directed by the Engineer. The Contractor may submit for the Engineer's consideration a method for handling traffic other than as shown on the plans. The alternate traffic control plans shall not be used until they are approved in writing by the Engineer. During periods when not warranted, warning signs and other devices shall be removed from the work area, covered with specified material, or otherwise positioned so that they do not convey their message to the traveling public. If covered, the covering material shall be exterior plywood and shall cover the entire face of the sign panel. The covering material shall be installed in such a manner that the sign panel will not be defaced. Non-metal washers or other spacing devices shall be used to keep the plywood covering material from direct contact with the sign panel. Covering material shall be maintained in a neat manner during its use.

3.04 Weeds, brush, trees, construction materials, equipment, etc. shall not be allowed to obscure any traffic control device in use. There will be no separate compensation for any trimming or cutting required for this purpose.

3.05 Competent and properly trained flaggers, properly attired and equipped, shall be provided when directed by the Engineer or when the Contractor deems it necessary to safely handle traffic through the construction zone.

3.06 The Contractor shall assume full responsibility for the continuous and expeditious maintenance of all construction warning signs, barricades, and other traffic control devices which in the opinion of the Engineer are damaged by traffic or other means or deteriorated beyond effectiveness. Conditions covered under maintenance shall include but not be limited to replacement due to loss of reflectivity; replacement of broken supports; plumbing of leaning signs; cleaning of dirty signs, barricades, and other devices; repair of defaced sheeting and legend; and replacement of stolen or vandalized items. All items used for traffic control shall be maintained in a satisfactory condition. Failure to maintain all traffic control devices in a satisfactory

condition may be cause for suspension of construction operations until proper traffic control is re-established.

3.07 The Contractor shall follow the construction procedure and maintenance of traffic as shown on the Traffic Control Plan, unless a more workable plan is agreed to by the Engineer prior to or during the execution of the work. The Contractor shall complete each construction phase in the sequence shown (Example: Phase I-A must be completed before I-B).

3.08 Work on the project shall not start until all the traffic control devices required for the particular work activity have been inspected and approved by the Engineer.

3.09 The Contractor shall continuously review and maintain all traffic control measures to assure that adequate provisions have been made for the safety of the public and workers.

3.010 The Contractor shall furnish a material certification for all new and used reflective sheeting.

PART 4 – MEASUREMENT AND PAYMENT

4.01 Payment for traffic control shall be made at the contract lump sum price for "Temporary Traffic Control" or as designated on the Itemized Proposal. Payment will include all work covered by this section. Payment will be full compensation for all work of furnishing, erecting, relocating, maintaining and removing any and/or all temporary traffic control devices.

4.02 If traffic control measures are designated separately on the Itemized Proposal, measurement and payment shall be made as follows:

1. "Stationary Construction Signs" will be paid by the actual number of square feet of sign panels installed at each location required by the contract. Where a particular sign is used at more than one location, measurement will be made at each location.

2. "Drums" shall be paid at unit price per each for the maximum number of drums acceptably placed at any one time during the life of the project as required by the contract. There shall be no additional costs associated with replacement or shifting of drums during the course of the project.

3. "Portable Temporary Traffic Control Devices" shall be paid at a lump sum price to include, but not limited to portable signs, temporary guardrails, barricades, barriers, electronic variable message boards, cones, delineators, flaggers, pilot vehicles, and any other traffic control devices not covered by any other section included in this contract.

4.03 Payment for “Temporary Traffic Control,” “Stationary Construction Signs,” “Drums,” and “Portable Temporary Traffic Control Devices” shall be made as follows:

1. Fifty percent (50%) of the total quantity of each item on the Itemized Proposal on the first partial payment estimate after which said item(s) have been placed into operation.

2. Twenty-five percent (25%) of the total quantity of each item on the Itemized Proposal on the first partial payment estimate made after the project is 50% complete.

3. Twenty-five percent (25%) of the total quantity of each item on the Itemized Proposal on the first partial payment after the project is one hundred percent (100%) complete.

END OF SECTION

SECTION 15000
PAVEMENT MARKINGS AND
RAISED PAVEMENT MARKERS
(REVISED 4-9-19)

PART 1 - GENERAL

A. All work associated with the furnishing, installing and removing of pavement markings and pavement markers shall be performed in accordance with these contract documents and the latest publication of the North Carolina Department of Transportation “Standard Specifications for Roads and Structures” and “Roadway Standard Drawings.” Permanent Pavement Markings in the Right of Way shall be Alkyd/Maleic Thermoplastic. On-site Permanent Pavement Markings shall be two coats of white traffic paint.

PART 2 – MEASUREMENT AND PAYMENT

A. Payment for pavement markings and pavement markers shall be as indicated on the Itemized Proposal in the Contract Documents.

END OF SECTION

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SECTION 16000
SOIL EROSION AND SEDIMENTATION CONTROL
(REVISED 4-9-19)

PART 1 - GENERAL

1.01 Except as otherwise specified herein, all sedimentation and erosion control measures shall be in accordance with Division 16 of the "NCDOT Standard Specifications for Roads and Structures", latest edition.

1.02 Temporary and permanent erosion control measures shall be provided for all land disturbing activities in accordance with the Contract Documents and/or an erosion control plan approved by the North Carolina Department of Environmental Quality (NCDEQ). Temporary measures shall be installed by the Contractor, then inspected by the Town Stormwater Inspector and NCDEQ for compliance prior to any land disturbing activity. The inspection and approval process shall be required on each phase of construction. All permanent erosion control measures shall be incorporated into the work at the earliest practical time. All temporary measures shall be maintained until the permanent measures have taken effect. Temporary and permanent measures shall be coordinated to provide effective and continuous erosion control throughout the construction and post-construction period to minimize siltation of streams, lakes, reservoirs, and other impoundments, ground surfaces, and other property. These measures shall remain in effect until final approval for removal is given by the Inspector and/or the NCDEQ at which time the Contractor shall remove all temporary erosion control measures at no additional cost to the Owner.

1.03 The Contractor shall be familiar with the applicable provisions of the Sedimentation Pollution Control Act of 1973, General Statutes, Chapter 113A, Article 4. The Contractor shall be responsible for incorporating conservation procedures necessary to comply with this act in minimizing erosion and sediment pollution associated with the construction of this project as directed by the Engineer.

1.04 The Contractor shall be financially responsible for any and all fines that result from the Contractor's failure to install and/or maintain erosion control measures in accordance with the Contract Documents.

1.05 The Contractor shall check all erosion and sediment control measures for stability and operation following each rainfall event, and no less than once per week. The Contractor shall make any needed repairs immediately to maintain all control measures as designed.

1.06 The Contractor shall clean out all sediment trapping devices when the device reaches 50% trap capacity and shall dispose of the sediment by spreading on the site in a protected area or by hauling away if not suitable for fill at no additional cost to the Owner.

PART 2 - TEMPORARY MEASURES

2.01 GENERAL

A. Temporary Silt Fence shall be installed around inlets, at the toe of all fill slopes, and any other necessary locations as shown on the plans and as directed by the Engineer. Silt fence shall be erected in accordance with details as shown on plan.

B. Inlet Protection shall be installed around inlets and any other necessary locations as shown on the plans and as directed by the Engineer. Inlet protection shall be erected in accordance with details as shown on plan.

C. Diversion Ditches shall be installed at the top of cut and fill slopes and any other necessary locations as shown on the plans and as directed by the Engineer. Diversion ditches shall be installed in accordance with details as shown on plan

D. Temporary Silt Ditches shall be installed at the bottom of fill slopes and any other necessary locations as shown on the plans and as directed by the Engineer. Temporary silt ditches shall be installed in accordance with details as shown on plan details.

E. Tree Protection Fence shall be installed around the drip line of trees in the construction work area as shown on the plans and as directed by the Engineer. The tree protection fence shall be installed in such a manner that it prevents all construction activities from encroaching into the area inside the drip line of the tree. The material and installation specifications for the tree protection fence shall be approved for use by the Engineer prior to installation. Tree Fencing shall be erected in accordance with details as shown on plan.

F. Watercourse Buffer Protection Fence shall be installed along watercourse buffers as shown on the plans and as directed by the Engineer. The watercourse buffer protection fence shall be installed in such a manner that it prevents all construction activities from encroaching into the watercourse. The material and installation specifications for the watercourse buffer protection fence shall be approved for use by the Engineer prior to installation. Watercourse Buffer Protection Fence shall be erected in accordance with details as shown on plan.

G. Sediment and Filter Traps shall be installed at all points where accumulated runoff is released to natural drainage channels as shown on the plans and as directed by the Engineer. Sediment pits and filter basins shall be sized to hold 1800 cubic feet of sediment for every acre of denuded area tributary to the structure. Sediment and filter basins shall be installed in accordance with details as shown on plan.

H. Sediment Riser Basins shall be installed at locations as shown on the construction drawings. Sediment Basins shall be installed in accordance with details as shown on plan.

I. Skimmer Sediment Basins shall be installed at locations as shown on the construction drawings. Skimmer Sediment Basins shall be installed in accordance with details as shown on plan.

J. Sediment Basin with Rock Dam shall be installed at locations as shown on the construction drawings. Sediment Basins with Rock Dams shall be installed in accordance with details as shown on plan.

K. Rock Pipe Inlet Protection shall be installed at entrances to culvert crossings at locations as specified on the construction drawings. Rock Pipe Inlet Protection shall be installed in accordance with details as shown on plan.

L. Catch Basin Risers/Filters shall be installed at proposed catch basin locations or at other necessary locations as shown on the plans and as directed by the Engineer. Catch basin risers/filters shall be erected in accordance with details as shown on plan.

M. Construction Entrances shall be installed at all points of access to the construction site and as shown on the construction drawings. Any access point, which does not have a construction entrance, shall be barricaded to prevent its use. Construction entrances shall be installed in accordance with details as shown on plan. **Construction entrances shall be included in the unit bid price for "Mobilization."**

N. Check Dams shall be installed in ditches any and at other necessary locations as shown on the plans and as directed by the Engineer. Check dams shall be erected in accordance with details as shown on plan.

O. Wattles shall be installed in ditches or curbs at necessary locations as shown on the plans and as directed by the Engineer. Wattles shall be installed in accordance with details as shown on plan.

P. Silt Fence Outlets shall be installed in low points of silt fence at necessary locations as shown on the plans and as directed by the Engineer. Silt Fence Outlets shall be installed in accordance with details as shown on plan.

2.02 MEASUREMENT AND PAYMENT

A. Payment for "Temporary Silt Fence", "Temporary Tree Protection Fence", "Diversion Ditches", "Silt Ditches", "Watercourse Buffer Protection Fence" shall be at the contract unit price per linear foot unless otherwise indicated on the Itemized Proposal in the contract documents. These prices will be full compensation for all work covered by this section including but not limited to the

labor, equipment, and materials for furnishing and installing the temporary erosion control measures indicated on the plans, maintenance and sediment cleanout of the work throughout the life of the project as required by the Inspector, and removal of the devices following completion of the work.

B. Payment for “Inlet Protection”, “Sediment Traps/Basins”, “Skimmer Basins”, “Catch Basin Risers/Filters”, “Wattles”, “Check Dams”, and “Silt Fence Outlets”, shall be at the contract unit price per each unless otherwise indicated on the Itemized Proposal in the contract documents. These prices will be full compensation for all work covered by this section including but not limited to the labor, equipment, and materials for furnishing and installing the temporary erosion control measures indicated on the plans, maintenance and sediment cleanout of the work throughout the life of the project as required by the Inspector, and removal of the devices following completion of the work.

PART 3 - MATTING FOR EROSION CONTROL

3.01 GENERAL

A. Matting for erosion control shall be straw matting, coir fiber mat, excelsior matting, or permanent soil reinforcement matting (PSRM). Matting for erosion control shall not be dyed, bleached, or otherwise treated in a manner that will result in toxicity to vegetation.

B. Straw Matting: Straw matting shall be a machine produced matting of 100% grain straw in accordance with Section 1060-8C of the NCDOT Standard Specifications for Roads and Structures, latest edition.

C. Coir Fiber Mat: Coir fiber shall consist of a 100% coconut fiber (coir) twine woven into high strength matrix and in accordance with Section 1060-14 of the NCDOT Standard Specifications for Roads and Structures, latest edition. Staples shall be the preferred anchors used.

D. Excelsior Matting: Excelsior matting shall be a machine produced mat of curled wood excelsior in accordance with Section 1060-8(B) of the NCDOT Standard Specifications for Roads and Structures, latest edition.

E. Permanent Soil Reinforcement Matting (PSRM): The product shall be a permanent erosion control reinforcement mat and shall be constructed of synthetic or a combination of coconut and synthetic fibers evenly distributed throughout the mat between a bottom UV stabilized netting and a heavy duty UV stabilized top net. The matting shall be stitched together with UV stabilized polypropylene thread to form a permanent three-dimensional structure.

The mat shall have the following minimum physical properties:

Property	Test Method	Value Unit
Light Penetration	ASTM D6567	9 %
Thickness	ASTM D6525	0.40 in
Mass Per Unit Area	ASTM D6566	0.55 lb/sy
Tensile Strength	ASTM D6818	385 lb/ft
Elongation (Maximum)	ASTM D6818	49 %
Resiliency	ASTM D1777	>70 %
UV Stability *	ASTM D4355	>80 %
Porosity (Permanent Net)	ECTC Guidelines	>85 %
Maximum Permissible Shear Stress (Vegetated)	Performance Bench Test	>8.0 lb/ft2
Maximum Allowable Velocity (Vegetated)	Performance Bench Test	>16.0 ft/s

*ASTM D1682 Tensile Strength and % strength retention of material after 1000 hours of exposure.

Submit a certification (Type 1, 2, or 3) from the manufacturer showing:

(A) the chemical and physical properties of the mat used, and
(B) conformance of the mat with this specification.

F. Wire Staples: Staples shall be machine-made of No. 11 gage new steel wire formed into a “U” shape. The size when formed shall be not less than 6 inches in length with a throat of not less than 1 inch in width.

3.02 CONSTRUCTION METHODS

A. All erosion control matting shall be installed in accordance with Section 1631-3 of the “NCDOT Standard Specifications for Roads and Structures”, latest edition.

3.03 MEASUREMENT AND PAYMENT

A. Measurement and payment for for “Straw Matting”, “Excelsior Matting”, “Coir Fiber Mat”, or “Permanent Soil Reinforcement Matting” shall be at a price per square yard and shall include all labor, equipment, and materials to perform the work.

PART 4 - RIPRAP DISSIPATION PADS

4.01 GENERAL

A. After construction is complete, all points of stormwater release shall be protected by riprap dissipation pads.

B. Stone for plain riprap shall consist of field stone or rough unhewn quarry stone. The stone shall be sound, tough, dense, resistant to the action of air and water, and suitable in all other respects for the purpose intended. Stone shall vary in weight from 5 to 200 pounds. At least 30 percent of the total weight of the riprap shall be in individual pieces weighing a minimum of 60 pounds each. Not more than 10 percent of the total weight of the riprap may be in individual pieces weighing less than 15 pounds each.

C. Unless otherwise directed by the Engineer, the stone shall be placed on a flat slope or as indicated on the plans. The stone shall be graded so that the smaller stones are uniformly distributed throughout the mass.

D. The Contractor may place the stone by mechanical methods, augmented by hand-placing where necessary, provided that when the riprap is completed it forms a properly graded, dense, neat layer of stone.

E. The completed riprap shall be at least the thickness indicated on the plans, with the top of the riprap pad flush with the surrounding finished grade.

F. Geotextile fabric shall be installed under all riprap unless otherwise noted. Geotextile fabric shall be Type 2 and meet criteria as outlined in Table 1056-1 of the NCDOT Standard Specifications for Roads and Structures, latest edition. No direct payment shall be made for geotextile fabric. The price for geotextile fabric used under riprap shall be included in the unit price bid for “Riprap.”

4.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for “Class B Riprap” shall be based on the actual quantity of riprap in tons provided and per the unit price for the appropriate class as indicated on the Itemized Proposal in the Contract Documents for “Riprap.” The unit prices and payments for “Riprap” will be full compensation for all work covered by this section including, but not limited to, all excavation, embankment preparation, backfilling, and furnishing and placing riprap and other materials.

PART 5 – STORMWATER MANAGEMENT DEVICES

5.01 GENERAL

A. Level spreaders shall be constructed in accordance with the NC Division of Water Quality BMP Manual, latest edition.

B. Dry Detention Basins and Wet Detention Basins shall be constructed in accordance with the NC Division of Water Quality BMP Manual, latest edition.

C. Infiltration Basins shall be constructed in accordance with the NC Division of Water Quality BMP Manual, latest edition.

D. Bioretention Areas shall be constructed in accordance with the NC Division of Water Quality BMP Manual, latest edition.

E. Stormwater Wetlands shall be constructed in accordance with the NC Division of Water Quality BMP Manual, latest edition.

F. Filter Strips shall be constructed in accordance with the NC Division of Water Quality BMP Manual, latest edition.

5.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for “Level Spreaders” shall be made under the contract unit price bid per linear foot for the type of level spreader as indicated on the plans and in the Itemized Proposal. The unit prices and payments shall be full compensation for all labor, equipment, and materials necessary to properly install and maintain the level spreader in accordance with the Contract Documents and shall also include any necessary clearing and grubbing, grading, seeding and mulching and other incidentals to satisfactorily install level spreaders.

B. Measurement and payment for “Dry Detention Basins”, “Wet Detention Basins”, “Infiltration Basins”, Bioretention Areas”, and “Stormwater Wetlands” shall be made under the contract unit price for the items as indicated in the Itemized Proposal. The unit prices and payments shall be full compensation for all labor, equipment, and materials necessary to properly install and maintain the level spreader in accordance with the Contract Documents and shall also include any necessary clearing and grubbing, grading, seeding and mulching and other incidentals to satisfactorily install the basins.

END OF SECTION

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SECTION 17000
TEMPORARY AND PERMANENT GRASSES
(REVISED 4-9-19)

PART 1 - GENERAL

1.01 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

D. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill immediately beneath planting soil.

E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

F. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surfaces oil can be subsoil.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated, including planting soil.

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, inert matter, noxious weeds by name & % per pound and weed seed. Include the year of production and date of packaging.

C. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.

D. Qualification Data: For landscape Installer. Include key personnel background and list of similar projects, minimum 3 projects completed and 5 years of experience in turf installation by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

E. Material Test Reports: For existing surface soil and imported or manufactured topsoil.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in Turfgrass Producers International's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding." or other approved professional organization such as North Carolina State University's Turf Files or Clemson University. Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion control measures to prevent erosion or displacement of bulk materials, discharged of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.04 PLANTING TIMES AND RESTRICTIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion. Variation in schedule shall be pre-approved by Owner.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.08 SITE STABILIZATION TIMEFRAMES

NPDES Stormwater Discharge Permit for Construction Activities (NCGO1) NCDEQ/Division of Water Quality		
NEW STABILIZATION TIMEFRAMES (Effective Aug. 3, 2011)		
SITE AREA DESCRIPTION	**STABILIZATION**	**TIMEFRAME EXCEPTIONS**
Perimeter dikes, swales, ditches, slopes	7 days	None
High Quality Water (HQW) Zones	7 days	None
Slopes steeper than 3:1	7 days	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allowed.
Slopes 3:1 or flatter	14 days	7 days for slopes greater than 50' in length.
All other areas with slopes flatter than 4:1	14 days	None, except for perimeters and HQW Zones.

1.09 SEEDING SCHEDULES

A. Temporary Seeding Schedule

Date	Type	Min.Application Rate
Sept. 15 – Mar. 30	Tall Fescue and	250 lbs/acre
	Winter Rye	50 lbs/acre
Apr. 1 – Sept. 15	Tall Fescue and	250 lbs/acre
	German Millet or	25 lbs/acre
	Sudangrass (small-stemmed var.)	30 lbs/acre

B. Permanent Seeding Schedule for Non-Lawn Areas

For Shoulders, Side Ditches, Slopes (Max 3:1):

Date	Type	Planting Rate
Aug 15–Nov 1	Tall Fescue	300 lbs/acre
Nov 1–Mar 1	Tall Fescue & Abruzzi Rye	300 lbs/acre
Mar 1–Apr 15	Tall Fescue	300 lbs/acre
Apr 15–Jun 30	Hulled Common Bermudagrass	25 lbs/acre
Jul 1–Aug 15	Tall Fescue AND Browntop Millet or Sorghum-Sudan Hybrids***	125 lbs/acre (Tall Fescue); 35 lbs/acre (Browntop Millet); 30 lbs/acre (Sorghum-Sudan Hybrids)

For Shoulders, Side Ditches, Slopes (3:1 to 2:1):

Date	Type	Planting Rate
Mar 1–Jun 1	Sericea Lespedeza (scarified) and use the following combinations:	50 lbs/acre (Sericea Lespedeza);
Mar 1–Apr 15	Add Tall Fescue	120 lbs/acre
Mar 1–Jun 30	Or add Weeping Love grass	10 lbs/acre
Mar 1–Jun 30	Or add Hulled Common Bermudagrass	25 lbs/acre
Jun 1–Sept 1	Tall Fescue AND Browntop Mullet or Sorghum-Sudan Hybrids***	120 lbs/acre (Tall Fescue); 35 lbs/acre (Browntop Mullet); 30 lbs/acre (Sorghum-Sudan Hybrids)
Sept 1–Mar 1	Sericea Lespedeza (unhulled – unscarified) AND Tall Fescue	70 lbs/acre (Sericea Lespedeza); 120 lbs/acre (Tall Fescue)
Nov 1–Mar 1	AND Abruzzi Rye	25 lbs/acre

Consult S&EC Environmental Engineers for additional information concerning other alternatives for vegetation of denuded areas. The above vegetation rates are those that do well under local conditions; other seeding rate combinations are possible.

***** TEMPORARY**: Reseed according to optimum season for desired permanent vegetation. Do not allow temporary cover to grow more than 12" in height before mowing; otherwise, fescue may be shaded out.

C. Permanent Seeding Schedule for Lawn Areas

Date	Type	Min.Application Rate
Apr 1 – July 15	Common Bermudagrass or Improved Bermudagrass	75 lbs/acre
Apr 1 – July 15	Centipedegrass	40 lbs/acre
Apr 1 – July 15	Zoysiagrass	75 lbs/acre
June 1 – Aug 15	Tifway 419 or Tifton 10	6 bushels/1,000 sq ft (sprigs)
	Zoysiagrass	6 bushels/1,000 sq ft (sprigs)
June 1 – Aug 15	Tifway 419 or Tifton 10 Centipedegrass or Zoysiagrass	sod
Sept 1 – Oct 15	Turf Type Tall Fescue	350 lbs/acre
Sept 1 – Oct 15	Turf Type Tall Fescue	sod

PART 2 - PRODUCTS

2.01 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed:

1. Permanent seeding:
   Common Bermudagrass (Hulled)
   Turf Type Tall Fescue
   Improved Bermudagrass
   Centipedegrass
   Zenith Zoysiagrass

2. Temporary seeding:
   Tall Fescue and Winter Rye
   Tall Fescue and German Millet or Sudangrass

2.02 TURFGRASS SOD

A. Turfgrass Sod: Certified complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed.

1. Tifway 419, Tifton 10, Centipedegrass, Zoysiagrass or Turf Type Tall Fescue

2.03 PLANTING SOILS

A. Planting soil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 20 percent organic material content; free of stones 1/2 inch or larger in any dimension and other extraneous materials harmful to plant growth.

1. Soil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce viable planting soil. Remove roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth. Amend surface soil per soil test recommendations.

2. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient.

2.04 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

C. Slow-Release Fertilizer: Granular or pelletized fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
2. Fish-emulsion, compost tea.

D. Other Organic Fertilizer: Contractor is encouraged to utilize other organic fertilizer with a lower nitrogen value, such as worm castings, sewage sludge. Contractor shall submit product information for Architect’s approval prior to application.

2.05 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

C. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

D. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

E. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

PART 3 - INSTALLATION

3.01 EXAMINATION

A. Examine areas to receive turf and grass for compliance with requirements and other conditions affecting performance. Grade strictly according to the proposed grading plan. Proceed with installation only after Owner approves the subgrade and unsatisfactory conditions have been corrected.

3.02 SITE PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding overspray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 TURF/SEEDBED PREPARATION

A. After construction is complete in any area or phase of the project, the disturbed areas shall receive a permanent ground cover. Seeding and mulching shall be performed immediately behind construction. The Contractor shall provide permanent seeding in all disturbed areas as indicated in the Contract Documents. The Contractor shall adapt permanent seeding operations to protect and to accommodate any temporary seeding and soil and erosion control measures that may already be in place during the work period.

B. When seeding must take place out of season for permanent grass the appropriate temporary seeding shall be done and the contractor shall be responsible for permanent seeding as specified in season at no additional cost to Owner.

C. Contractor shall be responsible for turf maintenance through substantial completion. Slopes must be at 90% coverage at substantial completion review to be accepted. If not at 90% coverage, substantial completion will be delayed until the following growing season.

D. Use following table for seedbed preparation.

Mixture

Agricultural Limestone	2 tons/acre (3 tons/acre in clay soils)
Fertilizer	1,000 lbs/acre – 10-10-10
Superphosphate	500 lbs/acre – 20% analysis
Mulch	2 tons/acre – small grain straw
Anchor	Asphalt emulsion at 300 gals/acre

E. Limit turf subgrade preparation to areas to be planted.

3.04 ESTABLISHMENT OF TEMPORARY AND PERMANENT NON-LAWN AREAS

A. GENERAL

1. After construction is complete in any area or phase of the project, the disturbed areas shall receive a permanent ground cover. Seeding and mulching shall be performed immediately behind construction. The Contractor shall provide permanent seeding in all disturbed areas as indicated in the Contract Documents. The Contractor shall adapt permanent seeding operations to protect and to accommodate any temporary seeding and soil and erosion control measures that may already be in place during the work period.

2. Seed or plant the required grass according to TEMPORARY SEEDING SCHEDULE AND/OR PERMANENT SEEDING SCHEDULE FOR NON-LAWN AREAS TABLE as specified herein.

3. The choice of turfgrass type, variety and propagation form shall be specified in the Contract Documents, as specified in the Itemized Proposal, or as designated by the Engineer.

4. Seed shall be tagged certified seed. Germination shall be a minimum of 90%. Seed shall be 98% pure with less than 2% other-crop seed or debris. Seed shall be free of noxious weed seed.

5. When seeding must take place out of season for permanent grass the appropriate temporary seeding shall be done and the contractor shall be responsible for permanent seeding as specified in season at no additional cost to Owner.

6. Contractor shall be responsible for turf maintenance through substantial completion. Slopes must be at 90% coverage at substantial completion review to be accepted. If not at 90% coverage, substantial completion will be delayed until the following growing season.

B. SITE PREPARATION

1. Ground Cover: All disturbed areas shall be dressed to a depth of six (6) inches. The top two (2) inches shall be pulverized to provide a uniform seedbed. Rake or harrow the site to establish a smooth and level final grade. Soil particles should be no larger than marble size, and pea gravel size is even better. Agricultural lime shall be applied at the rate of 95 lbs./1000 sq. ft. immediately before plowing. Grass seed shall be applied at the rates outlined in Tables 1 and 2.

2. 5-10-10 fertilizer shall be applied to all disturbed areas at a rate of 21 lbs./1000 sq. ft. Mulching shall consist of small grain straw applied at a rate of 70 lbs./1000 sq. ft. Mulched areas shall be tacked with asphalt or other approved method sufficient to hold the straw in place, at a rate of 150 to 200 gallons per ton of straw.

3. If active construction ceases in any area for more than thirty (30) days, all disturbed areas must be seeded, mulched, fertilized and tacked at no additional cost to the Owner.

4. Some areas may require temporary seeding due to an interruption of work exceeding thirty (30) days or seasonal restrictions as specified in the permanent seeding schedule, or a combination thereof. These areas shall be reseeded in accordance with the permanent seeding schedule. If temporary seeding is required due to Contractor delays, there will be no compensation for the temporary seeding. Temporary seeding shall be performed only at the direction of the Engineer or Inspector.

5. When seeding must take place out of season for permanent grass the appropriate temporary seeding shall be done and the contractor shall be responsible for permanent seeding as specified in season at no additional cost to Owner.

3.05 ESTABLISHMENT OF PERMANENT LAWN AREAS

A. GENERAL

1. Seed or plant the required grass according to PERMANENT SEEDING FOR LAWN AREAS TABLE as specified herein.

2. The choice of turfgrass type, variety and propagation form shall be specified in the Contract Documents, as specified in the Itemized Proposal, or as designated by the Engineer.

3. Seed shall be tagged certified seed. Germination shall be a minimum of 95%. Seed shall be 98% pure with less than 2% other-crop seed or debris. Seed shall be free of noxious weed seed.

4. Sod, sprigs, plugs or other vegetative plant propagation materials shall be certified free of noxious weeds. Materials shall be in good health and vigor, free of disease or pests, or damage from dryness, adverse temperature, herbicides, fertilizer or other chemicals. Sprigs that are older than 48 hours are not acceptable regardless of condition.

5. The Contractor shall maintain a log of dates that sod, sprigs, plugs, or other seeding installation was completed for each individual property and shall notify the Engineer or Inspector of each day's progress.

B. SEEDING

1. Apply a starter-type fertilizer to the soil surface for example, 10 pounds of 5-10-10 or 5 pounds of 10-20-20 per 1,000 square feet at the time of seeding.

2. Lightly cover the seed by hand raking or dragging with a mat or chain-link fence. Roll or tamp the soil lightly to firm the surface and provide good seed-to-soil contact.

3. Mulch grass seed with weed-free small grain straw or hay. Use one bale per 1,000 square feet for warm-season grasses and 1 to 2 bales for cool-season grasses. Stabilize small areas of mulch by rolling, watering or tacking with asphalt tacking spray. Twine netting can be used if wind displacement is a problem. If applied evenly and lightly, these materials need not be removed. Larger areas shall be stabilized by asphalt tacking spray or twine netting.

4. Lightly water seeding areas periodically to keep soil moist through the first 7 days to ensure proper germination.

C. SODDING

1. Remove plastic netting or backing from sod.

2. Lay sod as soon as possible after it has been harvested to prevent injury. Sod should be installed within 24 hours of harvesting. While installing, take action as necessary to prevent heat buildup within the unlaid sod. Plan to unstack and unroll the sod if it cannot be laid within 48 hours. Soil should be moist (but not overly wet) before laying sod. Irrigating the soil several days before delivery is often adequate.

1. Start sodding from a straight edge (driveway or sidewalk) and butt strips together, staggering them in a brick-like pattern. Avoid stretching sod. Use a knife or sharp spade for trimming to fit irregularly shaped areas. Lay sod lengthwise across the face of slopes and peg or stake the pieces to prevent slippage. After the sod has been placed, roll the lawn to ensure good sod-to-soil contact.

    a. Lay sod across angle of slopes exceeding 1:3.
    b. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

3. Water sod immediately after installation. Soak sod thoroughly enough to penetrate soil below the newly installed sod to a minimum depth of two (2) inches. Contractor is responsible for insuring adequacy of water supply. The Contractor shall provided any necessary temporary means to properly water sod, including temporary pumps and sprinklers. Proper irrigation shall be required by the contractor until the project has been inspected and is accepted by the Town. (The Contractor shall be required to obtain all applicable watering permits from the Town prior to beginning watering activities.)

3.06 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with a tackifier.
2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 1500-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate.

3.07 TURF RENOVATION

A. Renovate existing turf damaged by Contractor's operations at no additional cost to the Town, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.

B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

C. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.

D. Mow, dethatch, core aerate, and rake existing turf.

E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

H. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Provide new planting soil to fill low spots and meet finish grades.

I. Apply seed and protect with straw mulch as required for new turf.

J. Water newly planted areas and keep moist until new turf is established.

3.08 MOWING

A. Mowing may be periodically required as directed by the Engineer.

B. Mow at the location and times as directed.

C. Specialized Hand Mowing shall be performed in accordance with Section 1667 of the latest edition of the "North Carolina Standards and Specifications for Roads and Structures".

3.09 CLEANUP AND INSPECTION:

A. Upon completion of work, the Contractor shall remove from the site all equipment and other articles used. All excess soil, stone, and debris shall be removed and legally disposed of at no additional cost to the Town. All work areas shall be left in a clean and neat condition. All damage to existing construction caused by landscaping operations shall be repaired to the satisfaction of the Town at the Contractor's expense.

B. Seeded areas shall be protected and replanted as necessary to establish a uniform stand of specified grass. Scattered bare spots, none of which shall be larger that one (1) square foot, will be allowed up to a maximum of 3% of the seeded area for each property. When seeded areas are ready for inspection, the maintained turf areas shall be neatly mowed to the uniform height of approximately two and one-half (2.5) inches. The lawns shall be considered established only when the specified grass is vigorous and growing well in addition to meeting the other requirements specified.

C. An inspection of the completed seeding shall be made at the conclusion of the landscape work upon written notice requesting such inspection submitted by the Contractor to the Engineer, at least ten (10) days prior to the anticipated date of inspection.

D. A final inspection shall be performed when a satisfactory stand of seeded turf grass has been produced, upon written notice requesting such inspection submitted by the Contractor to the Engineer, at least ten (10) days prior to the anticipated date of inspection. If a satisfactory stand of turf has not been produced at the time of final inspection, necessary repairs shall be performed in conformance with the requirements of this section. Upon completion of these repairs, the seeded grass shall be reinspected upon written notice as above.

PART 4 – MEASUREMENT AND PAYMENT

A. "Permanent Non-Lawn Seeding and Mulching" and "Temporary Seeding and Mulching" shall be measured and paid at a contract price per acre or square yard of the actual amount of seeding installed as indicated on the Itemized Proposal". These prices shall be full compensation for all work covered by this section including but not limited to furnishing all permanent and temporary seeding, mulching, fertilizing, tacking, watering, site preparation, cleanup, maintenance, and warranty of work as specified.

B. "Permanent Lawn Seeding and Mulching, Type _____" shall be measured and paid at a contract price per acre or square yard for the appropriate grass type as indicated on the Itemized Proposal". This price shall be full compensation for all work covered by this section including but not limited to furnishing all permanent and temporary seeding, mulching, fertilizing, tacking, watering, site preparation, cleanup, maintenance, and warranty of work as specified.

C. "Permanent Lawn Sodding, Type _____" shall be measured and paid at a contract price per acre or square foot for the appropriate grass type as indicated on the Itemized Proposal". This price shall be full compensation for all work covered by this section including but not limited to furnishing all permanent sodding, fertilizing, watering, site preparation, cleanup, maintenance, and warranty of work as specified.

D. "Mowing" shall be measured and paid at a contract price per acre or square yard as indicated on the Itemized Proposal". This price shall be full compensation for all materials, labor, and incidentals to complete the work.

E. "Specialized Hand Mowing" shall be measured and paid at a contract price per manhour as indicated on the Itemized Proposal". This price shall be full compensation for all materials, labor, and incidentals to complete the work.

F. Distribution of Billing and Payments for "Permanent Non-Lawn Seeding and Mulching", "Permanent Lawn Seeding and Mulching", and/or "Temporary Seeding and Mulching" shall be made as follows:

1. Fifty percent (50%) of the total quantity of the seeding and mulching items on the Itemized Proposal on the first partial payment estimate after which the initial seeding has been completed and accepted.

2. Twenty-five percent (25%) of the total quantity of the seeding and mulching items on the Itemized Proposal on the first partial payment estimate made after which the initial establishment of grass and any required reseeding is complete.

3. Twenty-five percent (25%) of the total quantity of the seeding and mulching items on the Itemized Proposal on the first partial payment after the final establishment of grass and the project is one hundred percent (100%) complete.

END OF SECTION

SECTION 18000
PROJECT SPECIAL PROVISIONS

ROADWAY CONSTRUCTION

GENERAL

All construction shall conform to pertinent OSHA requirements, Town of Wake Forest Standard Detail and NCDOT Standard Specifications for Roads and Structures. Specification editions in effect at the time of the bid date shall govern.

1. SITE CONDITIONS

The Contractor shall accept the actual conditions at the site and perform the work specified without additional compensation for possible variation from grades and conditions shown whether surface or subsurface, except as provided for by the Contract Documents. If existing conditions are at variance with the drawings, the Engineer shall be notified before proceeding with the work, and adjustments shall be made only as directed by the Engineer.

The Contractor shall inspect existing buildings, sidewalks, curb and gutter, pavement, light posts, and other physical features within and in the proximity of the project limits, and shall notify the Engineer, in writing, prior to beginning any construction, of any distress or existing damage such as cracking, settlement, and spalling or light malfunctions. Documentation of such distress or existing damages shall include date stamped photographs or motion video as necessary to provide eveidence of such damage prior to the beginning of construction operations. Any damage to these items resulting from the work of this contract shall be promptly repaired by the Contractor at no additional cost to the Town, in a manner approved by the Engineer.

2. CITIZEN NOTIFICATION

The Contractor shall be responsible for notifying, in writing all residents and business/property owners as per article 104-13, Citizen Notification of the Contract General Conditions.

3. MEETINGS

The Contractor shall have his job supervisor or superintendant attend project meetings with the Town, as he deems necessary to ensure proper coordination of construction. These meetings shall be scheduled by the Engineer.

4. PREPARATION OF SITE

Excavation shall be done in such a manner as to provide for safe working conditions for the duration of the project.

5. ADJACENT PROPERTY ACCESS

Driveway and roadway access to properties adjoining the project must be maintained at all times during construction. The Contractor shall provide all labor and materials necessary to accomplish this work. There shall be no separate compensation for this work.

6. GRADING, SHOULDERS AND SLOPES:

Shoulders and slopes (for a depth of 4 to 6 inches) shall be free of all stone and clods that exceed one inch in diameter. Fine grading (raking) shall take place just before seeding and mulching. The inspector must approve all areas to be seeded prior to seeding.

7. EXCESS TOPSOIL EXCAVATION

All excess excavation incluing topsoil shall be hauled off-site at a site approved by the Town, or as an alternative, the topsoil may be blended with on-site borrow, which will reduce the total quantity of off-site borrow. If a blending option is a preferred method, the soil blending ratio shall be as directed by the Geotechnical Engineer and the Geotechnical Engineer and/or Town Inspector shall observe the blending operations. This work shall be considered incidental to the job and shall be included in the unit price for “Unclassified Excavation” on a per cubic yard basis.

8. SEEDING/MULCHING IN ESTABLISHED AREAS:

Special attention shall be given in the seeding and mulching in established areas. Lawn quality care shall be taken and appropriate seed used to match existing lawn types on a lot per lot basis. All seeding areas shall be measured prior to installation so the Town inspector may verify the correct amount of seed, fertilizer, lime and any other supplements required for the seeding area in accordance with the Contract Documents. Seeding, mulching and seedbed preparation shall be approved by both the Project Engineer and the Project Inspector prior to acceptance and payment.

Compensation for seeding and mulching shall include the initial seeding, repair seeding at the time of final inspection (if necessary), and repair seeding at the end of the one-year warranty period (if necessary).

9. MAINTENANCE AND REMOVAL OF EROSION CONTROL MEASURES

All unit prices for erosion control measures shall include the installation, maintenance, and removal of these measures. This shall also include any modifications to the erosion control measures during the course of the project due to grade changes around the location of the installed measures.

10. GEOGRID REINFORCEMENT

Geogrid Reinforcement shall be a regular grid structure formed by biaxially drawing a continuous sheet of select polypropylene material and shal have aperture geometry and rib and junction cross section sufficient to permit significant mechanical interlock with the material being reinforced. The geogrid shall have high flexural rigidity and high tensile modulus in relation to the material being reinforced and shall also have high continuity of tensile strength through all ribs and junctions of the grid structure. The geogrid shall maintain its reinforcements and interlock capabilities under repeated dynamic loads while in service and shall also be resistant to ultraviolet degradation, resistant to damage under normal construction practices, and resistant to all forms of biological or chemical degradation normally encountered in the material being reinforced. The goegrid material shall be type BX1100 or UX1100 as manufactured by Tensar Corp. (or approved equal). The contractor shall receive approval from the Engineer and/or Geotechnical Engineer prior to performing any work under "Geogrid Reinforcement".

Measurement and payment will be made at the unit price per square yard. Payment for "Geogrid Reinforcement" shall be considered full compensation for all equipment, materials, and labor required to complete the work.

11. SUPPLEMENTAL CONCRETE REMOVAL:

Remove additional concrete curbs, sidewalks, structures, or other miscellaneous concrete items that are not shown as to be removed on the contract documents and as directed by the ENGINEER.

Supplemental Concrete Removal will be measured and paid in square yards.

Payment will be made under:

Pay Item	**Pay Unit**
Concrete Removal	Square Yard

12. INCIDENTAL STONE BASE

Description

Place incidental stone base on driveways, mailboxes, etc. immediately after paving and do not have the paving operations exceed stone base placement by more than one week without written permission of the Engineer.

Materials and Construction

Provide and place incidental stone base in accordance with Section 545 of the *NCDOT Standard Specifications, latest edition.*

Measurement and Payment

Incidental Stone Base will be measured and paid in accordance with Article 545-6 of the *NCDOT Standard Specifications, latest edition.*

13. PRICE ADJUSTMENT-ASPHALT BINDER FOR PLANT MIX

There shall be no price adjustments for asphalt binder for plant mix for asphalt whether paid for by the square yard or by the ton. The unit price for all asphalt shall include the cost of binder.

14. ASPHALT BINDER CONTENT OF ASPHALT PLANT MIXES:

The approximate asphalt binder content of the asphalt concrete plant mixtures used on this project will be as follows:

Asphalt Concrete Base Course	Type B 25.0C	4.5%
Asphalt Concrete Intermediate Course	Type I 19.0C	4.8%
Asphalt Concrete Surface Course	Type S 9.5C	6.0%
Asphalt Concrete Surface Course	Type S 9.5B	6.7%

The actual asphalt binder content will be established during construction by the Engineer within the limits established in the *NCDOT Standard Specifications, latest edition.*

15. ASPHALT CONCRETE SURFACE COURSE COMPACTION

Compact the asphalt surface course on this project in accordance with Subarticle 610-9 of the *NCDOT Standard Specifications, latest edition* and the following provision:

Perform the first rolling with a steel wheel roller followed by rolling with a self-propelled pneumatic tired roller with the final rolling by a steel wheel roller.

16. TEMPORARY SEEDING & MULCHING

Modify Sections 1615-4 and 1620-4 in the NCDOT Standard Specifications to state…

The Seed for Temporary Seeding, Fertilizer for Temporary Seeding, and Temporary Mulching will be measured and paid in acres, measured along the surface of the ground over which temporary seeding, fertilizer & mulch has been placed as directed and accepted.

Mowing will be measured and paid in accordance with Article 1660-8.

Where earthwork and temporary seeding have been adequately constructed, completely drained and properly maintained, and damage occurs due to natural causes, the Contractor will be paid at the contract unit price for the excavated material required for repairs to the damaged earthwork and the contract unit prices for Seed For Temporary Seeding and Fertilizer for Temporary Seeding for correcting the damaged temporary seeding.

Repair, at no cost to the Town, any damage to earthwork or temporary seeding which is due to carelessness or neglect on the part of the Contractor.

Payment will be made under:

Pay Item	Pay Unit
Temporary Seeding & Mulching	Per Acre

17. SPECIAL AGREEMENTS

The special agreements listed in Appendix A – Right of Way Agreements are hereby considered part of this contract. If there is no line item to pay for special agreement work and/or the work is not otherwise noted on the plans, the work is considered incidental to the other pay items.

18. STREET SIGNS AND MARKERS AND ROUTE MARKERS

Move any existing street signs, markers, and route markers out of the construction limits of the project and install the street signs and markers and route markers so that they will be visible to the traveling public if there is sufficient right of way for these signs and markers outside of the construction limits.

Near the completion of the project and when so directed by the Engineer, move the signs and markers and install them in their proper location in regard to the finished pavement of the project.

Stockpile any signs or markers that cannot be relocated due to lack of right of way, or any signs and markers that will no longer be applicable after the construction of the project, at locations directed by the Engineer for removal by others.

The Contractor will be responsible to the owners for any damage to any street signs and markers or route markers during the above described operations.

No direct payment will be made for relocating, reinstalling, and/or stockpiling the street signs and markers and route markers as such work will be considered incidental to other work being paid for by the various items in the contract.

19. PAVEMENT MARKINGS

All temporary pavement markings shall be paint and all permanent pavement markings shall be thermoplastic unless otherwise noted on the plans. The pavement marking contractor shall premark all pavement markings and have the Engineer approve the premarking prior to completing these pavement markings in case any adjustments are required based on actual site conditions. Any pavement markings placed prior to approval of the Engineer are subject to removal and replacement at no cost to the Town as directed by the Engineer.

20. PERMANENT TRAFFIC SIGNAGE

Permanent traffic signage shall be considered full compensation for all equipment, materials, labor, and incidentals for work associated with the installation of new permanent traffic signage at locations as shown on the plans. The work shall include, but is not limited to signage fabrication and installation, including 3 lb. galvanized steel U-channel posts, bolts, and any incidentals required to install the traffic signage. Payment will be made at the unit price per

square foot or as otherwise indicated in the itemized proposal.

21. MODULAR BLOCK RETAINING WALL

DESCRIPTION:
This work consists of designing, furnishing and installing retaining wall including any and all materials required in accordance with the details and location shown in the plans. The wall may be of a Keystone ® Retaining Wall System or similar type, or of a custom design.

DETAILED DESIGN:
The Contractor shall submit previously designed retaining wall and shall submit it to the Town of Wake Forest for approval. Construction may begin only after the design has been approved by the Engineer. Any wall installed by the Contractor prior to approval by the Engineer may be subject to removal and replacement at no cost to the Town.

CONSTRUCTION:
Perform installation in accordance with the details in the plans and details and assembling instructions furnished by the Manufacturer.

MEASUREMENT AND PAYMENT:
Measurement will be made at a cost per square feet of the exposed vertical surface of the wall.

Payment will include all materials and activities necessary to complete the construction of the wall including shoring, foundation grading and preparation, installation of leveling structures, the primary wall structure, cap stones or structures, reinforcing steel, straps, wick drains.

Earth excavation and embankment are not part of this payment and are covered under Section 226, “Comprehensive Grading” of the *NCDOT Standard Specifications for Roads and Structures, latest edition*.

Pay Item	**Pay Unit**
Modular Block Retaining Wall	Square Foot

UTILITY CONSTRUCTION

22. ADJUSTMENT OF MANHOLES

The Contractor's attention is directed to Section 858-3 of the *NCDOT Standard Specifications, latest edition*.

The use of cast iron or steel fittings in the adjustment of manholes will not be permitted on this project except where it is considered by the Engineer to be in the best interest of the Department to allow rings to be used. When rings are permitted for the adjustment of manholes, the rings shall have satisfactory bearing on the existing manhole frames and 50 percent of the circumference shall be tack welded at four equally spaced locations as directed by the Engineer. If the existing covers do not fit the rings, furnish and install new

covers at no additional expense to the Town. The Contractor shall be responsible for the removal, maintenance, and replacement of manhole rings and covers. Upon removal of the manhole rings and covers, the Public Works Director or his representative shall inspect them for defects or damage.

Unless otherwise stipulated in the Contract Documents, the Contractor shall only be compensated one time for the adjustment of each manhole as called out in the construction drawings. Any additional adjustments required by the Contractor beyond the first adjustment of a manhole will be the responsibility of the Contractor at no additional cost to the Town.

23. ADJUSTMENT OF VALVE BOXES AND METER BOXES

The Contractor's attention is directed to Article 858-3 of the *NCDOT Standard Specifications, latest edition.*

Cast iron or steel fittings will not be permitted for the adjustment of meter boxes and valve boxes on this project. The Contractor shall be responsible for the removal, maintenance, and replacement of valve boxes and water meter boxes. Upon removal of the above mentioned items, the Public Works Director or his representative shall inspect them for defects or damage.

Unless otherwise stipulated in the Contract Documents, the Contractor shall only be compensated one time for the adjustment of each valve box or meter box as called out in the construction drawings. Any additional adjustments required by the Contractor beyond the first adjustment of a valve box or meter box will be the responsibility of the Contractor at no additional cost to the Town.

24. MINIMUM SEPARATIONS

Minimum separations between existing and proposed utilities shall be as specified in the Town of Raleigh Public Utilities Handbook and Details. If utility separation conflicts occur during construction, the Contractor shall coordinate required adjustments with the Engineer prior to proceeding with the work.

25. UTILITY TRENCHES

Contractor shall ensure all utility trenches are backfilled to comply with Section 10000 of these Specifications, latest edition. The Town will selectively test trench compactions, but the Contractor shall be held financially responsible for remedial repairs of any settlement or other failures associated with utility installations to meet the Town of Wake Forest, City of Raleigh, or NCDOT requirements for final acceptance.

All costs associated with the placement of washed stone bedding shall be considered incidental to the installation of storm drainage pipe per Section 10000, Part 1D.

26. MISCELLANEOUS UTILITY CONSTRUCTION

The proposed utility construction shall meet the applicable requirements of the City of Raleigh Public Utilities Handbook, current edition, and the details as shown on the plans, as outlined in the following provisions, or as directed by the Engineer.

Owner and Owner's Requirements:

The existing water and sewer mains to be relocated are owned by the City of Raleigh or private residents. The Contractor shall provide access for the owners' representatives to all phases of construction. The owners shall be notified two weeks prior to commencement of any work and one week prior to service interruption. Only authorized personnel of the owners shall operate valves in the existing public water distribution or sewer collection systems.

.Concrete Cradle

Install concrete pipe cradle as indicated on drawings and details so to provide support for pipelines that are in proximity to the water or sewer utility pipe.

Electrical Conduit For Site Lighting

Install electrical conduit using Utility provided- 2-inch diameter HDPE for installation of site lighting power wiring from light poles. This work to be coordinated with Wake Electric or their contractors as illustrated on the Utility by Others (UBO) drawings. Wake Electric will provide all conduit and elbows for the project. Contractor is responsible for any material needed outside those provided by Wake Electric. Ends of conduit shall be sealed with duct tape. Five foot sections of conduit shall be used in place of cable markers at each new street light locations buried with at least 18-inches above grade for locating purposes. Depth and method of installation to be coordinated with other utility installation as necessary.

MEASUREMENT AND PAYMENT:

Repair Septic Field: will be measured and paid for lump sum. Payment will be inclusive of all work, materials and equipment to include, but not limited to, permitting, excavation, repair materials and inspection.

Relocate Water Meter Vault and Backflow Assemblies: The quantity of water vaults relocated and accepted will be measured and paid for at the contract unit price each for "Relocate Water Vault". Such price and payment will be full compensation for all labor and materials, new box/vault, excavation, removal and relocation of the assembly, removal and disposal of the existing box/vault, backfilling, and incidentals necessary to complete the work as required.

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Concrete Cradle: will be measured and paid for per each concrete cradle installed. The price per each cradle will include all labor, material, testing and all else required to construct and install cradles as indicated on the utility drawings.

Electrical Conduit for Site Lighting: will be measured and paid per linear foot of 2-inch HDPE conduit installed. Payment will be inclusive of all work, glue, cable markers, clamps, hand holes, grading, compaction and connection as indicated on drawings.

Utility by Others

GENERAL:

The owners of utilities within this project are, but are not limited to:

COMPANY	CONTACT	PHONE NO.
Charter/Spectrum	Jacob Moyer	919-573-7638
Brightspeed	Billie Goodman	919-696-6912
Windstream	Keith Lloyd	704-319-1933
North Carolina EMC	-	919-645-2407
Conterra Ultra Broadband	-	318-657-1030
Ting Fiber, Inc	John Mickert	919-924-5934
Verizon	Alan Roberts	919-628-7097
Dominion	Matthew Koehl	919-819-0485
Wake Electric	Jim Haynes	919-863-6466
Raleigh Water/Sewer	Timothy Beasley	919-996-2176

END OF SECTION 18000

PROJECT SPECIAL PROVISIONS – ON-SITE PARKING LOT

SITE FURNISHINGS

PART 1 – GENERAL

1.01 Summary

A. This item consists of all site furnishings associated with the project. Construction and/or installation shall be in complete accordance with the Construction Documents, special provisions, and the manufacturer's recommendations.

This Section includes the following:

1. Steel Bollards

2. Installation of Bicycle Racks

PART 2 – PRODUCTS

2.01 Manufacturers

A. Subject to compliance with requirements, furnishings shall be provided by qualified manufacturers or approved equals as noted below for inspection and approval by Engineer.

2.02 Steel Bollards

A. Install 6" diameter steel bollard by 6' length, 3' above ground and 3' below ground. Set bollard with a minimum of 6" clearance from bottom of footing.

B. Finish: Traffic Yellow Powder Coat

C. Concrete Footing: Footing shall be reinforced. Footing shall be visible at finish grade and shall include a broom finish. Finish shall be swept parallel to the path of vehicular travel. Footing shall be 12" in width and a minimum of 3' in depth. Footing shall include reinforcing. Reinforcing shall be #4 rebar spaced 12 inches on center each way. Provide 4,000 PSI concrete footing.

D. Contractor to install as illustrated on detail sheets.

2.03 Bicycle Racks

A. To be provided by furnished and installed by Contractor.

1. Contractor to install a 12" by 12" by 5" thick concrete pad under

each side of each bike rack. Concrete pads shall be used for surface mounting the legs of each bicycle rack.

2. Contractor to install bike racks per manufacturer's recommendations and as illustrated on detail sheets.

2.04 Submittals

A. Submit the following for approval prior to installation:

1. Product Data: For each product indicated.

2. Samples: For each type of exposed finish and for each color and texture required.

3. Warranties: For each product specified.

4. Maintenance Data: For all the above materials.

PART 3 – EXECUTION

3.01 Fabrication and installation shall be in complete accordance with the Construction Documents, this special provision, and the manufacturer's recommended method of installation.

3.02 Warranty

A. The Contractor shall provide a one-year warranty against defects in materials, installation, or workmanship. This warranty period shall begin at substantial completion of the project.

3.03 Quality Assurance

A. Installer Qualifications: The Contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

3.04 Product Delivery, Storage and Handling

A. Deliver materials to project site in undamaged condition.

B. Store and handle materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, or other causes.

C. Store cementitious materials off the ground, under cover and in a dry location.

D. Store aggregates covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

PART 4 – MEASUREMENT AND PAYMENT

4.01 The quantity of these items as described in this special provision section will be paid for at the contract unit price per each, completed and accepted site furnishing. Price will be full compensation for providing and installing each site furnishing, all labor, materials, concrete, equipment, excavation, finishing, mounting footings, tools, and any incidentals for attaching the furnishings in their locations per the plans.

4.02 Payment will be made under:

Pay Item	Pay Unit
Steel Bollard	Each
Installation of Bicycle Rack	Each

RETAINING WALL AND GUARDRAIL

PART 1 – GENERAL

1.01 Summary

A. Provide labor, material, equipment, related services, and supervision required including, but not limited to, installation for all retaining wall and fall protection fence improvements as required for the complete performance of the work and as shown on the Construction Documents. This Section includes the following:

This Section includes the following:

1. Vehicular Guardrail

2. Retaining Wall (MSE)

PART 2 – PRODUCTS

2.01 Manufacturers

A. Subject to compliance with requirements, wall components and fence shall be provided by qualified manufacturers or approved equals as noted below for inspection and approval by Landscape Architect.

2.02 Vehicular Guardrail: Contractor to furnish guardrail per NCDOT STD. 862.01 and installed as shown the civil and retaining wall plans

2.03 Retaining Wall (MSE): Segmental block to be Ridgerock II Straight Face and Cap (or approved equal), color to match the building and shall be approved by Architect and Engineer. Wall and associated footing to include reinforcing. Wall and associated reinforcement to be designed by a geotechnical engineer licensed in the State of North Carolina. Retaining wall shall include a minimum 4” diameter HDPE perforated pipe with sock to be installed behind the retaining side of the wall. Pipe shall be wrapped in washed gravel. Gravel shall then be wrapped in geotextile. Pipe shall run entire length of wall and shall daylight as necessary. Wall and associated reinforcement to be designed by a structural engineer licensed in the State of North Carolina.

2.04 Geotextile: Non-woven, permeable geotextile.

2.05 Submittals

A. Product Data: For each variety of manufactured product specified.

B. Retaining wall and guardrail shop drawings are the responsibility of the Contractor. Shop drawings shall illustrate the full design of the walls (including footings) and are required to be designed, signed, and sealed by a structural engineer licensed in the State of North Carolina. Structural engineer shall include a design for the vehicular guardrail installation on top of the "Retaining Wall". Retaining wall plans have been provided with the bid set and shall be permitted through the Town by the Contractor.

C. Warranties: For each product specified.

PART 3 – EXECUTION

3.01 Fabrication and installation shall be in complete accordance with the Construction Documents, this special provision, and the manufacturer's recommended method of installation.

3.02 Warranty

A. The Contractor shall provide a one-year warranty against defects in materials, installation, or workmanship. This warranty period shall begin at substantial completion of the project.

3.03 Quality Assurance

A. Installer Qualifications: The Contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

B. Source Limitations: Obtain all concrete ingredients from a single manufacturer and each aggregate from one source or producer.

C. Installation of walls with fall protection fence: All wall construction to be completed prior to installation of fall protection fence.

3.04 Product Delivery, Storage and Handling

A. Deliver materials to project site in undamaged condition.

B. Store and handle materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, or other causes.

C. Store cementitious materials off the ground, under cover and in a dry location.

D. Store aggregates covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

PART 4 – MEASUREMENT AND PAYMENT

4.01 The quantity of improvements will be paid for at the contract unit price using the units of measurement and pay items listed below. Unit price will be full compensation for all labor, materials, equipment, substructure (such as concrete, aggregate base, reinforcing materials, guardrail, sleeves for guardrail posts, drains, etc.), hauling, excavation, piping, delivery charges, tools, geotextile, and any incidentals necessary to excavate, furnish, and install all improvements as noted within the Construction Documents and this special provision.

4.02 Payment will be made under:

Pay Item	Pay Unit
Vehicular Guard Rail	Linear Feet
Retaining Wall (MSE)	Square Feet

DEMOLITION

PART 1 – GENERAL

1.01 Summary

A. This item covers the Contractor's demolition and removal of existing site elements as illustrated on the Demolition Plan. This includes all necessary physical equipment, materials, manpower, removal costs, etc. Refer to the Public Safety Warehouse Construction Documents for extent of demolition. All demolition shall be in complete accordance with the Construction Documents and technical specifications.

PART 2 – EXECUTION

2.01 Quality Assurance

A. The Contractor shall be responsible for the removal and salvage noted in the plans unless otherwise noted.

B. If existing flatwork, hardscape material, or buildings that are to remain are damaged during construction, those sections of flatwork or hardscape materials are to be repaired or replaced at no expense to the Town and to the satisfactory of the Project Landscape Architect. The contractor is required to video or photograph the project site in its entirety before construction begins to document existing site conditions.

C. Demolition and excavations shall be done in such a manner as to provide for safe working conditions for the employees and the public for the duration of the project. Access to businesses, buildings and facilities along the project will be maintained at all times, unless directed otherwise by the Engineer. The Contractor must coordinate with the property/business owners and give at least 72 hours' notice prior to detouring or closing any driveway or business access within the project limits.

PART 3 – MEASUREMENT AND PAYMENT

3.01 The quantity of Demolition will be paid for as a lump sum. The lump sum price will include all deconstruction, removal, hauling and disposal fees, tilling and ripping, equipment, and all other incidentals required to complete demolition.

3.02 Payment will be made under:

Pay Item	Pay Unit
Demolition	Lump Sum

WHEEL STOP

PART 1 – GENERAL

1.01 Summary

A. The work covered by this section consists of installing concrete wheel stops in accordance with the requirements shown on the plans and the provisions of these specifications.

PART 2 – PRODUCTS

2.01 All materials shall meet the requirements shown below:

A. Concrete Wheel Stop:

1. Precast, air-entrained concrete, 2500-PSI minimum compressive strength, 6-inches high by 9-inches wide by 84 inches long. Provide 1.5” chamfered corners, 1” drainage slots on underside, and holes for anchoring to substrate. Contractor shall provide submittal for approval of the product by the Town as they will be the final authority as to which product(s) or material(s), is acceptable.

B. Anchoring Dowels:

1. Three (3) No. 4 rebars placed longitudinally at least 18” into pavement. Ensure rebar is driven at least ½” below wheel stop to prevent damages to wheels.

PART 3 - EXECUTION

3.01 Contractor to install as illustrated on detail sheets.

PART 4 – MEASUREMENT AND PAYMENT

4.01 The quantity of these items as described in this special provision section will be paid for at the contract unit price per each, completed, and accepted, which price will be full compensation for all labor, materials, concrete, equipment, excavation, finishing, tools, and any incidentals for installing the wheel stops in their locations per the plans.

4.02 Payment will be made under:

Pay Item	Pay Unit
Wheel Stop	Each

STORMWATER WET POND

PART 1 – GENERAL

1.01 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 Summary

Provide labor, material, equipment, related services, and supervision required including, but not limited to, installation wet pond stormwater control measure as required for the complete performance of the work and as shown on the Construction Documents. This Section includes the following:

1. Pipe and fittings
2. Cleanouts
3. Aquatic Shelf and Wet Pond Plantings
4. Stormwater Control Structure
5. Pipe Outlets/Riprap
6. Aluminum Trash Rack
7. Impermeable Clay Liner

1.03 Definitions

A. RCP: Reinforced Concrete Pipe

1.04 Submittals

A. Product Data: For each variety of manufactured product specified.

B. Shop drawings:

i. Pipe: Pipe, pipe fittings, gaskets and cleanouts
ii. Stormwater structures: Include plans, elevations, sections, details, frames, covers, trash rack, and concrete design-mix reports.
iii. Wet Pond Plantings
iv. Pipe Outlet/Riprap
v. Impermeable Clay Liner

Field quality-control reports.

1.05 Product Delivery, Storage and Handling

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and drop inlets according to manufacturer's written rigging instructions.

1.06 Project Conditions

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Engineer and Town (Owner) no fewer than two (2) days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Engineer’s or Owner’s written permission.

PART 2 – PRODUCTS

2.01 PVC Pipe and Fittings

A. PVC Cellular-Core Piping:

1. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.

2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.

2.02 Concrete Pipe and Fittings

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.

1. Bell-and-spigot ends and sealant joints with ASTM C990, bitumen or butyl-rubber sealant.

2. Class III, shall be used unless otherwise noted on Drawings.

2.03 Cleanouts

A. Plastic Cleanouts:

1. Manufacturers: Subject to compliance with requirements of local governing authority. Available manufactures offering products that may be incorporated into the Work include, but not limited to, the following:

a. Canplas LLC

b. IPS Corporation

c. NDS Inc.

d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

e. Sioux Chief Manufacturing Company, Inc.

f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group

2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.04 Concrete

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.05 Stormwater Control Structure

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch minimum thickness for floor slab and 6-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 6-inch (102-mm) minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings. Each section shall be bolted to adjacent sections with stainless steel straps and hardware.
5. Joint Sealant: ASTM C 990, bitumen or butyl rubber and all joints shall be rated as “watertight”.
6. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match diameter frame and grate.
7. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 15-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches.
8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Designed Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.

1. Joint Sealants: ASTM C 990, bitumen or butyl rubber.
2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match diameter frame and grate.
3. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps

into sidewalls at 12- to 15-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches

4. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

C. Aluminum Trash Rack: 6061-T6 Aluminum Bolted to top of concrete box with Stainless Steel Anchors. Anchor 1 per side minimum with 3" x ¼" Stainless Steel support plate.
   1. Trash rack must have minimum roof slope of 2:1
   2. Access Hatch Shall Align with the Access Steps inside of the Structure and shall have a minimum clear space opening of 2'x3'
3. Contractor shall furnish shop drawing meeting specifications to engineer for approval.

2.10 Pipe Outlets

A. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
   1. Average Size: NSSGA No. R-3, screen opening 2 inches.
   2. Average Size: NSSGA No. R-4, screen opening 3 inches.
   3. Average Size: NSSGA No. R-5, screen opening 5 inches.

B. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

2.11 Impermeable Liner

A. Soil used to construct the liner shall consist of clayey sand (SC), Silt (ML, MH) or Clay (CL, CH).
B. The Contractor shall submit 50-Pound bulk samples of different proposed liner soils to the Geotechnical Engineer for lab testing at least 2 weeks prior to its placement.

PART 3 – EXECUTION

3.01 Earthwork

A. Excavation, trenching, and backfilling are specified in Section 04000 "Earthwork."
B. Grade wet pond SCM as shown on plans and per Town and NCDEQ requirements.
C. Install impermeable clay liner as shown on plans per Town and NCDEQ requirements.

3.02 Piping Installation

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:
   1. Install piping pitched down in direction of flow.
   2. Install piping at invert elevations as specified on Drawings.
   3. Install ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
   4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
   5. Install PVC water-service piping according to ASTM D 2321 and ASTM F 1668.
   6. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105:
   1. Ductile-iron pipe and fittings.

3.03 Pipe Joint Construction

a. Join gravity-flow, nonpressure drainage piping according to the following:
   1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
   2. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
   3. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

4. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
5. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.04 Plastic Pipe Installation

1. Polyvinyl chloride (PVC) pipe shall be laid and joints assembled according to the respective manufacturer's recommendations and applicable Sections of the Uni-Bell PVC Pipe Association recommended Standard Specifications.

3.05 Stormwater Outlet Installation

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
B. Construct riprap of broken stone, as indicated.
C. Install outlets that spill onto grade, anchored with concrete, where indicated.
D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
E. Construct energy dissipaters at outlets, as indicated.

3.06 Concrete Placement

A. Place cast-in-place concrete according to ACI 318.

3.07 Connections

A. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to

undisturbed ground.

a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.10 Closing Abandoned Storm Drainage Systems

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
   1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
   2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
   1. Remove manhole or structure and close open ends of remaining piping.
   2. Remove top of manhole or structure down to at least 48 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 31 Section "Earth Moving."

3.11 Aquatic Shelf and Plantings

A. Aquatic shelf shall be graded and planted as shown on the plans and per NCDEQ requirements.

B. Special Warranty: The Contractor agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period as specified in “Exterior Plantings” Section.

3.12 Impermeable Liner

A. Soil Liner material shall be placed in loose lifts no more than 8” thick.
B. Soil Liner Material shall be compacted with a sheepsfoot roller to at least 93% of its standard proctor maximum dry unit weight at a minimum of 2% wet of the soil’s optimum moisture content as determined by ASTM D698.
C. Impermeable Clay Liner to be installed at pond bottom to maintain permanent pool elevation. Liner shall have an infiltration rate less than

0.01 IN/HR.

3.13 Field Quality Control

A. Slopes shall be stabilized prior to installation wet pond plantings. Upstream drainage area must be fully stabilized prior to conversion from skimmer basin to permanent wet pond.
B. Post Construction survey shall meet minimum standards specified in plans and applicable Town as-built survey requirements.

3.14 Cleaning

i. Clean interior of piping of dirt and superfluous materials. Flush with water.

PART 4 – MEASUREMENT AND PAYMENT

4.01 The quantity of improvements will be paid for at the contract unit price using the units of measurement and pay items listed below. Unit price will be full compensation for all labor, materials, equipment, substructure, hauling, excavation, piping, delivery charges, tools, geotextile, and any incidentals necessary to excavate, furnish, and install all improvements as noted within the Construction Documents and this special provision.

4.02 Payment will be made under:

Pay Item	Pay Unit
Wet Pond Plantings	Lump Sum
Wet Pond Stormwater Control Structure	Each
Wet Pond Trash Rack	Each
Wet Pond Outlet/Riprap	Tons
Wet Pond Clay Liner	Square Yards
Wet Pond Stormwater Control Measure	Lump Sum

MOBILIZATION

PART 1 – GENERAL

1.01 Summary

A. This item covers the Contractor's transfer of resources to the construction site. This includes physical equipment, materials, manpower, etc. Refer to the Public Safety Warehouse Construction Documents for extent of project needs. All necessary resources shall be in complete accordance with the Construction Documents.

PART 2 – PRODUCTS

2.01 Summary

A. The Contractor shall submit a detailed mobilization schedule and / or plan to the Project Engineer within one week of the pre-construction conference.

PART 3 – EXECUTION

3.01 Quality Assurance

A. The Contractor is responsible for proposing a suitable construction entrance, route for all deliveries, and area to dispose of excess concrete on-site. The Contractor shall submit this in writing at the pre-construction conference.

PART 4 – MEASUREMENT AND PAYMENT

4.01 The quantity of Mobilization will be paid for as a lump sum. The lump sum price will include all labor, equipment, temporary field office setup, fees, and all other incidentals required to complete mobilization and demobilization.

4.02 Payment will be made under:

Pay Item	Pay Unit
Mobilization	Lump Sum

UTILITIES BY OTHERS

(05-30-17) SP (Kimley-Horn and Associate, Inc.)

GENERAL:

1.01 The Town will request all utility owners to attend the preconstruction conference to discuss potential conflicts and their schedule for relocation/installation where required. All adjustments or relocations will be made by the Contractor unless otherwise indicated in the Contract Documents. All utilities are shown on the plans for the best available information.

1.02 The following utility companies have facilities that will be in conflict with the construction of this project:

A. Wake Electric – Power (Distribution)

B. Verizon - Communications

C. Charter/Spectrum – Communications

D. Ting Fiber, Inc – Communications

E. North Carolina EMC – Communications

F. Conterra Ultra Broadband – Communications

G. Brightspeed – Communications

H. Dominion Energy – Gas

I. City of Raleigh Public Utilities – Water and Sewer

1.03 The conflicting facilities of concerns will be adjusted after to the date of availability, unless otherwise noted and are therefore listed in these special provisions for the benefit of the Contractor. All utility work listed herein will be done by the utility owners. All utilities are shown on the plans from the best available information.

1.04 The Contractor's attention is directed to Article 105-8 of the 2024 Standard Specifications.

Utilities Requiring Adjustment:

2.01 Utility relocations are shown on the Utility Plans.

A. Wake Electric (Distribution)

1. Wake Electric will remove and relocate two (2) existing power poles at Sta. 10+53 and Sta. 13+34 of Forestville Road prior to construction. Final pole locations to be coordinated by the Contractor with Wake Electric and the Town of Wake Forest.

2. Wake Electric will install any electrical service lines for the proposed Public Safety Warehouse from the existing transformer.

3. Contact person for Wake Electric is Jim Haynes Jim.Haynes@wemc.com and phone # 919-863-6466

B. Verizon – Communications

1. Verizon fiber is located on the east side of Forestville Road and is not anticipated to be impacted during construction. If required, Verizon will adjust as necessary any conflicts that may be identified during construction.

2. Contact person for Verizon is Alan Roberts at alan.roberts@verizon.com and phone # 919-628-7097

C. Charter/Spectrum – Communications

1. Charter/Spectrum will relocate the existing aerial CATV lines mounted on Wake Electric power pole(s) from Sta. 10+53 to 11+00 of Forestville Road onto the relocated Wake Electric pole(s) prior to construction. Contractor to coordinate with Charter/Spectrum on final pole locations.

2. Contact person for Charter/Spectrum is Jacob Moyer at jacob.moyer@charter.com and phone # 919-573-7638

D. Ting Fiber, Inc.

1. Ting Fiber, Inc. will adjust as necessary any conflicts with their existing fiber line(s) that may be identified during and prior to construction from Sta. 10+00 to 14+86 of Forestville Road. Ting Fiber, Inc. requires [XX] week(s) notice by the Contractor to begin work and [XX] week(s) to complete work at each location.

2. Contact person for Ting Fiber, Inc. is John Mickert at jmickert@tucowsinc.com and phone # 919-924-5934

E. North Carolina EMC

1. North Carolina EMC will adjust as necessary any conflicts with their existing fiber line(s) that may be identified during and prior to construction from Sta. 10+00 to 14+86 of Forestville Road. North

Carolina EMC requires [XX] week(s) notice by the Contractor to begin work and [XX] week(s) to complete work at each location.

2. Contact information for North Carolina EMC is phone # 919-645-2407

F. Conterra Ultra Broadband

1. Conterra Ultra Broadband will adjust as necessary any conflicts with their existing fiber line(s) that may be identified during and prior to construction from Sta. 10+00 to 14+86 of Forestville Road. Conterra Ultra Broadband requires [XX] week(s) notice by the Contractor to begin work and [XX] week(s) to complete work at each location.

2. Contact information for Conterra Ultra Broadband is phone # 318-657-1030

G. Brightspeed

1. Brightspeed will adjust as necessary any conflicts with their existing phone and fiber line(s) that may be identified during and prior to construction from Sta. 11+00 to 14+86 of Forestville Road. Brightspeed requires [XX] week(s) notice by the Contractor to begin work and [XX] week(s) to complete work at each location.

2. Contact person for Brightspeed is Billie Goodman at billie.goodman@brightspeed.com and phone # 919-696-6912

H. Dominion Energy

1. Dominion Energy will relocate a portion of their existing 1.5” PVC gas service line at Sta. 11+07 of Forestville Road.

2. Dominion Energy will provide an additional gas service line for the Public Safety Warehouse. Service line location to be coordinated by the Contractor, Architect, and Engineer with Dominion Energy.

3. Contact person for Dominion Energy is Matthew Koehl at matthew.koehl@dominionenergy.com and phone # 919-819-0485

I. City of Raleigh Public Utilities Department

1. City of Raleigh Public Utilities Department will remove/relocate their existing 6” DIP fire line, hotbox and fire department connection (FDC), as well as the existing public domestic water service line, meter, and hot box off the fire line at Sta. 10+39 of Forestville Road.

2. City of Raleigh Public Utilities Department will relocate a portion of the existing 12" DIP waterline below the proposed 18" RCP storm drain from Sta. 14+45 to 14+72 of Forestville Road.

3. Contact person for City of Raleigh Public Utilities Department is Tim Beasley at timothy.beasley@raleighnc.gov or phone # 919-996-2176

2.02 The Contractor will be required to grade around utility poles and guy wires which may be left in place within the construction limits of the project and where the poles remain in their present position on the outer edge of fills, to place such fills without disturbing the poles with grading equipment.

2.03 The Contractor shall adhere to the provisions of *Underground Utility Safety and Damage Prevention Act, North Carolina General Statutes, Chapter 87, Article 8A*. To assist the Contractor and utility owners in meeting the requirements of this law, the Contractor must contact North Carolina 811 prior to any underground work. Most major utilities with underground facilities in the State are included in this service. For calls originating within North Carolina, NC 811's telephone number is 811. For calls originating outside North Carolina, the number is 1-800-632-4949. The Contractor shall, at their own expense, locate all existing utilities and other structures ahead of construction. The Contractor shall coordinate with each utility company where removals, relocations, or new installations are required. The Contractor shall make every effort to avoid damage or disruption of services during the work to be performed.

2.04 The Contractor shall include the cost of any coordination and cooperation of utilities in his bid. No additional compensation shall be allowed for delays or inconvenience sustained by the Contractor due to utility relocation or adjustments. Contractor is to notify utility companies and the City of any known conflicts in writing before he begins work in a certain area. No additional payment will be made for re-mobilization required by the utility's failure to relocate a utility at the request of the Contractor.

2.05 No delay claims will be granted unless the Contractor can prove private utility relocations are causing delay to controlling operations. If documentation proving the Contractor's controlling operations are halted due to the failure of a utility owner to relocate or adjust a utility after being properly notified by the Contractor, the Contract Period will be extended by the amount of time the Contractor's controlling operations have been delayed while awaiting the relocation or adjustment. Contractor is to notify utility companies and the City of any known conflicts in writing before he begins work in a certain area. Contractor shall build into his schedule and cost coordination with private utility companies. No separate payment will be made for these efforts.

2.06 Where changes to utility facilities are to be made solely for the convenience of the Contractor, it shall be the Contractor's responsibility to arrange for such changes, and the Contractor shall bear all costs of such changes.

UTILITY CONNECTIONS:

(05-30-17) SP (Kimley-Horn and Associates, Inc.)

3.01 Make connections between existing and proposed utilities at times most convenient to the public, without endangering the utility service, and in accordance with the owner's requirements. Should the position of any pole, pipe, conduit, or other structure require removal or adjustment, the Engineer will coordinate the change with the owner of the obstructions or a representative of the owner. There will be no direct payment for the work covered by this provision. Payment at the contract unit prices for the various items in the contract will be full compensation for all work covered by this provision.

GENERAL APPURTENANCES

PART 1 – GENERAL

1.01 Related Documents

A. See City of Raleigh Public Utilities Handbook for general, products and execution information.

PART 2 – MEASUREMENT AND PAYMENT

2.01 The quantity of these items as described in this special provision section will be paid for at the contract unit price per each, completed, and accepted, which price will be full compensation for all labor, materials, concrete, equipment, excavation, finishing, tools, and any incidentals for installing the general appurtenances.

2.02 Payment will be made under:

Pay Item	Pay Unit
General Appurtenances	Lump Sum

CONCRETE ADA RAMP WITH HANDRAILS

SUMMARY

Provide labor, material, equipment, related services, and supervision required including, but not limited to, installation for all improvements adjacent to the Public Safety Building as required for the complete performance of the work and as shown on the Construction Documents. This Section includes the following:

1. Cast In Place Retaining Wall 'A'
2. Handrail
3. Concrete Ramp

PART 1 – SUBMITTALS

1.01 Product Data: For each variety of manufactured product specified.

PART 2 – PRODUCT DELIVERY, STORAGE AND HANDLING

1.01 Deliver materials to project site in undamaged condition.

1.02 Store and handle materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, or other causes.

1.03 Store cementitious materials off the ground, under cover and in a dry location.

1.04 Store aggregates covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

PART 3 – QUALITY ASSURANCE

1.01 Installer Qualifications: An experienced installer who has completed masonry and unit paver installations similar in material, design, and extent to that is indicated for this Project and whose work has resulted in construction with a record of successful performance.

1.02 Source Limitations: Obtain all concrete ingredients from a single manufacturer and each aggregate from one source or producer.

1.03 Installation of walls with railing: All wall construction to be completed prior to installation of railings.

PART 4 – PRODUCTS

4.01 Non-shrink Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107 and specifically recommended by manufacturer for exterior applications.

4.02 Caulking: Caulk joints where pavers are placed adjacent to walls, existing buildings and structures, concrete foundations, walls, and where the base of site furnishings interfaces with paver areas.

4.03 Handrails: Handrail to be 1 ¼" schedule 40 aluminum pipe, 36" in height, powder coated black. Handrail to be installed per detail 2 / L-2.5 and shall meet all ADA accessibility code requirements.

4.04 Foundation Drain in Sock: 4" diameter HDPE perforated pipe with sock. Pipe shall run entire length of wall and shall connect to the adjacent storm drain system in South White Street.

4.05 Concrete Retaining Wall 'A': Cast-in-place concrete with rubbed finish, minimum 3,600 PSI at 28 days. Wall and associated footing to include reinforcing. Reinforcing to be #4 rebar spaced 12" on center each way. Wall shall be core-drilled to accommodate handrail.

4.06 Geotextile: Non-woven, permeable geotextile.

4.07 Concrete Ramp: Cast-in-place concrete, minimum 3,000 PSI at 28 days. Ramp and associated footing to include reinforcing. Reinforcing to be #4 rebar spaced 12" on center each way. Staircase to include a 5/8" slip down spaced 18" on center at bottom of stair. Staircase shall be core-drilled to accommodate handrail.

4.08 Expansion Joint: A ½" expansion joint shall be included at all instances where Retaining Wall 'A' is adjacent to concrete flatwork as shown on ADA RAMP SITE DETAILS, SHEET C7.3.

PART 5 – WARRANTY

1.01 The Contractor shall provide a one-year warranty against defects in materials, installation, or workmanship. This warranty period shall begin at substantial completion of the project.

MEASURE AND PAYMENT

The quantity of improvements at the Public Safety Building will be paid for at the contract unit price using the units of measurement and pay items listed below. Unit price will be full compensation for all labor, materials, equipment, substructure (such as concrete, aggregate base, reinforcing materials, drains, etc.), hauling, excavation, piping, delivery charges, tools, and any incidentals necessary to excavate, furnish, and install all improvements as noted within the Construction Documents and this special provision.

Payment will be made under:

Pay Item	**Pay Unit**
Cast in Place Retaining Wall 'A' (ADA RAMP)	Linear Foot
Caulking	Linear Foot
Concrete Ramp	Square Yard
Handrail	Linear Foot

EXTERIOR PLANTING

PART 1 – GENERAL

1.01 Summary

Work of this section includes provision of plant material and supplementary items necessary to complete the work required for installation including:

A. Plant Installation

B. Soil Preparation

C. Installation of Landscape Appurtenances

D. Warranty

PART 2 – PRODUCTS

2.01 Topsoil

A. Materials

1. Topsoil materials shall be furnished by the Contractor from off-site sources in quantities sufficient to complete the requirements as specified. Topsoil shall be a sandy loam based mix. The topsoil material shall not contain slag, cinders, stones, lumps of soil, sticks, roots, trash, clay lumps, or other extraneous materials larger than 1 1/2 inches in diameter or length. Contractor shall ensure that these soils are free of plants or plant parts of quack grass, Johnson grass, nut sedge, poison ivy, or other noxious weeds. Proposed topsoil materials shall be subject to approval prior to installation by the Project Landscape Architect. These materials shall be placed in a 2” lift for all landscaped areas including sodded lawn areas shown on the project plans and used as planting soil mix for holes dug for trees and large shrubs.

B. Analysis

1. The Contractor shall submit for approval prior to installation the following: Proposed topsoil sample and analysis to include soil type, pH organic content, and critical nutrient composition (nitrogen, phosphorus, potassium).

2.02 FERTILIZER: Granular, 100% organic or palletized, such as GreenSense 6-2-4 or approved equal.

2.03 ORGANIC SOIL AMENDMENTS: Organic soil amendment material (compost) shall be a blend of composted manure and humus and well-aged pine bark. Materials shall be screened and free from lumps, stones, plant material and debris, free of weed seed and other material harmful to plant life. Soil amendment materials shall meet the following organic/chemical analysis.

A. Organic Matter Content: 50% to 80%

B. pH Range: 6.0-8.0

C. Ammonia Nitrogen: Maximum 500 ppm

D. Salt Content (Standard pace extract): Maximum 5.0 mmchis/cm

E. Carbon/Nitrogen Ratio: 15 - 30

2.04 Mulches:

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Double Shredded Hardwood Mulch and shall contain no extraneous material

2.05 Soils:

A. Topsoil: Refer to section “Topsoil” Special Provisions.

B. Soil Amendments: As required by soils analysis testing.

1. Top-dress fertilizer shall be complete fertilizer with 50% of the nitrogen to be derived from natural organic sources or urea form. Available phosphoric acid shall be from superphosphate, bone or tankage. Potash will be derived from muriate of potash containing 60% potash.

2. Tree and shrub planting fertilizer shall be Agriform 20-20-5 formula 21-gram tablet or approved equal.

2.06 Plants:

A. Provide nursery grown plants typical of their species or variety, with normal, densely developed branches and vigorous, fibrous root systems. Provide only solid, healthy, vigorous plants free from defects, disfiguring knots, sunscald injuries, and frost cracks, abrasions of the bark, plant diseases, insect eggs, borers, fire ants, and all forms of infestation. Al plants shall have a fully

developed form without voids and open spaces. ALL PLANTS SHALL BE NURSERY GROWN AND NOT FIELD COLLECTED.

B. B & B Stock: Dig balled and burlap plants with firm, natural balls of earth, of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the "American Standard for Nursery Stock". Cracked, mushroomed, or “manufactured”, (including the addition of soil inside burlap to meet specifications), rootballs are not acceptable.

1. Matched Specimens: Plants indicated on plans to be matched specimens shall have similar shape and form during installation. Any plants not meeting the standards of the matching plant material will be rejected.

C. Container Grown Stock: Grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm and whole. No plants shall be loose in the container. Container stock shall not be pot bound. Plants planted in rows shall be matched in form and shall meet the requirements for spread and height as indicated in the plant list. The measurements for height shall be taken from the ground level to the average height of the top branches of the plant, and not the longest branch. Single stemmed or thin plants will not be accepted. Side branches shall be generous, well twigged, and the plant, as a whole, well bushed to the ground. Plants shall be in a moist, vigorous condition, free from dead wood, bruises, or other root or branch injuries.

2.07 Planting Accessories:

A. Anti-desiccant: The use of anti-desiccant is not allowed without prior approval of the Project Landscape Architect or Town.

B. Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.

C. Planter Filter Fabric: Nonwoven geotextile manufactured for separation applications and made polypropylene, polyolefin or polyester fibers or combination of them.

2.08 WATER: Potable

2.09 PRE-EMERGENT: Team-Pro 19-3-6, Lasso, Ronstar or approved equal shall be applied to plant beds in the late winter or early spring, prior to the emergence of any weed seeds, by the Contractor. Pre-emergent shall be applied at rates specified on the package and only as recommended by the manufacturer and approved by the Town.

2.10 HERBICIDE: “Round-Up” by Monsanto or equal approved is to be applied twice to all plant beds prior to planting by the contractor Rates as recommended by manufacturer.

A. Four weeks prior to planting.

B. Two weeks prior to planting.

2.11 Submittals

A. Plant materials: Include sizes and source for plant materials.

B. Mulch: 1-quart sample.

C. Compost: 1-quart sample and product data.

D. Topsoil: 1-quart sample and analysis to include soil type, pH, organic content, and critical nutrient composition.

E. Product information for fertilizer products.

F. Plant material photos with a measuring stick.

PART 3 – EXECUTION

3.01 Warranty

A. Special Warranty: The Contractor agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor’s control.
b. Lack of water.
c. Structural failures including plantings falling or blowing over.

2. Warranty Period from Date of Substantial Completion is 12 months for all trees, shrubs, ornamental grasses, and annuals.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.

b. Replace plants that are more than 10% dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

4. The Town will notify the Contractor in writing of plants to be replaced. Replacement dates shall be established by mutual agreement between the Town and the Contractor.

5. The Contractor shall be responsible for maintenance of plant material included in this special provision for 1 full year. Refer to section “Landscape Maintenance” Special Provision in this document for landscape maintenance activities.

3.02 Quality Assurance

A. Bidder Qualifications: Those submitting bids shall be registered with the North Carolina Landscape Contractors Registration Board, and have been actively and directly engaged in landscape installations of similar scope, size and complexity, and provide proof of five (5) or more successful installations in the past two years.

B. Plant names indicated comply with "Standardized Plant Names" as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Names of varieties not listed must conform to genus and species as accepted by the nursery trade. Provide stock true to botanical name and legibly tagged.

C. Comply with sizing and grading standards of the latest edition of "American Standard for Nursery Stock". A plant shall be dimensioned as it stands in its natural position.

D. Supervision: Planting shall be performed only by experienced workman familiar with planting procedures and under the supervision of a qualified supervisor. Contractor is required to have an English-speaking Supervisor on the site at all times.

3.03 Product Delivery, Storage and Handling

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials

1. Do not dump or store bulk materials near structure, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems or walkways.
3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scale, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.

2. Do not remove container-grown stock from containers before time of planting.

3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root system in a moist, but not overly-wet condition.

3.04 Examination

A. Examine substrate surfaces to receive plant material and associated work and conditions under which work will be installed. Verify that no foreign of deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area. Do not proceed until unsatisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of work within a particular area will be construed as Installers acceptance of surface conditions.

3.03 Installation of Plant Materials

A. Utilities: Notify utility companies of planting schedule and have existing utilities field located prior to excavation. Notify the Town of potential conflicts.

B. Layout: Stake plants as indicated on the drawings. Obtain approval of Town or Project Landscape Architect prior to any installation of plant material. If obstructions are encountered, do not proceed with planting operations until alternate plant locations have been selected and approved.

C. Existing Plant Materials: Protect all existing plant materials from damage. Contractor will be responsible to replace or, if feasible, repair (by pruning according to the written instructions of a qualified arborist) any damages at his cost. Replacement values will be determined by the Town Staff through previously utilized methodologies.

D. Amendments of Planting Mixture: The Contractor shall obtain a NC Department of Agriculture soils test for all areas to be planted and incorporated into the top six inches of the planting mixture soil the recommended adjustments as per the test. After incorporation of the amendments the Contractor shall remove all stones and clods over one inch in diameter, roots, weeds and other extraneous materials. The Contractor shall bring all amended soil areas to finished grade.

E. Excavation:

1. Tree Pits: Excavate tree pits with "rough," sides as indicated in plans. Provide pits at least 24" greater than the diameter of the root system. Depth of pit shall accommodate the root system, contractor to loosen encircling roots from the soil so that they may extend outward from the ball, (both container and B&B material). In general, the depth of the hole shall be 2-3” less than the depth of the root ball. Scarify the sides of the pit. Avoid creating smooth or "glazed" sides of the pit. Dispose of any unsuitable subsoil removed from excavations. The bottom of the hole shall be flat and firm to prevent settling; do not dig or scarify.

    a. For trees planted within sidewalk tree pits, reference section “Structural Soil Mix for Trees” special provision for planting techniques.

    b. Shrubs/Groundcover: Excavate as necessary for planting after preparation of planting mix described below.

F. Drainage: Test each tree planting pit for adequate percolation. If subsoil conditions indicate retention of water in planting areas, or if seepage or other evidence indicating presence of underground water exists, notify Town before backfilling. Fill excavations with water and allow percolating out before setting trees and shrubs.

G. Preparation of Planting Pit:

1. Trees: Backfill only with approved planting mixture. Should any "non-soil" materials be encountered (i.e. Building materials, construction debris, solid waste) or any other deleterious matter, those materials shall be totally removed and replaced with approved topsoil.

2. Shrubs/Groundcover: Excavate as necessary to remove all existing weeds, grass, and roots. Roto-till beds to depth of 6", add 3" of compost and Roto-till again. Rake beds to create a smooth level planting area. Apply pre-emergent to meet manufacturer recommendations prior to planting and mulching of the entire plant bed area.

H. Installation:

1. Set plant material in the planting pit 2-3" above grade, sloping surrounding soil to meet the outside edge of the rootball. Use large equipment as needed to properly set trees in pits. Do not bend trunk or use trunk as lever to move tree in pit. ANY OPERATIONS OBSERVED USING THESE METHODS WOULD CAUSE IMMEDIATE REJECTION OF THAT PLANT MATERIAL. Set plants upright, plumb and faced to give the best appearance or relationship to each other or adjacent structure. No filling will be permitted around trunks or stems. Root flare should be visible. Backfill the pit with planting mixture. Do not use frozen or muddy mixtures for backfilling. Form a ring of soil around the edge of each planting pit to retain water.

2. After balled and burlap plants are set, muddle planting soil mixture around bases of balls and fill all voids. Remove all burlap, ropes and wires from the root balls per the project details.

3. Moisten shrub/groundcover areas prior to setting plants. Space ground cover plants in accordance with indicated dimensions. Adjust spacing as necessary to evenly fill planting bed with indicated quantity of plants. Plant to within 36" of the trunks of trees within planting bed.

4. Water trees, plants, and ground cover beds within the first 24 hours of initial planting.

5. Ensure that trunk flare is AT FINISH GRADE of the root ball at the time of delivery. Maximum buried trunk flare that will be acceptable is 2". Anything greater than 2" will be reason for rejection. Remove soil to expose root flare.

I. Mulching: Mulch tree planting pits and shrub beds with required mulching material, 3" deep, as shown on drawings immediately after planting thoroughly water mulched areas. After watering, rake mulch to provide a uniform, finished surface. Keep mulch 6" away from tree trunk flare.

J. Pruning:

1. Prune branches of deciduous stock after planting only to cut back broken branches. Proportion shall, in all cases, be subject to approval. Prune evergreens only to remove broken or damaged branches or if considered necessary to enhance survivability of B & B stock.

2. Multiple Leader Plants: Prune evergreens only to remove broken or damaged branches or if considered necessary to enhance survivability of B & B Stock.

K. Stake Plants: Staking shall be completed immediately after planting. Plants shall stand plumb after staking. Only stake trees that are deemed top heavy. Contractor to remove when required so as to not girdle trees with staking and wires.

L. Fertilizing Application: Apply fertilizer to the surface of planting beds, at a rate of one pound per caliper of trees and one pound per square yard of shrub bed.

M. Watering: Contractor to water all plant material until substantial completion.

N. Clean-up: Upon completion of planting, the Contractor shall clean up all debris on the site and remove any unused materials along with any remaining topsoil from the site. This clean up includes planting areas, lawn areas, rights-of-way adjacent to the site, and buffer areas.

O. Final Acceptance:

1. Planted areas will be inspected at the Contractor's request upon completion of installation and a "punch list" will be prepared including items necessary to receive final acceptance. Inspection shall be by the Town, and Project Landscape Architect. Inspection to determine final acceptance of planted areas will be made upon Contractor's request. Provide notification at least 10 working days before requested inspection date. Planted areas will be accepted provided all requirements have been complied with and plant materials are alive and in a healthy, vigorous condition.

2. Upon acceptance (as confirmed in writing by the Project Landscape Architect or Town) of the landscape operations, the contractor's one-year warranty and maintenance period shall begin.

3.04 Maintenance

A. Maintenance Period: One year from time of substantial completion.

B. Maintenance and protection of the work is the responsibility of the Contractor for the entire one-year maintenance period.

1. Maintenance of plantings shall consist of pruning, cultivating, watering weeding, fertilizing, mulching, restoring plant saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

2. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

3. Apply treatments as required to keep plant materials, planted areas, and soils free of weeds, pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps and biological control agents.

3.05 Project Conditions

A. Field Measurements: Verify actual grade elevations, service and utility locations, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or other unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to the requirements indicated:

1. Notify Owner’s Representative no fewer than two days in advance of proposed interruption of each utility or service.

2. Do not proceed with interruption of services or utilities without Owner’s written permission.

C. Planting restrictions: Plant during one of the following periods. If circumstances require planting outside the approved planting periods, written approval must be obtained from the Town and Landscape Architect. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: March 1 – May 31

2. Fall Planting: September 1 – November 30

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated. When planting trees, shrubs and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

PART 4 – MEASUREMENT AND PAYMENT

4.01 The quantity of these items as described in this special provision section will be paid for at the contract unit price per cubic yard for "Mulch" and "Topsoil", and each for all other items, including plant material, which price will be full compensation for all labor, delivery fees, materials, equipment, tools, water, and any incidentals necessary to complete landscape installation. The maintenance of all plant material covered in this specification shall be included in the unit price of each plant which will be full compensation for labor and incidentals such as watering, weeding, pruning, treatment of pesticides, replacement mulch, and adjustments to plant material necessary to conduct one year of maintenance.

4.02 Payment will be made under:

Pay Item	Pay Unit
Streetwise Trident Maple	Each
American Hornbeam Multi-Trunk	Each
Savannah Holly	Each
Bracken's Beauty Southern Magnolia	Each
Saucer Magnolia Multi-Trunk	Each
Hightower Willow Oak	Each
Allee Lacebark Elm	Each
Radiance Glossy Abelia	Each
Autumn Spirit Camillia	Each
October Magic Carpet Camellia	Each
Duke Gardens Plum Yew	Each
Frostproof Gardenia	Each
Nigra Inkberry holly	Each
Crimson Fire Fringe Flower	Each
Burkwood Osmanthus	Each
Nantucket Viburnum	Each
TIF 419 Bermudagrass (Sod)	Square Feet
Big Blue Lilyturf	Each
Pink Muhly Grass	Each

Hameln Fountain Grass..... Each
Threeway Sedge ..... Each
Goldenclub ..... Each
Pickerel Weed ..... Each
Arrow Arum..... Each
Broadleaf Arrowhead..... Each
Double Shredded Hardwood Mulch (3” Depth)..... Cubic Yards
Stone Mulch (3” Depth) ..... Cubic Yards
Topsoil / Soil Amendments (2”-12” Depth)..... Cubic Yards

APPENDIX

- **Geotechnical Report**

ECS Southeast, LLP

Geotechnical Engineering Report

Public Safety Warehouse (Town of Wake Forest)

1412 Forestville Road
Wake Forest, Wake County, NC

ECS Project No. 06:25219

October 24, 2023

October 24, 2023

Mr. John Kuzenski, P.E.
Kimley-Horn
421 Fayetteville Street
Raleigh, NC 27601

ECS Project No. 06:25219

Reference: Geotechnical Engineering Report
Public Safety Warehouse (Town of Wake Forest)
1412 Forestville Road
Wake Forest, Wake County, NC

Dear Mr. Kuzenski:

ECS Southeast, LLP (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to Kimley-Horn during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions assumed for this report. Should you have questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Southeast, LLP

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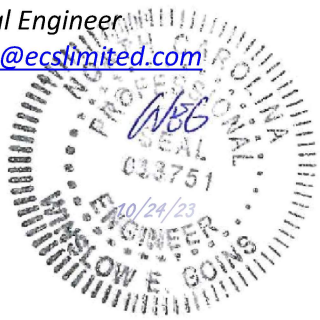

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EXECUTIVE SUMMARY

This Executive Summary is intended as a very brief overview of the primary geotechnical conditions that are expected to affect design and construction. Information gleaned from this Executive Summary should not be utilized in lieu of reading the entire geotechnical report.

- Existing fill was encountered in a few of the borings. Trace amounts of organics and debris were observed in some of the fill soil samples. The existing fill should be evaluated at the time of construction by proofrolling, excavation of test pits, hand auger borings, and/or construction excavations. If the existing fill is very soft to soft and/or contains excessive inert debris or excessive organic materials, it should not be used to support foundations, floor slabs, or pavements, and it should be undercut and replaced with engineered fill consisting of suitable materials.

- We anticipate that most of the soils encountered in the borings within the anticipated excavation depths will likely be suitable for use as engineered fill.

- Groundwater seepage was not encountered during our exploration at the depths explored.

- Partially weathered rock (PWR) was encountered in borings B-03 and B-04 at 22 feet and 24 feet below existing grade surface, respectively. The remaining borings did not encounter PWR at the depths explored. Therefore, we do not anticipate difficult excavation will likely be required.

- The planned building can be supported by conventional shallow foundations consisting of column and/or strip footings bearing on engineered fill or natural soils or approved existing fill. The footings should be sized using a net allowable soil bearing pressure of 2,000 psf.

- Based on the N-values measured in the borings, a Seismic Site Class D designation is appropriate for seismic design of the proposed building.

- The planned site retaining walls in the western portion, or the site can consist of mechanically stabilized earth (MSE) segmental retaining walls (SRWs). It is unlikely the onsite soils can be reused and backfill in the reinforced zone of the wall and imported material will be likely required.

- ECS should be retained to review the design documents for conformance with our recommendations and should be retained for construction materials testing and special inspections to facilitate proper implementation of our recommendations.

1.0 INTRODUCTION

1.1 GENERAL

The purpose of this study was to provide geotechnical information for the design of the proposed building foundations, floor slab, pavement areas, and retaining wall.

The recommendations developed for this report are based on the results of our subsurface exploration and project information provided by Kimley-Horn. This report contains the results of our subsurface exploration and laboratory testing programs, site characterization, engineering analyses, and recommendations for the design and construction of the planned development.

1.2 SCOPE OF SERVICES

The purposes of this exploration were to explore the soil and groundwater conditions at the site and to develop engineering recommendations to guide design and construction of the proposed project.

We accomplished the purposes of the study by:

- Reviewing the available publications concerning local geology of the site and performing a general site reconnaissance.
- Drilling borings to explore the subsurface soil and groundwater conditions.
- Performing laboratory tests on selected representative soil samples from the borings to evaluate pertinent engineering properties.
- Evaluating the field and laboratory data to develop appropriate engineering recommendations.

1.3 AUTHORIZATION

Our services were provided in accordance with our Proposal No. 06:24043, dated September 15, 2023, as authorized by John Kuzenski with Kimley-Horn on September 18, 2023, and the Consultant Agreement/Master Services Agreement/Contract between ECS Southeast, LLP and Kimley-Horn, dated June 11, 2021.

2.0 PROJECT INFORMATION

This report is based on the following sources of information:

- Emails between John Kuzenski with Kimley-Horn and Santhosh Mahavadi with ECS between August 22, 2023, and September 13, 2023.
- Preliminary Grading Plan prepared by Kimley-Horn dated July 25, 2023.
- Google Earth aerial photos dated between 1985 and 2023.
- United States Geologic Survey Quadrangle Map (Google Earth overlay .kmz file).
- Geologic Map of North Carolina.

2.1 SITE INFORMATION

The site is located at 1412 Forestville Road in Wake Forest, North Carolina, at the approximate location shown in the following figure.

Current Site Condition

Based on historic aerial photographs dating back to 1993, the property was occupied by a single-family residence until February 2005. Between February 2005 and July 2005, the residence was demolished. Between October 2008 and October 2009, the adjacent Wake Forest Fire Department Station 3 was constructed. From July 2010 to current day the site has remained relatively unchanged as a grass covered undeveloped lot.

2.2 PROPOSED CONSTRUCTION

The project involves site development for a 7,000 square foot warehouse building with associated pavement areas and a retaining wall on the west side of the site. We assume that the proposed building will likely be a one-story, steel-framed structure with a slab-on-grade ground floor. Design foundation loads have not been provided to us. We assume the maximum unfactored foundation loads will be:

- Maximum Column Load = 100 kips
- Maximum Wall Loads= 4 kips per foot
- Maximum Ground Floor Slab Load = 200 pounds per square foot (psf)

The structural engineer should verify these assumptions and notify ECS if the actual unfactored foundation design loads exceed or are significantly less than these assumed values.

The grading plan provided to us indicates that maximum fill depths will likely be less than 9 feet and cut depths will likely be less than 4 feet for general site grading. Cuts in the building area will likely be up to 4 feet and fill depth will likely be up to 7 feet.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

To explore the subsurface conditions at this site, a total of 9 soil test borings were performed in the proposed development areas. The borings have been performed in the proposed developed areas to depths below existing grades as shown below.

Boring No.	Proposed Structure/Site Feature	Boring Depth (feet)
B-01	Building	15
B-02	Building	15
B-03	Building	25
B-04	Building	25
P-01	Pavement	10
P-02	Pavement	10
RW-01	Retaining Wall	10
RW-02	Retaining Wall	10
RW-03	Retaining Wall	10

The borings were located by an ECS representative who used a handheld GPS unit and their approximate locations are shown on the Boring Location Plan (Figure 2) in Appendix A. Our exploration procedures are explained in greater detail in Appendix B including the insert titled Subsurface Exploration Procedure: Standard Penetration Testing (SPT).

Please note that the ground surface elevations shown on the boring logs and cross sections were not surveyed by a licensed surveyor. These elevations were interpolated using topographic information obtained from the civil drawings provided to us. They should be considered approximate.

3.1 SUBSURFACE CHARACTERIZATION

3.1.1 Regional Geology

The site is located within the Piedmont physiographic province. The Piedmont is characterized by residual overburden soils weathered in place from the underlying igneous and metamorphic rock. The topography and relief of the Piedmont uplands have developed from differential weathering of the bedrock. Because of the continued chemical and physical weathering, the bedrock in the Piedmont is now generally covered with a mantle of soil that has weathered in place from the parent bedrock. These soils have variable thicknesses and are referred to as residuum or residual soils. The residuum is typically finer grained and has higher clay content near the surface because of the advanced weathering. Similarly, the soils typically become coarser grained with increasing depth because of decreased weathering. As the degree of weathering decreases, the residual soils generally retain the overall appearance, texture, gradation and foliations of the parent rock.

The boundary between soil and rock in the Piedmont is not sharply defined. A transitional zone termed "partially weathered rock" is normally found overlying the parent bedrock. Partially weathered rock (PWR) is defined for engineering purposes as residual material with Standard Penetration Resistances (N-values) exceeding 100 blows per foot. The transition between hard/dense residual soils and partially weathered rock occurs at irregular depths due to variations in degree of weathering. Also, it is not unusual to find lenses and boulders of hard rock and/or zones of partially weathered rock within the soil mantel well above the general bedrock level.

According to the *1985 Geologic Map of North Carolina* the site is underlain by foliated to massive granitic rock of Permian to Pennsylvanian age (PPmg).

It is important to note that the natural geology within portions of the site has been modified in the past that included the placement of fill materials. The quality of man-made fills can vary significantly, and it is often difficult to assess the engineering properties of existing fills.

3.1.2 Soil Conditions

Data from the soil test borings is included in Appendix B. The subsurface conditions discussed in the following paragraphs and those shown on the boring logs represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. We note that the transition between different soil strata is usually less distinct than those shown on the boring logs. Please refer to individual boring logs that are contained in Appendix B.

Stratum	Description	Ranges of SPT (1) N-values (bpf (2))
N/A	**Topsoil** – The surface layer at the boring locations consisted of approximately 1 to 2 inches of topsoil at the test locations. Thicknesses are expected to be variable across the project site.	N/A
I	**FILL –** Soils described as Fill soils and consisting of Sands (SC/SM) were encountered at Borings B-02 and B-06 to a depth ranging between 3.5 and 10 feet below existing grade surface. Concerning debris or excessive organics were not observed in B-06. Boring B-02 contained debris described as asphalt.	6 to 19
II	**Natural Soils** – Beneath the topsoil or fill soils are natural soils described as Silty and Clayey SAND (SM and SC)	7 to 38
III	**Partially Weathered Rock (PWR)-** PWR was encountered in borings B-03 and B-04 at 22 feet and 24 feet below existing grade surface, respectively. PWR was not encountered in the remaining boring locations to the depths explored.	+100

Notes: (1) Standard Penetration Testing.
(2) bpf – Blows per foot.
(3) Partially Weathered Rock (PWR) is a transitional material between soil and rock, which retains the relic structure of the rock and exhibits Standard Penetration resistances greater than 100, but still can be penetrated by the power auger.

3.2 GROUNDWATER OBSERVATIONS

Groundwater seepage into our borings was not observed during our exploration at the depths explored. Variations in the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

3.3 LABORATORY TESTING

Classification and index property tests were performed by ECS on representative soil samples obtained from the test borings in order to aid in classifying soils according to the Unified Soil Classification System and to quantify and correlate engineering properties. Laboratory testing included moisture content testing, Atterberg Limits, washed sieve gradation analyses, and triaxial compression testing. The results of the laboratory testing program are included in Appendix C.

Each sample was visually classified on the basis of texture and plasticity in accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and including USCS classification symbols, and ASTM D2487 Standard Practice for Classification for Engineering Purposes (Unified Soil Classification System (USCS)). After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; in situ, the transitions may be gradual.

4.0 DESIGN RECOMMENDATIONS

4.1 IMPACTS ON SITE DEVELOPMENT AND DESIGN

4.1.1 Design Implications of Undocumented Fill

As previously noted, existing undocumented fill materials was encountered in borings B-02 and B-06. The undocumented fill contained trace amounts of organic material with rock fragments. Boring B-06 also encountered buried debris described as asphalt.

If very soft soils or pockets of debris, organics, stumps, etc., exist within the fill and are not removed during construction, then localized excessive differential settlements could occur in response to new structural loads and the on-going process of volume change which may still occur in the fill. If such non-uniform settlements occur, then moderate distress could result.

While most of the fill material encountered appears to be suitable for reuse, undocumented fill may be present in areas not explored during this study. The existing fill should be evaluated at the time of construction by proofrolling, excavation of test pits, hand auger borings, and/or construction excavations.

4.2 FOUNDATIONS

Provided subgrades and Engineered Fills are prepared as recommended in this report, the proposed structure can be supported by shallow foundations including column footings and continuous wall footings. We recommend the foundation design use the following parameters:

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure (1)	2,000 psf (2)	2,000 psf (2)
Acceptable Bearing Soil Material	New Engineered fill, PWR, and competent natural soils	
Minimum Width	24 inches	24 inches
Minimum Footing Embedment Depth (Below slab or outside finished grade) (3)	12 inches	12 inches
Estimated Total Settlement (4)	Less than 1 inch	Less than 1 inch
Estimated Differential Settlement (5)	Less than ½-inch	Less than ½-inch

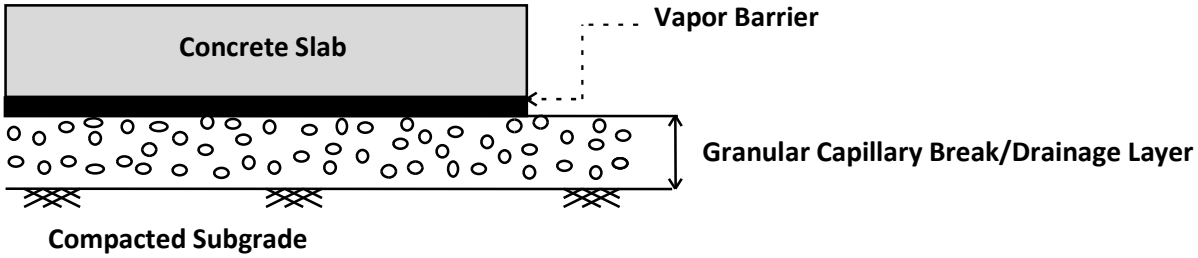
Notes:
(1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
(2) Higher bearing capacities would be available where PWR may be present at foundation bearing elevations.
(3) For bearing considerations and frost penetration requirements.
(4) Based on assumed structural loads. If final loads are different, ECS must be contacted to update foundation recommendations and settlement calculations.
(5) Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

Potential Undercuts: Most of the soils at the foundation bearing elevation are anticipated to be suitable for support of the proposed structure. If soft or unsuitable soils are observed at the footing bearing

elevations, the unsuitable soils should be undercut and removed. Undercut should be backfilled with lean concrete ($f'_c \geq$ 1,000 psi at 28 days) up to the original design bottom of footing elevation; the original footing shall be constructed on top of the hardened lean concrete.

4.3 SLABS ON GRADE

Based on a lowest finished floor elevation of 280 ft-MSL, it appears that the slabs will likely bear on a combination of new engineered fill or natural soils. The on-site natural soils are considered suitable for support of the floor slabs. Within the building footprint there may be areas of soft or yielding existing fill or natural soils that should be removed and replaced with compacted engineered fill in accordance with the recommendations included in this report. The following graphic depicts our soil-supported slab recommendations:



1. Drainage Layer Thickness: 4 inches
2. Drainage Layer Material: A compactable granular fill that will likely remain stable and support construction traffic. At least 10% to 30% of the material should pass a No. 100 sieve with a maximum aggregate size of ¼ inch. Suitable materials are GRAVEL (ABC, GW, GW-SM), SAND (SP-SM, SW-SM), and SILTY SAND (SM) with less than 30% fines.
3. Subgrade compacted to *98%* maximum dry density per ASTM D698

Soft or yielding soils may be encountered in some areas. Those soils should be removed and replaced with compacted Engineered Fill in accordance with the recommendations included in this report.

Subgrade Modulus: Provided the Engineered Fill and Granular Drainage Layer are constructed in accordance with our recommendations, the slab may be designed assuming a modulus of subgrade reaction, k_1 of 125 pci (lbs./cu. inch).

Vapor Barrier: Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture vapor penetration through the floor slab. When a vapor barrier is used, special attention should be given to surface curing of the slab to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to eliminate the vapor barrier.

Slab Isolation: Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration restricts the use of a free-floating slab such as in a drop down footing/monolithic slab configuration, the slab should be designed with adequate reinforcement and load transfer devices to reduce overstressing of the slab.

The above should be considered general guidance to assist the Owner/Developer and design team. Project specific designs, plan details or other input from the Structural Engineer of Record should control.

4.4 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The International Building Code (IBC) requires site classification for seismic design based on the upper 100 feet of a soil profile. Two primary methods are utilized in classifying sites, namely the shear wave velocity (v_s) method and the Standard Penetration Resistance (N-value) method, as indicated in the following table. The N-value method was used for this project.

SEISMIC SITE CLASSIFICATION			
Site Class	**Soil Profile Name**	**Shear Wave Velocity, Vs, (ft./s)**	**N value (bpf)**
A	Hard Rock	Vs > 5,000 fps	N/A
B	Rock	2,500 < Vs ≤ 5,000 fps	N/A
C	Very dense soil and soft rock	1,200 < Vs ≤ 2,500 fps	>50
D	Stiff Soil Profile	600 ≤ Vs ≤ 1,200 fps	15 to 50
E	Soft Soil Profile	Vs < 600 fps	<15

The Site Class for the site was evaluated by calculating a weighted average SPT N-value for the top 100 feet of the subsurface profile. Based on the conditions encountered in the borings, we recommend that a Site Class "D" be used for design of the proposed building.

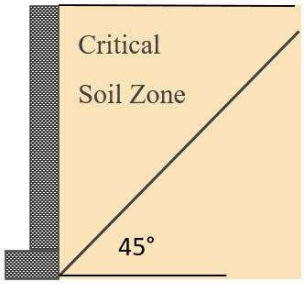
Our experience indicates that evaluation of seismic site class in North Carolina using N-values can be overly conservative. If it is evaluated that significant advantage could be gained with an improved Site Class, additional site testing could be performed to measure actual shear wave velocities at the site. ECS can provide a proposal for these services upon request.

4.5 SITE RETAINING WALLS

Unlike below grade walls, site retaining walls are free to rotate at the top (not restrained). For these walls the "Active" (k_a) soil condition should be used along with a triangular distribution of earth pressures. In addition, site retaining walls should be designed to withstand lateral earth pressures exerted by the backfill and any surcharge loads within the "Critical Soil Zone". The Critical Zone is defined as the area between the back of the retaining wall footing and an imaginary line projected upward and rearward at a 45-degree angle (see figure below).

The lateral earth pressures developed behind site retaining walls are a function of the backfill soil type, backfill slope angle, and any surcharge loads. For the design of site retaining walls, we recommend the soil parameters provided below.

RETAINING WALL BACKFILL IN THE CRITICAL SOIL ZONE	
Soil Parameter	**Estimated Value**
Soil Classification	Silty SAND (SM)
Fines Content	Max. 20%>#200 Sieve
Coefficient of Active Earth Pressure (K_a)	0.31
Retained Soil Moist Unit Weight (γ)	125 pcf
Cohesion (C)	0 psf
Angle of Internal Friction (ϕ)	32°
Friction Coefficient [Concrete on Soil] (μ)	0.40
Active Equivalent Fluid Pressure	39H (psf)



FOUNDATION SOILS – SC/SM	
Soil Parameter	**Estimated value**
Allowable Soil Bearing Pressure	3,000 psf
Minimum Wall Embedment Below Grade	24 inches
Coefficient of Passive Earth Pressure (K_p)	3.2
Soil Moist Unit Weight (γ)	120 pcf
Cohesion (C)	10 psf
Interface Friction Angle [Concrete on Soil] (ϕ_f)	20°
Sliding Friction Coefficient [Concrete on Soil] (μ)	0.35
Passive Equivalent Fluid Pressure	384H (psf)

It is critical that the soils used for backfilling of the retaining walls meet the soil parameters recommended above. If the soils available do not meet those parameters, then ECS should be contacted to provide revised values, and to confirm that only suitable soils will likely be used for wall backfill.

Care should be used to avoid the operation of heavy equipment to compact the wall backfill since it may overload and damage the wall. In addition, such loads are not typically considered in the design of site retaining walls, and are not provided for in our recommendations.

Wall Drainage: Retaining walls should be provided with a wall and foundation drainage system to relieve hydrostatic pressures which may develop behind the walls. This system should consist of weepholes through the wall and/or a 4-inch perforated, closed joint drain line located along the backside of the walls above the top of the footing. The drain line should be surrounded by a minimum of 6 inches of AASHTO #57 Stone wrapped with an approved non-woven geotextile, such as Mirafi 140-N or equivalent. Wall drains can consist of a 12-inch wide zone of free draining gravel, such as AASHTO #57 Stone, employed directly behind the wall and separated from the soils beyond with a non-woven geotextile. Alternatively, the wall drain can consist of a suitable geocomposite drainage board material. The wall drain should be hydraulically connected to the foundation drain.

4.6 PAVEMENTS

Design Traffic Loading: Design traffic loading information for the pavements has not been provided to us. Based on our experience with similar projects, we assume that the proposed private pavements will likely be subjected to a mix of traffic consisting of passenger cars, pickups, vans, SUV's, delivery trucks, and garbage trucks. Unless actual design traffic loading conditions are provided, we will estimate the 20-year 18-kip Equivalent Single Axle Loads (ESALS) for assumed vehicle types and average daily traffic. Based on these assumptions, we estimate a pavement design traffic load of 10,000 and 50,000 ESALs in 20 years light duty and heavy-duty pavements, respectively. The civil engineer should verify these assumptions and notify ECS if the actual pavement design traffic loading conditions exceed or are significantly less than these assumed values.

Subgrade Characteristics: Based on the results of our soil test borings and anticipated site grading, we anticipate that the soils that will likely be exposed as pavement subgrades, exposed in cuts and placed as fill, will likely consist mainly of Silty and Clayey SAND (SM and SC) material.

California Bearing Ratio (CBR) testing was not performed as part of this study. For preliminary design purposes, we recommend assuming a design CBR value of 6 be utilized based upon our visual classification of likely pavement subgrade soils. Prior to subbase placement and paving, CBR testing on the subgrade soils should be performed to confirm the soil engineering properties.

No traffic data was available; therefore, we have made assumptions in order to provide preliminary pavement sections. The pavement sections below are guidelines and may or may not comply with local jurisdictional minimums, but can be adjusted with more complete traffic data and actual CBR lab testing.

PROPOSED PAVEMENT SECTIONS				
	FLEXIBLE PAVEMENT			RIGID PAVEMENT
MATERIAL	Light Duty	Medium Duty	Heavy Duty	Heavy Duty
Portland Cement Concrete Air-Entrained (f'_c = 4,000 psi)	-	-	-	6.0 in.
Asphalt Surface Course (S9.5B)	3.0 in	-	1.0 in	-
Asphalt Intermediate Course (I19.0C)	-	-	2.5 in	-
Aggregate Base Course (ABC)	6.0 in	-	8.0 in	6.0 in

In general, heavy-duty sections should be used in areas that will likely be subjected to trucks, buses, or other similar vehicles including main drive lanes of the development. Light duty sections are appropriate for automobile traffic and parking areas.

Concrete Pavements: Concentrated front-wheel loads are frequently imposed on pavements in trash dumpster and truck loading dock areas. This type of loading typically results in rutting and scuffing of bituminous pavements and ultimately pavement failures and costly repairs. Therefore, we recommend that the pavements in trash pickup and loading dock aprons areas utilize the Portland Cement Concrete (PCC) pavement section. It may be prudent to use rigid pavement sections in areas planned for heavy

truck traffic.

The Portland cement concrete pavement section should consist of air-entrained Portland cement concrete having a minimum 28-day compressive strength of 4,000 psi. The rigid pavement section should be provided with construction joints and saw-cut control joints at appropriate intervals per Portland Cement Association (PCA) requirements. The construction joints should be reinforced with dowels to transfer loads across the joints. Wire mesh should be included to control shrinkage cracking of the concrete. The concrete pavement section thickness for plain jointed concrete pavement is with reinforcement dowels only at construction joints.

Construction Traffic: It is important to note that the design sections do not account for construction traffic loading. An incomplete pavement section without the final 1 inch of surface course asphalt can be used for temporary construction traffic, such as concrete trucks and tractor trailer material delivery trucks. Please note, however, that damage to the asphalt already placed is likely to occur in localized areas, and it should be repaired by removal and replacement with new asphalt at or near the end of construction, prior to placement of the surface course.

Alternatively, heavy construction vehicles and traffic should be limited to a temporary pavement section consisting of 12 inches of compacted ABC overlying a high-strength woven geotextile (Tencate Mirafi HP270 or equivalent). The temporary pavement section could then be graded and covered with asphalt to achieve the final design heavy duty pavement section.

Public Streets/Roads: It should also be noted that these design recommendations may not satisfy the local municipality or North Carolina Department of Transportation guidelines. Any roadways constructed for public use and to be dedicated to the local municipality or State for repair and maintenance must be designed in accordance with the local municipality or State requirements.

4.7 SLOPE STABILITY

Our exploration did not include an analysis of slope stability for any temporary or permanent condition. However, within construction areas, we recommend temporary cut slopes without seepage be constructed no steeper than 1.5H:1V.

Permanent fill or cut slopes in the existing site soils without seepage should be designed no steeper than 2H:1V for slopes heights of 20 feet or less. Slopes exceeding 20 feet in height or subject to seepage should be evaluated in more detail. For slopes greater than 25 feet in height, the slopes should include mid-slope benches at about 20 feet (vertical) intervals for stability and to reduce surface erosion due to sheet flow. Benches should be about 8 to 10 feet wide. In building, pavement, and equipment areas, minimum top of slope setbacks of 25 feet and 10 feet are recommended, respectively.

During construction, slopes should be regularly evaluated for signs of movement, seepage, or an unsafe condition. Soil slopes should be covered for protection from rain, and surface runoff condition. Stormwater runoff should be diverted away from the slopes. For erosion protection, a protective cover of grass or other vegetation should be established on permanent soil slopes as soon as possible. We recommend using erosion blankets on slopes greater than 20 feet in height for erosion protection.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

5.1.1 Stripping and Grubbing

The subgrade preparation should consist of stripping vegetation, rootmat, topsoil, existing fill, and soft or unsuitable materials from the 10-foot expanded building and 5-foot expanded pavement limits, and 5 feet beyond the toe of Engineered Fills. Borings performed in "undisturbed" areas of the site contained an observed 1 or 2 inches of topsoil. Deeper topsoil or organic laden soils may be present in wet, low-lying, and poorly drained areas. ECS should be retained to verify that topsoil and unsuitable surficial materials have been removed prior to the placement of engineered fill or construction of structures.

5.1.2 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by ECS. The exposed subgrade should be thoroughly proofrolled with construction equipment having a minimum axle load of 10 tons [e.g. fully loaded tandem-axle dump truck]. Proofrolling should be traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of ECS. This procedure is intended to assist in identifying localized yielding materials.

Where proofrolling identifies areas that are yielding or "pumping" subgrade those areas should be repaired prior to the placement of subsequent Engineered Fill or other construction materials. Methods of stabilization include undercutting, moisture conditioning, or chemical stabilization. The situation should be discussed with ECS to evaluate the appropriate procedure. Test pits may be excavated to explore the shallow subsurface materials to help in evaluating the cause of the observed yielding materials, and to assist in the evaluation of appropriate remedial actions to create a firm and unyielding subgrade.

5.2 EARTHWORK OPERATIONS

5.2.1 Excavation Considerations

Excavation Safety: Excavations and slopes should be made and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing and constructing stable, temporary excavations and slopes and should shore, slope, or bench the sides of the excavations and slopes as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

Excavatibility: Based on the assumed design grades, we anticipate that most of the natural soils encountered in the test borings can be removed with conventional earth excavation equipment such as track-mounted backhoes, loaders, or bulldozers.

5.2.2 Existing Man-Placed Fill

Existing fill was encountered in a few of the borings. Trace amounts of organics and debris were observed in some of the fill soil samples. The existing fill should be evaluated at the time of construction by proofrolling, excavation of test pits, hand auger borings, and/or construction excavations. If the existing fill is very soft to soft and/or contains excessive inert debris or excessive organic materials, it should not be used to support foundations, floor slabs, or pavements, and it should be undercut and replaced with engineered fill consisting of suitable materials.

5.2.5 Suitability of On-Site Soils for Reuse as Engineered Fill

On-Site Borrow Suitability: The on-site soils meeting the classifications for recommended engineered fill, plus meeting the restrictions on separation distances, organic content, and debris, may be used as engineered fill. We anticipate that most of the soils encountered in the borings within the anticipated excavation depths to be suitable for use as engineered fill.

Engineered Fill Materials: Materials for use as Engineered Fill should consist of inorganic soils with the following engineering properties and compaction requirements.

ENGINEERED FILL SOIL INDEX PROPERTIES	
Subject	**Property**
Soil Classification	CL, ML, SM, SC, SW, SP, GW, GM or GC
Max. Particle Size	3 inches
LL and PI for Fill in Building and Pavement Areas	LL $\leq$ 40, PI $\leq$ 20
Minimum dry unit weight (in place)	$\geq$ 90 pcf
Max. organic content	4% by dry weight

ENGINEERED FILL COMPACTION REQUIREMENTS	
Subject	**Requirement**
Compaction Standard	Standard Proctor, ASTM D698
Required Compaction	95% of Max. Dry Density (98% in the top 1 foot)
Moisture Content	$\pm$3 % points of the soil's optimum value
Loose Thickness	8 inches prior to compaction

Poor Quality Fill Materials: Poor quality fill materials include materials which do not satisfy the requirements for engineered materials, such as topsoil, organic materials, debris, debris-laden fill and highly elastic/plastic soils such as ELASTIC SILT (ML) and FAT CLAY (CH).

Fill Placement Considerations: Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen materials at the time of placement, and frozen or frost-heaved soils should be removed prior to placement of Engineered Fill or

other fill soils and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned. Fill material should be placed in horizontal lifts. Proper drainage should be maintained during the earthwork phases of construction to avoid ponding of water which can lead to degradation of the subgrade soils.

Subgrade Benching: In fill areas, new soil embankments should be constructed from the bottom up. End dumping from the top of the slope should not be permitted. Fill should not be placed on ground with a slope steeper than 5H:1V. Where steeper slopes exist, the ground should be benched to allow for fill placement on a horizontal surface. Each fill layer should be benched into the existing slope for stability.

5.3 FOUNDATION AND SLAB OBSERVATIONS

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 1 to 3-inch thick “mud mat” of “lean” concrete should be placed on the bearing soils before the placement of reinforcing steel.

Footing Subgrade Observations: We anticipate that most of the soils at the foundation bearing elevation are anticipated to be suitable for support of the proposed structure. It is important to have the Geotechnical Engineer of Record (ECS), or their authorized representative, observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are what was anticipated.

Slab Subgrade Verification: Prior to placement of a drainage layer, the subgrade should be prepared in accordance with the recommendations found in **Section 5.1.2 Proofrolling**.

5.4 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally suitable for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Loose or unsuitable materials encountered should be removed and replaced with suitable compacted Engineered Fill, or pipe stone bedding material.

Utility Backfilling: The granular bedding material should be at least 4 inches thick, but not less than that specified by the civil engineer’s project drawings and specifications. We recommend that the bedding materials be placed up to the springline of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the requirements for Engineered Fill and Fill Placement.

5.5 ADDITIONAL CONSIDERATIONS

During the cooler and wetter periods of the year, delays and additional earthwork costs should be anticipated. At these times, reduction of soil moisture may need to be accomplished by a combination of mechanical manipulation and the use of chemical additives, such as lime or cement, to lower moisture contents to levels appropriate for compaction. Alternatively, during the drier times of the year, such as the summer months, moisture may need to be added to the soil to provide adequate moisture for successful compaction according to the project requirements.

Measures should also be taken to limit site disturbance, especially from rubber-tired heavy construction equipment, and to control and remove surface water from development areas, including structural and pavement areas.

Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are dug. If surface water intrusion or exposure softens the bearing soils, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, we recommend that the foundations be covered or otherwise protected.

Positive site drainage should be maintained during earthwork operations, which should help maintain the integrity of the soil. Placement of fill on the near surface soils, which have become saturated, could be very difficult. When wet, these soils will likely degrade quickly with disturbance from contractor operations and will likely be extremely difficult to stabilize for fill placement.

Where unacceptable materials are encountered, they must be evaluated and may need to be undercut and replaced or improved by re-compaction.

The surface of the site should be kept properly graded to enhance drainage of the surface water away from the proposed structure areas during the construction phase. We recommend that an attempt be made to enhance the natural drainage without interrupting its pattern.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report. ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

The description of the proposed project is based on information provided to ECS by Kimley-Horn. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

We recommend that ECS review the final project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

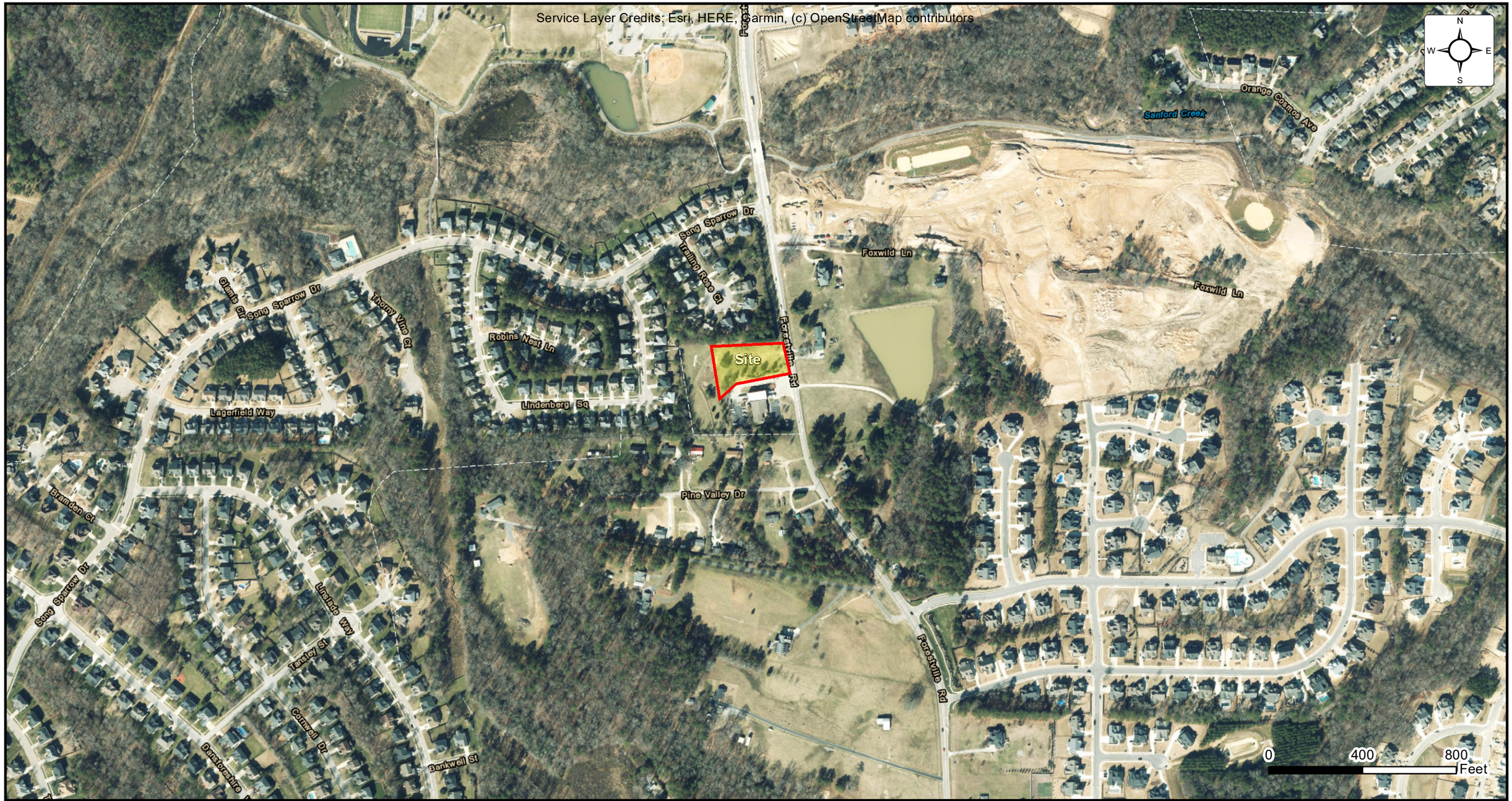
Because undocumented fill is present on this site, the Owner must assess the relative risk that unacceptable material could have been buried in the proposed development area which was not detected in the widely spaced borings.

Field observations, monitoring, and quality assurance testing during earthwork and foundation installation are an extension of and integral to the geotechnical design recommendation. We recommend that the owner retain these quality assurance services and that ECS be allowed to continue our involvement throughout these critical phases of construction to provide general consultation as issues arise. We would be pleased to provide an estimated cost for these services at the appropriate time.

This report is provided for the exclusive use of Kimley-Horn and their project specific design team. This report is not intended to be used or relied upon in connection with other projects or by other third parties. ECS disclaims liability for any such third-party use or reliance without express written permission.

Appendix A - Drawings and Reports

Site Location Diagram
Boring Location Diagram(s)
Subsurface Cross-Section(s)

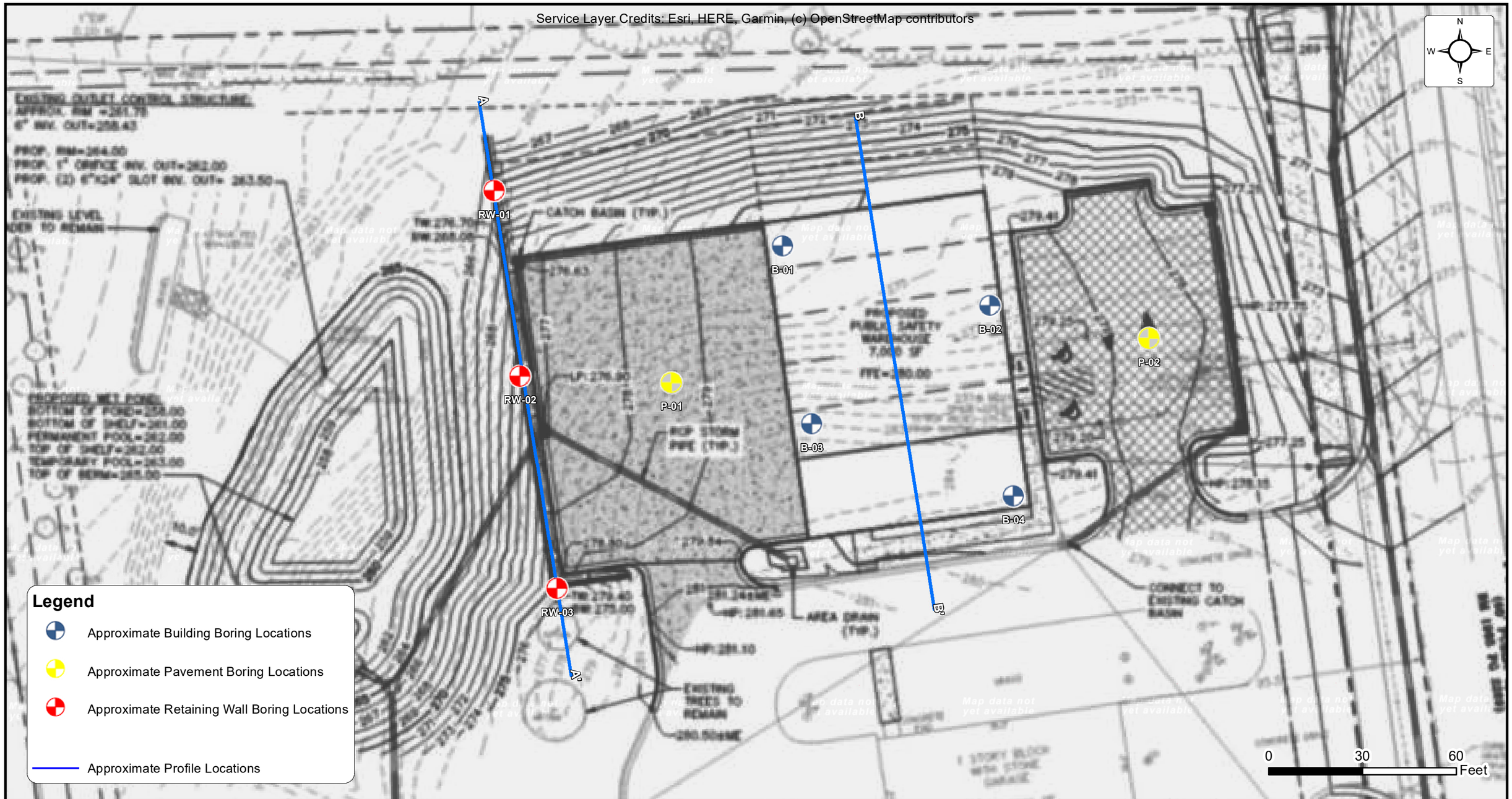


SITE LOCATION DIAGRAM
PUBLIC SAFETY WAREHOUSE (TOWN OF WAKE FOREST)

1412 FORESTVILLE ROAD, WAKE FOREST, NORTH CAROLINA
KIMLEY-HORN

ENGINEER	SKM1
SCALE	AS NOTED
PROJECT NO.	06:25219
FIGURE	1 OF 2
DATE	10/16/2023

Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors



Legend

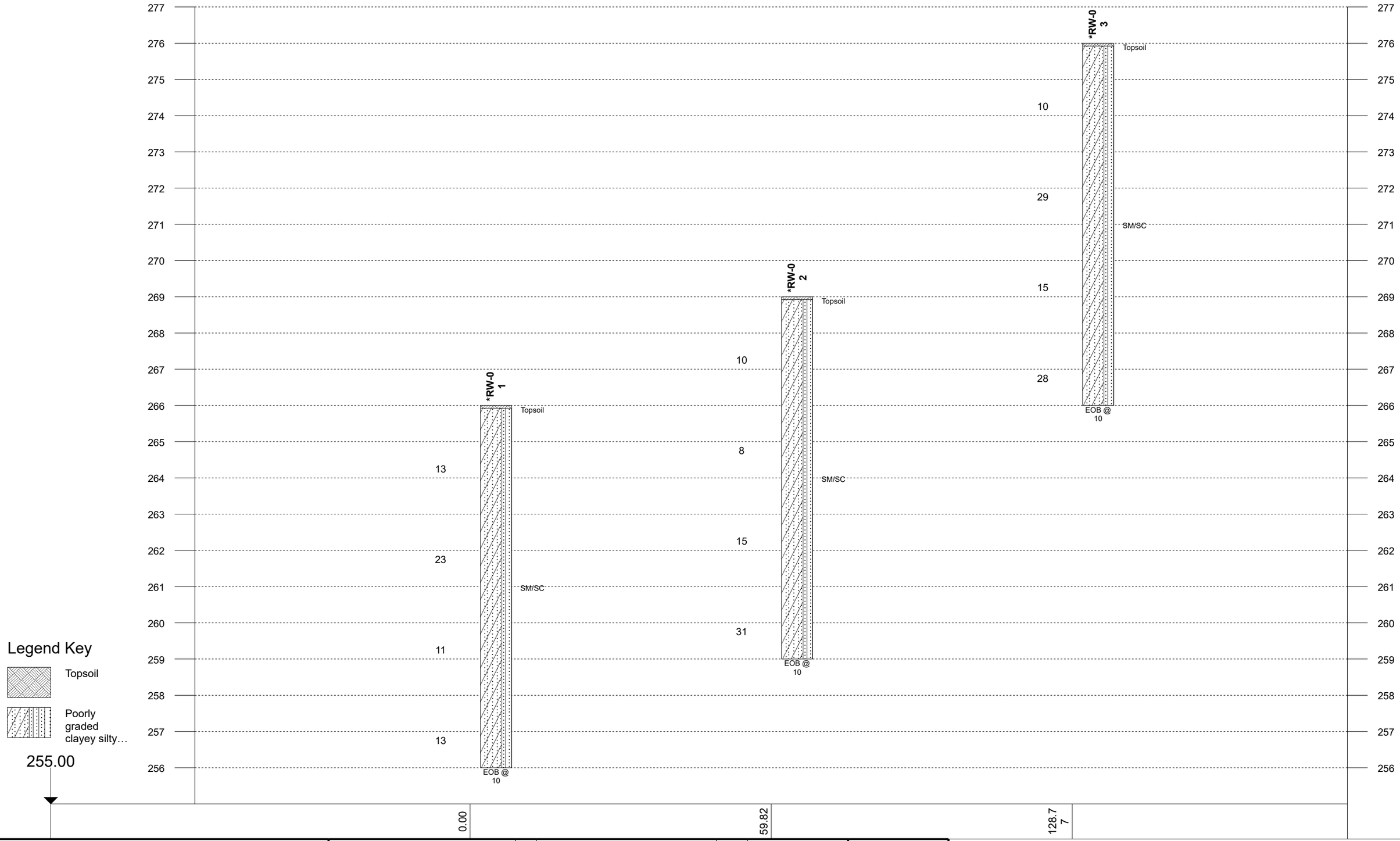
- Approximate Building Boring Locations
- Approximate Pavement Boring Locations
- Approximate Retaining Wall Boring Locations
- Approximate Profile Locations

BORING LOCATION DIAGRAM
PUBLIC SAFETY WAREHOUSE (TOWN OF WAKE FOREST)

1412 FORESTVILLE ROAD, WAKE FOREST, NORTH CAROLINA

KIMLEY-HORN

ENGINEER	SKM1
SCALE	AS NOTED
PROJECT NO.	06:25219
FIGURE	2 OF 2
DATE	10/16/2023



Legend Key

- Topsoil
- Poorly graded clayey silty…

255.00

Notes:

1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit Water Content Liquid Limit (X—●—△)	
[FINES CONTENT %]	
BOTTOM OF CASING	
100 LOSS OF CIRCULATION	
○ CALIBRATED PENETROMETER	

▽ WL (First Encountered)	Fill
▼ WL (Completion)	Possible Fill
▼ WL (Estimated Seasonal High Water)	Probable Fill
▽ WL (Stabilized)	Rock

GENERALIZED SUBSURFACE SOIL PROFILE

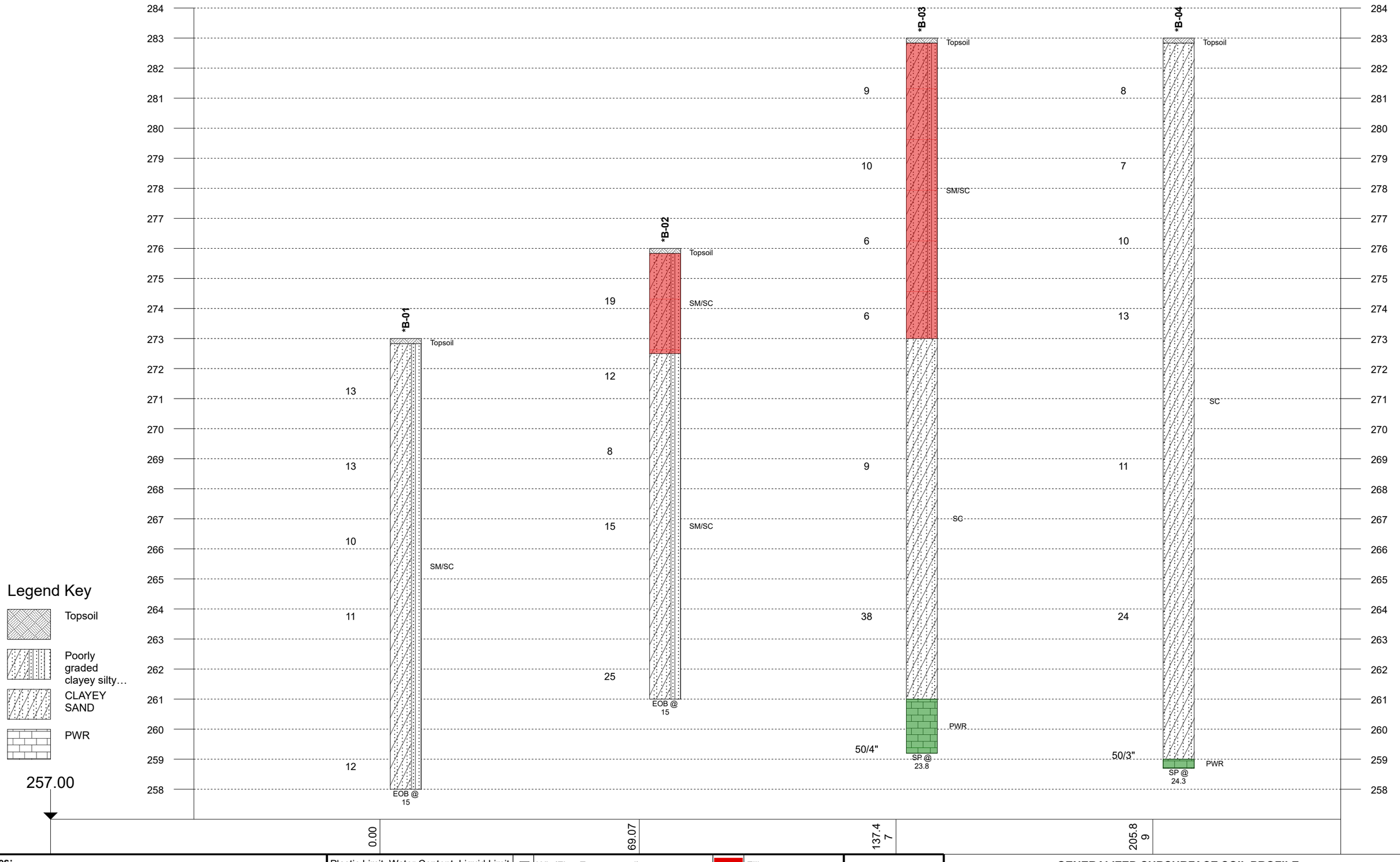
A-A'

Public Safety Warehouse (Town of Wake Forest)

Kimley-Horn

1412 Forestville Road, Wake Forest, North Carolina, 27587

Project No:	06:25219	Date:	10/18/2023



Legend Key

- Topsoil
- Poorly graded clayey silty…
- CLAYEY SAND
- PWR

257.00

Notes:

1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit Water Content Liquid Limit X——●——△	
[FINES CONTENT %]	
BOTTOM OF CASING	
100 LOSS OF CIRCULATION	
○ CALIBRATED PENETROMETER	

▽	WL (First Encountered)		Fill
▼	WL (Completion)		Possible Fill
▼	WL (Estimated Seasonal High Water)		Probable Fill
▽	WL (Stabilized)		Rock

GENERALIZED SUBSURFACE SOIL PROFILE

B-B'

Public Safety Warehouse (Town of Wake Forest)

Kimley-Horn

1412 Forestville Road, Wake Forest, North Carolina, 27587

Project No:	06:25219	Date:	10/18/2023

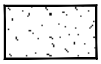
Appendix B – Field Operations

Reference Notes
Exploration Procedures
Boring Logs

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]


ASPHALT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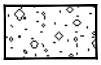
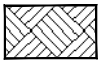
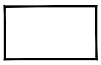
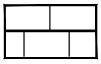

GRAVEL

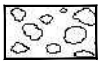

TOPSOIL

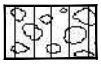

VOID


BRICK

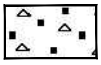

AGGREGATE BASE COURSE

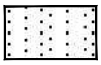

GW **WELL-GRADED GRAVEL**
gravel-sand mixtures, little or no fines

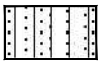

GP **POORLY-GRADED GRAVEL**
gravel-sand mixtures, little or no fines


GM **SILTY GRAVEL**
gravel-sand-silt mixtures

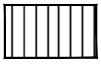

GC **CLAYEY GRAVEL**
gravel-sand-clay mixtures

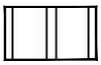

SW **WELL-GRADED SAND**
gravelly sand, little or no fines

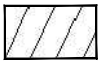

SP **POORLY-GRADED SAND**
gravelly sand, little or no fines


SM **SILTY SAND**
sand-silt mixtures

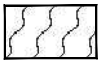

SC **CLAYEY SAND**
sand-clay mixtures

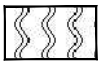

ML **SILT**
non-plastic to medium plasticity

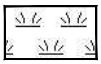

MH **ELASTIC SILT**
high plasticity


CL **LEAN CLAY**
low to medium plasticity


CH **FAT CLAY**
high plasticity


OL **ORGANIC SILT or CLAY**
non-plastic to low plasticity


OH **ORGANIC SILT or CLAY**
high plasticity


PT **PEAT**
highly organic soils

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, Q_P[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[5]	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective *(ex: "Silty")*	25 - 45	30 - 45

WATER LEVELS[6]

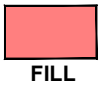

WL (First Encountered)


WL (Completion)


WL (Seasonal High Water)


WL (Stabilized)

FILL AND ROCK


FILL


POSSIBLE FILL


PROBABLE FILL


ROCK

[1]Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

[2]To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

[3]Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

[4]Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[5]Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[6]The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

[7]Minor deviation from ASTM D 2488-17 Note 14.

[8]Percentages are estimated to the nearest 5% per ASTM D 2488-17.

SUBSURFACE EXPLORATION PROCEDURE: STANDARD PENETRATION TESTING (SPT) ASTM D 1586 Split-Barrel Sampling

Standard Penetration Testing, or **SPT**, is the most frequently used subsurface exploration test performed worldwide. This test provides samples for identification purposes, as well as a measure of penetration resistance, or N-value. The N-Value, or blow counts, when corrected and correlated, can approximate engineering properties of soils used for geotechnical design and engineering purposes.

SPT Procedure:

- Involves driving a hollow tube (split-spoon) into the ground by dropping a 140-lb hammer a height of 30-inches at desired depth
- Recording the number of hammer blows required to drive split-spoon a distance of 18-24 inches (in 3 or 4 Increments of 6 inches each)

- Auger is advanced* and an additional SPT is performed
- One SPT typically performed for every two to five feet. An approximate 1.5 inch diameter soil sample is recovered.

**Drilling Methods May Vary*— The predominant drilling methods used for SPT are open hole fluid rotary drilling and hollow-stem auger drilling.

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Kimley-Horn	**06:25219**	**B-01**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Public Safety Warehouse (Town of Wake Forest)	**Bridger Drilling Inc.**

SITE LOCATION: **1412 Forestville Road, Wake Forest, North Carolina, 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
795749.6	**2145770.2**		**273.00**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[2.00"]			
	S-1	SS	18	18	(SM/SC) SILTY/CLAYEY SAND, contains slight mica, brown to reddish brown, moist, medium dense to loose to medium dense			5-6-7 (13)
	S-2	SS	18	18				6-6-7 (13)
5							268	
	S-3	SS	18	18				4-4-6 (10)
	S-4	SS	18	18				4-5-6 (11)
10							263	
	S-5	SS	18	18				4-5-7 (12)
15					**END OF BORING AT 15 FT**		258	
20							253	
25							248	
30							243	

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT %
[FINES CONTENT] % (10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	BORING STARTED: **Sep 27 2023**		CAVE IN DEPTH:
WL (Completion) **DRY**	BORING COMPLETED: **Sep 27 2023**		HAMMER TYPE: **Auto**
WL (Seasonal High Water)	EQUIPMENT: **CME 55**	LOGGED BY: **BAH1**	DRILLING METHOD: **2-1/4" HSA**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Kimley-Horn	**06:25219**	**B-02**	**1 of 1**

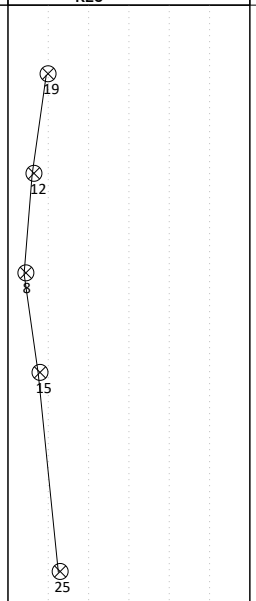
PROJECT NAME:	DRILLER/CONTRACTOR:
Public Safety Warehouse (Town of Wake Forest)	**Bridger Drilling Inc.**

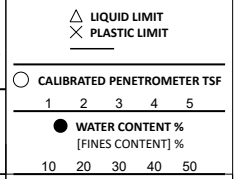
SITE LOCATION: **1412 Forestville Road, Wake Forest, North Carolina, 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
795730.5	**2145836.6**		**276.00**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[2.00"]			
	S-1	SS	18	18	(SM/SC FILL) FILL, SILTY/CLAYEY SAND, contains asphalt and rock fragments, moist, medium dense			12-12-7 (19)
	S-2	SS	18	18	(SM/SC) SILTY/CLAYEY SAND, reddish brown, moist, medium dense to loose to medium dense		271	5-6-6 (12)
5	S-3	SS	18	18				4-4-4 (8)
	S-4	SS	18	18				4-6-9 (15)
10							266	
	S-5	SS	18	18				9-12-13 (25)
15					**END OF BORING AT 15 FT**		261	
20							256	
25							251	
30							246	





THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	BORING STARTED: **Sep 27 2023**	CAVE IN DEPTH: **12.00**	
WL (Completion) **DRY**	BORING COMPLETED: **Sep 27 2023**	HAMMER TYPE: **Auto**	
WL (Seasonal High Water)	EQUIPMENT: **CME 55**	LOGGED BY: **BAH1**	DRILLING METHOD: **2-1/4" HSA**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

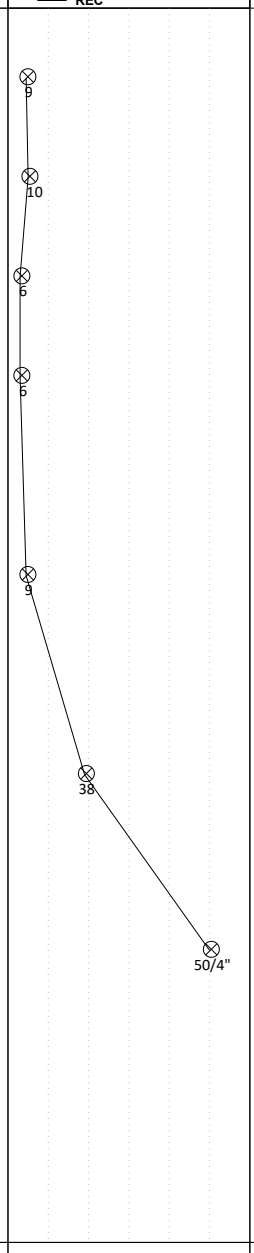
CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Kimley-Horn	**06:25219**	**B-03**	**1 of 1**

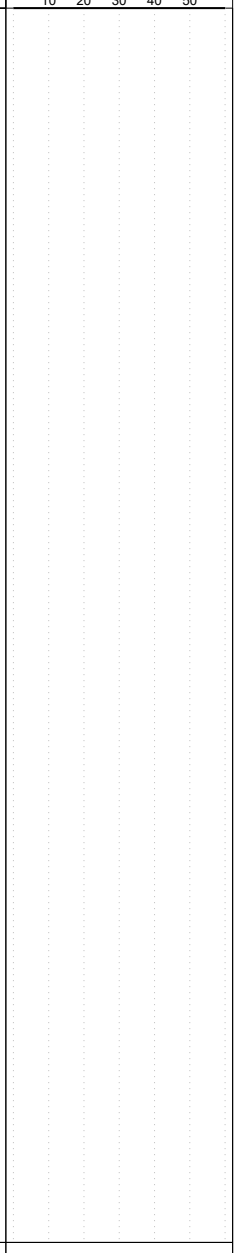
PROJECT NAME:	DRILLER/CONTRACTOR:
Public Safety Warehouse (Town of Wake Forest)	**Bridger Drilling Inc.**

SITE LOCATION:	LOSS OF CIRCULATION
1412 Forestville Road, Wake Forest, North Carolina, 27587	

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
795692.7	**2145779.6**		**283.00**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[2.00"]			
	S-1	SS	18	18	(SM/SC FILL) FILL, SILTY/CLAYEY SAND, trace organics, contains rock fragments, dark brown, moist, loose to medium dense to loose			3-5-4 (9)
	S-2	SS	18	18				3-5-5 (10)
5							278	
	S-3	SS	18	18				3-3-3 (6)
	S-4	SS	18	18				2-3-3 (6)
10					(SC) CLAYEY SAND, trace silt, contains mica, reddish brown and black, moist, loose to dense		273	
	S-5	SS	18	18				2-4-5 (9)
15							268	
	S-6	SS	18	18				5-16-22 (38)
20							263	
	S-7	SS	4	4	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND [Weathered ROCK]			50/4" (50/4")
					SPOON REFUSAL AT 23.8 FT			
25							258	
30							253	





THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	BORING STARTED: **Sep 27 2023**	CAVE IN DEPTH: **19.50**	
WL (Completion) **DRY**	BORING COMPLETED: **Sep 28 2023**	HAMMER TYPE: **Auto**	
WL (Seasonal High Water)	EQUIPMENT: **CME 55**	LOGGED BY: **BAH1**	DRILLING METHOD: **2-1/4" HSA**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Kimley-Horn	**06:25219**	**B-04**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Public Safety Warehouse (Town of Wake Forest)	**Bridger Drilling Inc.**

SITE LOCATION: **1412 Forestville Road, Wake Forest, North Carolina, 27587**

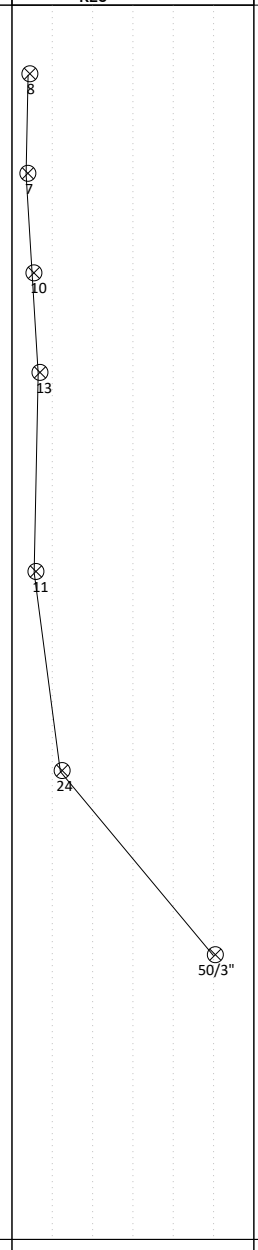
LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
795669.7	**2145844.1**		**283.00**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[2.00"]			
	S-1	SS	18	18	(SC) CLAYEY SAND, trace silt, orangish brown, moist, loose to medium dense			4-4-4 (8)
	S-2	SS	18	18				4-4-3 (7)
5	S-3	SS	18	18			278	3-4-6 (10)
	S-4	SS	18	18				4-6-7 (13)
10	S-5	SS	18	18			273	3-5-6 (11)
	S-6	SS	18	18			268	5-11-13 (24)
20	S-7	SS	9	9	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND [Weathered ROCK]		263	42-50/3" (50/3")
25					**SPOON REFUSAL AT 24.3 FT**		258	
30							253	

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT %
[FINES CONTENT] % (10 20 30 40 50)



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	BORING STARTED: **Sep 27 2023**	CAVE IN DEPTH: **17.50**	
WL (Completion) **DRY**	BORING COMPLETED: **Sep 27 2023**	HAMMER TYPE: **Auto**	
WL (Seasonal High Water)	EQUIPMENT: **CME 55**	LOGGED BY: **BAH1**	DRILLING METHOD: **2-1/4" HSA**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Kimley-Horn	**06:25219**	**P-01**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Public Safety Warehouse (Town of Wake Forest)	**Bridger Drilling Inc.**

SITE LOCATION: **1412 Forestville Road, Wake Forest, North Carolina, 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
795705.9	**2145734.7**		**277.00**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[1.00"]			
	S-1	SS	18	18	(SM/SC) SILTY/CLAYEY SAND, contains mica, reddish brown, moist, loose			3-5-5 (10)
	S-2	SS	18	18				5-5-2 (7)
5	S-3	SS	18	18			272	4-4-4 (8)
	S-4	SS	18	18				3-3-5 (8)
10					**END OF BORING AT 10 FT**		267	
15							262	
20							257	
25							252	
30							247	

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT %
[FINES CONTENT] % (10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Sep 27 2023**	CAVE IN DEPTH: **6.80**	
▼ WL (Completion) **DRY**	BORING COMPLETED: **Sep 27 2023**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **CME 55**	LOGGED BY: **BAH1**	DRILLING METHOD: **2-1/4" HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Kimley-Horn	**06:25219**	**P-02**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Public Safety Warehouse (Town of Wake Forest)	**Bridger Drilling Inc.**

SITE LOCATION: **1412 Forestville Road, Wake Forest, North Carolina, 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
795720.1	**2145887.5**		**278.00**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[1.00"]			
	S-1	SS	18	18	(SM/SC) SILTY/CLAYEY SAND, contains mica, reddish brown, moist, loose to medium dense			4-4-4 (8)
	S-2	SS	18	18				4-3-4 (7)
5							273	
	S-3	SS	18	18				4-4-6 (10)
	S-4	SS	18	18				4-5-6 (11)
10					**END OF BORING AT 10 FT**		268	
15							263	
20							258	
25							253	
30							248	

STANDARD PENETRATION BLOWS/FT
20 40 60 80 100
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF
1 2 3 4 5
WATER CONTENT %
[FINES CONTENT] %
10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)		BORING STARTED: **Sep 27 2023**	CAVE IN DEPTH: **7.50**
▼ WL (Completion)	**DRY**	BORING COMPLETED: **Sep 27 2023**	HAMMER TYPE: **Auto**
⧩ WL (Seasonal High Water)		EQUIPMENT: **CME 55** / LOGGED BY: **BAH1**	DRILLING METHOD: **2-1/4" HSA**
⧩ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Kimley-Horn	**06:25219**	**RW-01**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Public Safety Warehouse (Town of Wake Forest)	**Bridger Drilling Inc.**

SITE LOCATION: **1412 Forestville Road, Wake Forest, North Carolina, 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
795767.3	**2145678.0**		**266.00**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[1.00"]			
	S-1	SS	18	18	(SM/SC) SILTY/CLAYEY SAND, contains mica, reddish brown to orangish brown, moist, medium dense			4-6-7 (13)
	S-2	SS	18	18				10-12-11 (23)
5							261	
	S-3	SS	18	18				4-4-7 (11)
	S-4	SS	18	18				4-6-7 (13)
10					**END OF BORING AT 10 FT**		256	
15							251	
20							246	
25							241	
30							236	

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)

ROCK QUALITY DESIGNATION & RECOVERY — RQD — REC

LIQUID LIMIT △ PLASTIC LIMIT ×

CALIBRATED PENETROMETER TSF (1 2 3 4 5)

WATER CONTENT % ● [FINES CONTENT] % (10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Sep 27 2023**	CAVE IN DEPTH: **7.50**	
▼ WL (Completion) **DRY**	BORING COMPLETED: **Sep 27 2023**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **CME 55**	LOGGED BY: **BAH1**	DRILLING METHOD: **2-1/4" HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Kimley-Horn	**06:25219**	**RW-02**	**1 of 1**

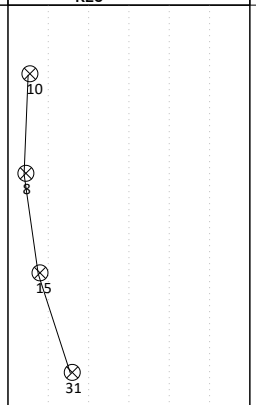
PROJECT NAME:	DRILLER/CONTRACTOR:
Public Safety Warehouse (Town of Wake Forest)	**Bridger Drilling Inc.**

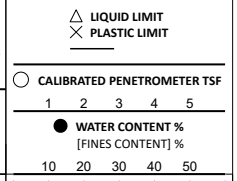
SITE LOCATION: **1412 Forestville Road, Wake Forest, North Carolina, 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
795708.1	**2145686.3**		**269**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[1.00"]			
	S-1	SS	18	18	(SM/SC) SILTY/CLAYEY SAND, contains mica, brown to orangish brown, moist, loose to dense			4-5-5 (10)
	S-2	SS	18	18				4-4-4 (8)
5							264	
	S-3	SS	18	18				3-5-10 (15)
	S-4	SS	18	18				12-14-17 (31)
10					**END OF BORING AT 10 FT**		259	
15							254	
20							249	
25							244	
30							239	





THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	BORING STARTED: **Sep 27 2023**		CAVE IN DEPTH:
WL (Completion) **DRY**	BORING COMPLETED: **Sep 27 2023**		HAMMER TYPE: **Auto**
WL (Seasonal High Water)	EQUIPMENT: **CME 55**	LOGGED BY: **BAH1**	DRILLING METHOD: **2-1/4" HSA**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Kimley-Horn	**06:25219**	**RW-03**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Public Safety Warehouse (Town of Wake Forest)	**Bridger Drilling Inc.**

SITE LOCATION: **1412 Forestville Road, Wake Forest, North Carolina, 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
795640.1	**2145698.1**		**266**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[1.00"]			
	S-1	SS	18	18	(SM/SC) SILTY/CLAYEY SAND, contains mica, brown to reddish brown to orangish brown, moist, loose to medium dense			4-5-5 (10)
	S-2	SS	18	18				4-9-20 (29)
5							271	
	S-3	SS	18	18				5-6-9 (15)
	S-4	SS	18	18				9-12-16 (28)
10					**END OF BORING AT 10 FT**		266	
15							261	
20							256	
25							251	
30							246	

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT %
[FINES CONTENT] % (10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	BORING STARTED: **Sep 27 2023**		CAVE IN DEPTH:
WL (Completion) **DRY**	BORING COMPLETED: **Sep 27 2023**		HAMMER TYPE: **Auto**
WL (Seasonal High Water)	EQUIPMENT: **CME 55**	LOGGED BY: **BAH1**	DRILLING METHOD: **2-1/4" HSA**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

Appendix C – Laboratory Testing

Plasticity Chart(s)
Triaxial Shear Test Results

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

AASHTO ACCREDITED

Tested By	GS
Date	10/16/23
Checked By	VB

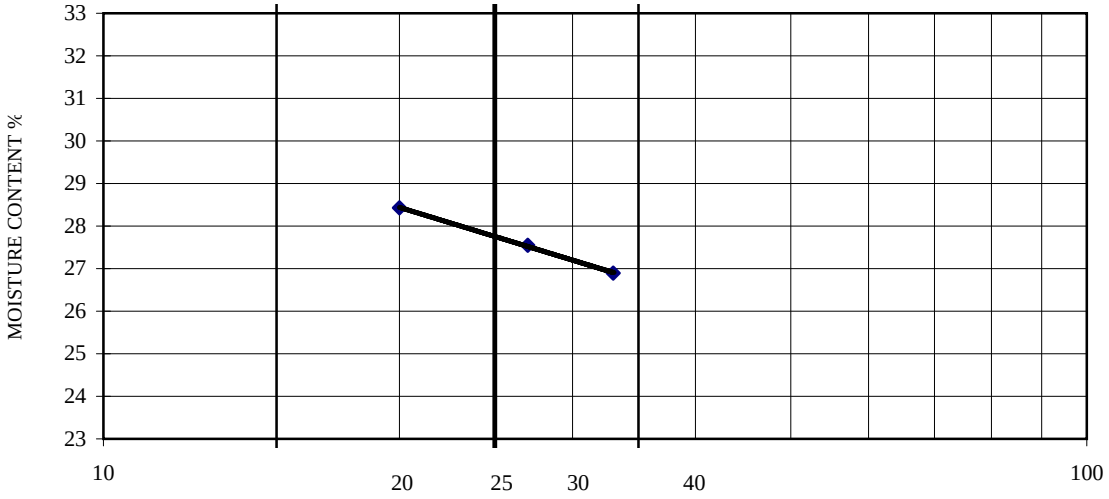
Client Pr. #	06:25219	Lab. PR. #	2320I-01-1
Pr. Name	Public Safety Warehouse-Retaining Wall	S. Type	UD
Sample ID	47602/Boring RW-2 Sample ST-1	Depth/Elev.	1-3.5'
Location	-	Add. Info	-

ASTM D 4318/AASHTO T 88, T 89
Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

LIQUID LIMIT

Number of Blows	33	27	20
Mass of Wet Sample & Tare, g	36.60	34.05	33.57
Mass of Dry Sample & Tare, g	34.61	31.94	31.29
Mass of Tare, g	27.21	24.28	23.27
Moisture Content, %	26.89	27.55	28.43

Oven ID #	495	60°C
Oven ID #	496/758	110°C
Balance ID #	563/818	
Liquid Limit Device ID #	451/1118	



PLASTIC LIMIT

Mass of Wet Sample & Tare, g	33.85	33.87
Mass of Dry Sample & Tare, g	32.51	32.52
Mass of Tare, g	24.53	24.70
Moisture Content, %	16.79	17.26

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

Mass of Wet Sample & Tare, g	385.30
Mass of Dry Sample & Tare, g	358.70
Mass of Tare, g	139.80
Moisture Content, %	12.15

LIQUID LIMIT (LL)	28
PLASTIC LIMIT (PL)	17
PLASTICITY INDEX (PI)	11
LIQUIDITY INDEX (LI)	-0.44

DESCRIPTION: Yellowish Brown Clayey Sand

USCS (ASTM D2487; D2488): SC

AASHTO (M 145): NA

TIMELY
ENGINEERING
SOIL
TESTS, LLC

1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

AASHTO ACCREDITED

Tested By	IH
Date	10/18/23
Checked By	LB

Client Pr. #	06:25219	Lab. PR. #	2320I-01-1
Pr. Name	Public Safety Warehouse-Retaining Wall	S. Type	UD
Sample ID	47602/Boring RW-2 Sample ST-1	Depth/Elev.	1-3.5'
Location	-	Add. Info	-

ASTM D 1140; Standard Test Method for Amount of Material in Soils Finer Than the No. 200 (75-mm) Sieve
AASHTO T11; Standard Test Method for Materials Finer Than the No. 200 (75-mm) Sieve in Mineral Aggregates by Washing

NATURAL MOISTURE CONTENT

Mass of Wet Sample & Tare, g	385.3
Mass of Dry Sample & Tare, g	358.7
Mass of Tare, g	139.8
Moisture Content, %	12.2

HYGROSCOPIC MOISTURE CONTENT

Mass of Wet Sample & Tare, g	
Mass of Dry Sample & Tare, g	
Mass of Tare, g	
Moisture Content, %	

SAMPLE DATA

Total mass of wet sample used for sieve analysis & tare, g	158.7
Mass of Tare, g	0.0
Total mass of dry sample used for sieve analysis, g	141.5

REMARKS

SIEVE ANALYSIS

Mass of Tare, g	0.0
Mass of sample and tare retained on No. 200 sieve, g	108.9
Percent of sample retained on No. 200 sieve, %	77.0
Percent of material finer than No. 200 sieve, %	**23.0**

DESCRIPTION: Yellowish Brown Clayey Sand

USCS (ASTM D2487; D2488): SC

NOTE: ASTM D1140 Method used: B
Length of Soaking Period: Overnight

LL		
PL		
PI		
Oven ID #	495	60°C
Oven ID #	496/758	110°C
Balance ID#	597/818/1035	
Sieve No. 200 ID #		1075/547
Sieve Shaker ID #		555/848

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1874 Forge Street Tucker, GA 30084

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Fax: 770-923-8973

Web: www.test-llc.com

AASHTO ACCREDITED

Tested By	EB
Date	10/16/23
Checked By	

ASTM D 4767/AASHTO T 297

Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils (Multistage per ASTM STP 883)

Client Project #	06:25219	Laboratory Project #	2320I-01-1
Project Name	Public Safety Warehouse-Retaining Wall	Sample Type	UD
Sample ID	47602/Boring RW-2 Sample ST-1	Depth/Elev.	1-3.5'
Location	-	Additional Info	-

SPECIMEN PROPERTIES

	(initial)	(after consol.)
Height, in	5.698	5.687
Diameter, in	2.871	2.812
Height-to-Diameter Ratio	2.0	2.0
Area, in^2	6.47	6.21
Volume, cm^3	604.48	578.68
Mass of Wet Sample, g	1236.90	1270.60
Mass of Dry Sample, g	1098.94	1098.94
Wet Density, pcf	127.7	137.1
Dry Density, pcf	113.5	118.6
Specific Gravity (assumed)	2.700	2.700
Volume of Solids, cm^3	407.01	407.01
Volume of Voids, cm^3	197.46	171.66
Void Ratio	0.49	0.42
% Saturation	69.9	100.0

WATER CONTENT DETERMINATION

	(initial)	(final)
Mass of Wet Sample and Tare, g	1236.90	1270.60
Mass of Dry Sample and Tare, g	1098.94	1098.94
Mass of Tare, g	0.00	0.00
Moisture, %	12.55	15.62

TEST DATA PRIOR TO LOADING

Volume change (Consolidation), ml	33.7
Machine Speed, in / min	0.0100
Strain Rate, % / min	0.18
Chamber Pressure, psi	90.0
Back Pressure, psi	80.0
Eff. Consol. Stress,(Minor pr. stress, s_3),psi	10.0
Change in Height, in	0.011
"B" Value	0.95

SHEAR DATA

Elapsed Time (min)	Deformation Stage 1 (inch)	Axial Load (lb)	Pore-Water Pressure, psi		Total Strain Stage 1 (%)	Corrected Area (in^2)	Dev.Stress ($Ds=s_1-s_3$)	Major Principal Stress, psi		Eff.Stress Ratio	P' $(s'_1+s'_3)/2$ (psi)	Q $(s_1-s_3)/2$ (psi)	Eff. Minor Pr. Stress
			Total, U	Change,DU			(psi)	Total s_1	Eff. s'_1	s'_1/s'_3			s'_3 (psi)
0.0	0.000	19.6	80.00	0.0	0.00	6.21	0.0	10.0	10.0	1.00	10.0	0.0	10.0
0.5	0.005	65.4	81.29	1.3	0.09	6.21	7.4	17.4	16.1	1.85	12.4	3.7	8.7
1.0	0.010	81.7	82.12	2.1	0.18	6.22	10.0	20.0	17.9	2.27	12.9	5.0	7.9
1.5	0.015	92.8	82.60	2.6	0.26	6.23	11.8	21.8	19.2	2.59	13.3	5.9	7.4
2.0	0.020	101.9	82.90	2.9	0.35	6.23	13.2	23.2	20.3	2.86	13.7	6.6	7.1
2.5	0.025	111.1	83.10	3.1	0.44	6.24	14.7	24.7	21.6	3.13	14.2	7.3	6.9
3.0	0.030	118.8	83.21	3.2	0.53	6.24	15.9	25.9	22.7	3.34	14.7	7.9	6.8
3.5	0.035	126.2	83.25	3.3	0.62	6.25	17.1	27.1	23.8	3.53	15.3	8.5	6.8
4.0	0.040	133.5	83.25	3.3	0.70	6.25	18.2	28.2	25.0	3.70	15.9	9.1	6.8
5.0	0.050	145.6	83.17	3.2	0.88	6.26	20.1	30.1	26.9	3.94	16.9	10.1	6.8
6.0	0.060	156.4	83.02	3.0	1.06	6.28	21.8	31.8	28.8	4.12	17.9	10.9	7.0
7.0	0.070	165.9	82.82	2.8	1.23	6.29	23.3	33.3	30.5	4.24	18.8	11.6	7.2
8.0	0.080	174.4	82.58	2.6	1.41	6.30	24.6	34.6	32.0	4.31	19.7	12.3	7.4
9.0	0.090	182.6	82.36	2.4	1.58	6.31	25.8	35.8	33.5	4.38	20.6	12.9	7.6
10.0	0.100	189.8	82.12	2.1	1.76	6.32	26.9	36.9	34.8	4.42	21.3	13.5	7.9
11.0	0.110	195.7	81.90	1.9	1.93	6.33	27.8	37.8	35.9	4.43	22.0	13.9	8.1
12.0	0.120	202.2	81.65	1.7	2.11	6.34	28.8	38.8	37.1	4.45	22.7	14.4	8.3
13.0	0.130	208.0	81.41	1.4	2.29	6.35	29.6	39.6	38.2	4.45	23.4	14.8	8.6
14.0	0.140	212.8	81.23	1.2	2.46	6.37	30.3	40.3	39.1	4.46	23.9	15.2	8.8
15.0	0.150	217.8	80.99	1.0	2.64	6.38	31.1	41.1	40.1	4.45	24.5	15.5	9.0
Values @ Failure				1.2	2.46	6.37	30.3	40.3	39.1	**4.46**	23.9	15.2	8.8

Failure criteria used* 3

*Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio(s'_1/s'_3)

TIMELY ENGINEERING SOIL TESTS, LLC

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AASHTO ACCREDITED

Tested By	EB
Date	10/17/23
Checked By	

ASTM D 4767/AASHTO T 297

Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils (Multistage per ASTM STP 883)

Client Project #	06:25219	Laboratory Project #	2320I-01-1
Project Name	Public Safety Warehouse-Retaining Wall	Sample Type	UD
Sample ID	47602/Boring RW-2 Sample ST-1	Depth/Elev.	1-3.5'
Location	-	Additional Info	-

SPECIMEN PROPERTIES

		(initial)	(after consol.)
Height, in		5.537	5.575
Diameter, in		2.850	2.824
Height-to-Diameter Ratio		1.9	2.0
Area, in^2		6.38	6.26
Volume, cm^3		578.68	572.28
Mass of Wet Sample, g		1270.60	1264.20
Mass of Dry Sample, g		1098.94	1098.94
Wet Density, pcf		137.1	137.9
Dry Density, pcf		118.6	119.9
Specific Gravity	(assumed)	2.700	2.700
Volume of Solids, cm^3		407.01	407.01
Volume of Voids, cm^3		171.66	165.26
Void Ratio		0.42	0.41
% Saturation		100.0	100.0

WATER CONTENT DETERMINATION

	(initial)	(final)
Mass of Wet Sample and Tare, g	1270.60	1264.20
Mass of Dry Sample and Tare, g	1098.94	1098.94
Mass of Tare, g	0.00	0.00
Moisture, %	15.62	15.04

TEST DATA PRIOR TO LOADING

Volume change (Consolidation), ml	-6.4
Machine Speed, in / min	0.0100
Strain Rate, % / min	0.18
Chamber Pressure, psi	100.0
Back Pressure, psi	80.0
Eff. Consol. Stress,(Minor pr. stress, s_3),psi	20.0
Change in Height, in	-0.038
"B" Value	0.95

SHEAR DATA

Deformation Stage 2 (inch)	Total Deformation ST.1 + ST.2 (inch)	Axial Load (lb)	Pore-Water Pressure, psi		Strain Stage 2 %	Corrected Area (in^2)	Dev.Stress ($Ds=s_1-s_3$)	Major Principal Stress, psi		Effective Stress Ratio	P' $(s'_1+s'_3)/2$ (psi)	Q $(s_1-s_3)/2$ (psi)	Eff. Minor Pr. Stress	Total Strain ST.1 + ST.2 %
			Total, U	Change,DU			(psi)	Total s_1	Eff. s'_1	s'_1/s'_3			s'_3 (psi)	
0.000	0.112	23.4	80.00	0.0	0.00	6.26	0.0	20.0	20.0	1.00	20.0	0.0	20.0	1.97
0.005	0.117	94.8	82.26	2.3	0.09	6.27	11.4	31.4	29.1	1.64	23.4	5.7	17.7	2.06
0.010	0.122	135.0	83.63	3.6	0.18	6.28	17.8	37.8	34.2	2.09	25.3	8.9	16.4	2.15
0.015	0.127	165.8	84.33	4.3	0.27	6.28	22.7	42.7	38.3	2.45	27.0	11.3	15.7	2.23
0.020	0.132	189.5	84.68	4.7	0.36	6.29	26.4	46.4	41.7	2.72	28.5	13.2	15.3	2.32
0.025	0.137	213.8	84.92	4.9	0.45	6.29	30.3	50.3	45.3	3.01	30.2	15.1	15.1	2.41
0.030	0.142	234.3	85.08	5.1	0.54	6.30	33.5	53.5	48.4	3.24	31.7	16.7	14.9	2.50
0.035	0.147	250.7	85.18	5.2	0.63	6.30	36.1	56.1	50.9	3.43	32.8	18.0	14.8	2.58
0.040	0.152	264.3	85.28	5.3	0.72	6.31	38.2	58.2	52.9	3.59	33.8	19.1	14.7	2.67
0.050	0.162	283.3	85.36	5.4	0.90	6.32	41.1	61.1	55.8	3.81	35.2	20.6	14.6	2.85
0.060	0.172	296.4	85.38	5.4	1.08	6.33	43.1	63.1	57.7	3.95	36.2	21.6	14.6	3.02
0.070	0.182	305.6	85.32	5.3	1.26	6.34	44.5	64.5	59.2	4.03	36.9	22.2	14.7	3.20
0.080	0.192	312.9	85.22	5.2	1.43	6.36	45.6	65.6	60.3	4.08	37.6	22.8	14.8	3.38
0.090	0.202	318.8	85.10	5.1	1.61	6.37	46.4	66.4	61.3	4.11	38.1	23.2	14.9	3.55
0.100	0.212	324.9	84.96	5.0	1.79	6.38	47.3	67.3	62.3	4.14	38.7	23.6	15.0	3.73
0.110	0.222	329.6	84.82	4.8	1.97	6.39	47.9	67.9	63.1	4.16	39.1	24.0	15.2	3.90
0.120	0.232	333.5	84.70	4.7	2.15	6.40	48.4	68.4	63.7	4.17	39.5	24.2	15.3	4.08
0.130	0.242	337.6	84.58	4.6	2.33	6.41	49.0	69.0	64.4	4.18	39.9	24.5	15.4	4.26
0.140	0.252	342.4	84.42	4.4	2.51	6.43	49.6	69.6	65.2	4.19	40.4	24.8	15.6	4.43
0.150	0.262	346.6	84.26	4.3	2.69	6.44	50.2	70.2	65.9	4.19	40.8	25.1	15.7	4.61
0.160	0.272	349.9	84.15	4.2	2.87	6.45	50.6	70.6	66.5	4.19	41.2	25.3	15.9	4.78
0.170	0.282	354.0	83.92	3.9	3.05	6.46	51.2	71.2	67.2	4.18	41.7	25.6	16.1	4.96
Values @ Failure				4.2	2.87	6.45	50.6	70.6	66.5	**4.19**	41.2	25.3	15.9	4.78

Failure criteria used* 3

*Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio(s'_1/s'_3)

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1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

AASHTO ACCREDITED

Tested By	EB
Date	10/18/23
Checked By	

ASTM D 4767/AASHTO T 297

Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils (Multistage per ASTM STP 883)

Client Project #	06:25219	Laboratory Project #	2320I-01-1
Project Name	Public Safety Warehouse-Retaining Wall	Sample Type	UD
Sample ID	47602/Boring RW-2 Sample ST-1	Depth/Elev.	1-3.5'
Location	-	Additional Info	-

SPECIMEN PROPERTIES

		(initial)	(after consol.)
Height, in		5.405	5.450
Diameter, in		2.868	2.842
Height-to-Diameter Ratio		1.9	1.9
Area, in^2		6.46	6.34
Volume, cm^3		572.28	566.48
Mass of Wet Sample, g		1264.20	1258.40
Mass of Dry Sample, g		1098.94	1098.94
Wet Density, pcf		137.9	138.7
Dry Density, pcf		119.9	121.1
Specific Gravity	(assumed)	2.700	2.700
Volume of Solids, cm^3		407.01	407.01
Volume of Voids, cm^3		165.26	159.46
Void Ratio		0.41	0.39
% Saturation		100.0	100.0

WATER CONTENT DETERMINATION

	(initial)	(final)
Mass of Wet Sample and Tare, g	1264.20	1561.50
Mass of Dry Sample and Tare, g	1098.94	1402.10
Mass of Tare, g	0.00	303.60
Moisture, %	15.04	14.51

TEST DATA PRIOR TO LOADING

Volume change (Consolidation), ml	-5.8
Machine Speed, in / min	0.01000
Strain Rate, % / min	0.18
Chamber Pressure, psi	110.0
Back Pressure, psi	80.0
Eff. Consol. Stress,(Minor pr. stress, s_3),psi	30.0
Change in Height, in	-0.045
"B" Value	0.95

SHEAR DATA

Deformation Stage 3 (inch)	Total Deformation ST.1 + ST.2 + ST.3 (inch)	Axial Load (lb)	Pore-Water Pressure, psi		Strain Stage 3 %	Corrected Area (in^2)	Deviator Stress ($Ds=s_1-s_3$)	Major Principal Stress, psi		Effective Stress Ratio	P' $(s'_1+s'_3)/2$ (psi)	Q $(s_1-s_3)/2$ (psi)	Eff. Minor Pr. Stress	Total Strain ST.1 + ST.2 + ST.3, %
			Total, U	Change,DU			(psi)	Total s_1	Eff. s'_1	s'_1/s'_3			s'_3 (psi)	
0.000	0.237	32.0	80.00	0.0	0.00	6.34	0.0	30.0	30.0	1.00	30.0	0.0	30.0	4.17
0.011	0.248	193.7	85.87	5.9	0.19	6.36	25.4	55.4	49.6	2.05	36.9	12.7	24.1	4.35
0.021	0.258	282.7	87.32	7.3	0.38	6.37	39.4	69.4	62.1	2.74	42.4	19.7	22.7	4.53
0.031	0.268	351.2	87.64	7.6	0.57	6.38	50.0	80.0	72.4	3.24	47.4	25.0	22.4	4.71
0.041	0.278	399.9	87.76	7.8	0.76	6.39	57.6	87.6	79.8	3.59	51.0	28.8	22.2	4.89
0.051	0.288	431.8	87.86	7.9	0.94	6.40	62.4	92.4	84.6	3.82	53.4	31.2	22.1	5.07
0.072	0.309	463.8	87.90	7.9	1.32	6.43	67.2	97.2	89.3	4.04	55.7	33.6	22.1	5.43
0.102	0.339	485.2	87.70	7.7	1.88	6.46	70.1	100.1	92.4	4.14	57.4	35.1	22.3	5.97
0.123	0.360	495.8	87.48	7.5	2.25	6.49	71.5	101.5	94.0	4.17	58.3	35.7	22.5	6.33
0.153	0.390	508.2	87.14	7.1	2.81	6.53	73.0	103.0	95.8	4.19	59.3	36.5	22.9	6.86
0.174	0.411	516.9	86.85	6.9	3.19	6.55	74.0	104.0	97.2	4.20	60.2	37.0	23.1	7.22
0.204	0.441	529.8	86.49	6.5	3.75	6.59	75.5	105.5	99.1	4.21	61.3	37.8	23.5	7.76
0.235	0.472	539.5	86.15	6.1	4.31	6.63	76.6	106.6	100.4	4.21	62.1	38.3	23.9	8.30
0.265	0.502	550.1	85.75	5.7	4.87	6.67	77.7	107.7	102.0	4.20	63.1	38.9	24.3	8.83
0.286	0.523	556.1	85.54	5.5	5.24	6.69	78.3	108.3	102.7	4.20	63.6	39.1	24.5	9.19
0.316	0.553	565.3	85.18	5.2	5.80	6.73	79.2	109.2	104.0	4.19	64.4	39.6	24.8	9.73
0.367	0.604	580.7	84.60	4.6	6.74	6.80	80.7	110.7	106.1	4.18	65.7	40.3	25.4	10.63
0.418	0.655	595.8	84.38	4.4	7.67	6.87	82.1	112.1	107.7	4.20	66.7	41.0	25.6	11.52
0.479	0.716	611.8	83.75	3.8	8.80	6.95	83.4	113.4	109.6	4.18	67.9	41.7	26.3	12.60
0.530	0.767	624.7	83.25	3.2	9.73	7.03	84.3	114.3	111.1	4.15	68.9	42.2	26.8	13.49
0.571	0.808	634.8	82.84	2.8	10.48	7.09	85.1	115.1	112.2	4.13	69.7	42.5	27.2	14.21
0.602	0.839	640.8	82.62	2.6	11.04	7.13	85.4	115.4	112.8	4.12	70.1	42.7	27.4	14.75
0.620	0.857	645.5	82.48	2.5	11.38	7.16	85.7	115.7	113.2	4.11	70.4	42.9	27.5	15.07
Values @ Failure				6.5	3.75	6.59	75.5	105.5	99.1	**4.21**	61.3	37.8	23.5	7.76

Failure criteria used* 3

*Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio(s'_1/s'_3)

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Tested By	EB
Date	10/18/23
Check	

ASTM D 4767/AASHTO T 297

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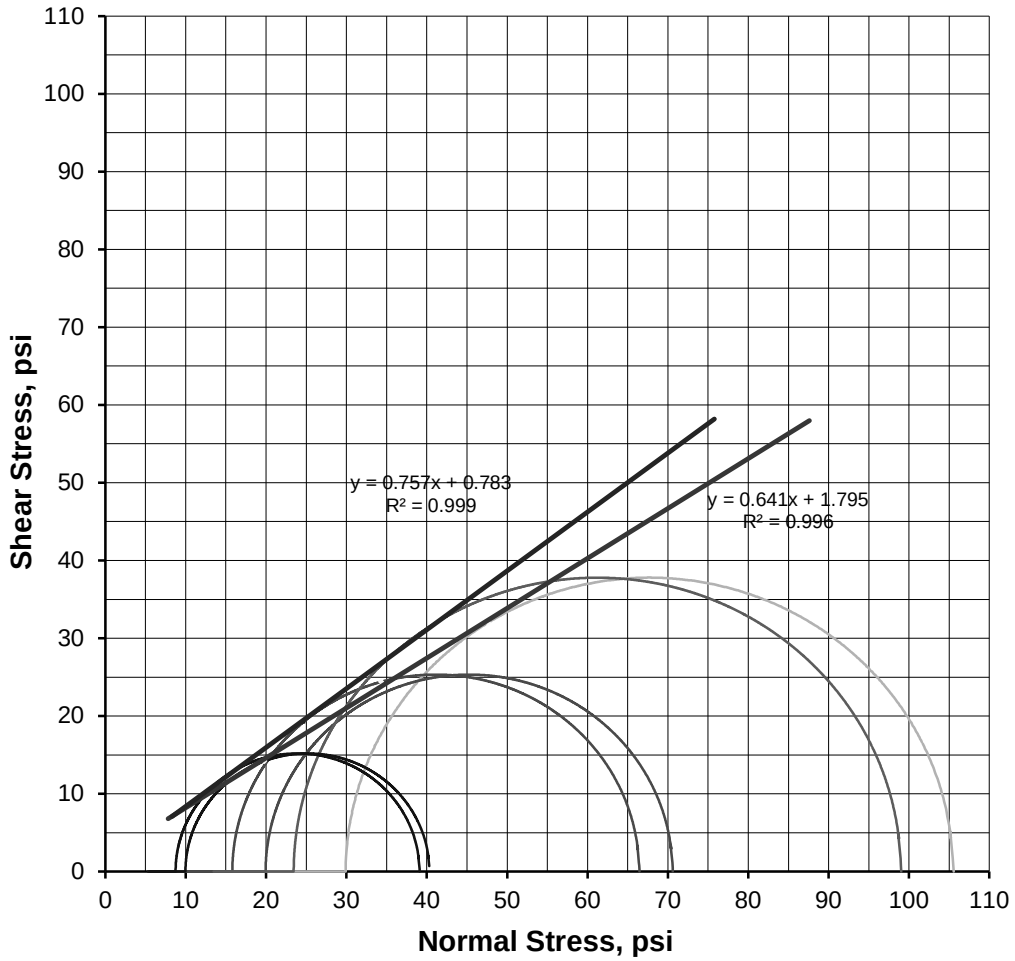
Client Project #	06:25219	Laboratory Project #	2320I-01-1
Project Name	Public Safety Warehouse-Retaining Wall	Sample Type	UD
Sample ID	47602/Boring RW-2 Sample ST-1	Depth/Elev.	1-3.5'
Location	-	Additional Info	-

Total and Effective Mohr's Circles



	ST. 1	ST. 2	ST. 3
Effective Consolidation Stress, psi	10.0	20.0	30.0
Deviator Stress at Failure, psi	30.3	50.6	75.5
Effective Minor Principal Stress at Failure, psi	8.8	15.9	23.5
Effective Major Principal Stress at Failure, psi	39.1	66.5	99.1
Axial Strain at Failure, %	2.46	2.87	3.75

STRENGTH PARAMETERS*			
Total		Effective	
f °	32.7	f ' °	37.1
C, psi	1.8	C', psi	0.8

***Valid only for Received Material at Reported Densities and Moisture Contents. Please see remarks on page 6 of this report**

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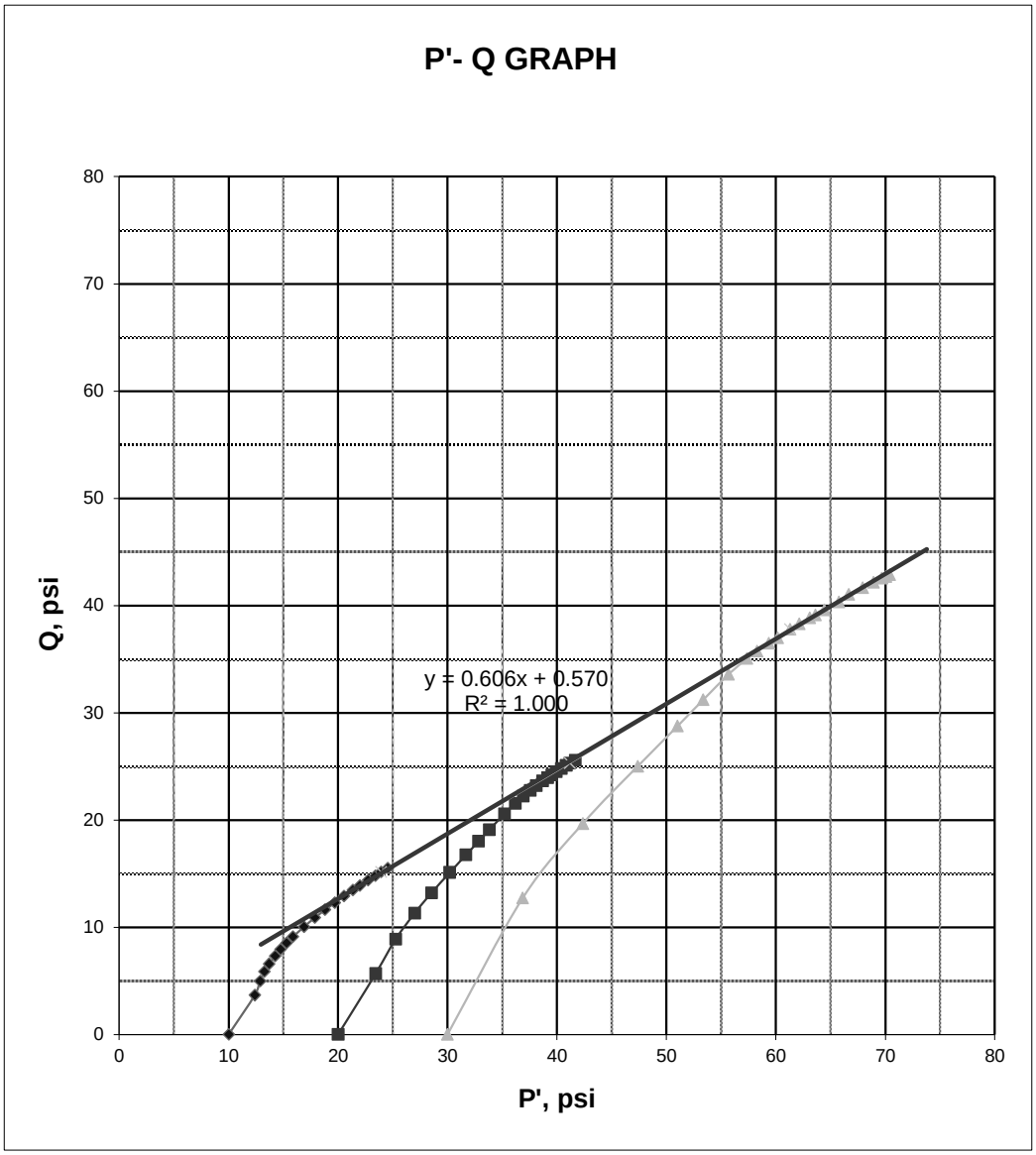
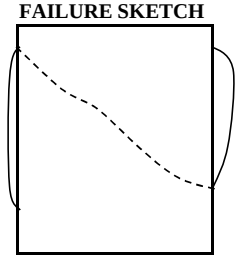


FAILURE SKETCH



a, psi	0.6
a, degree	31.2

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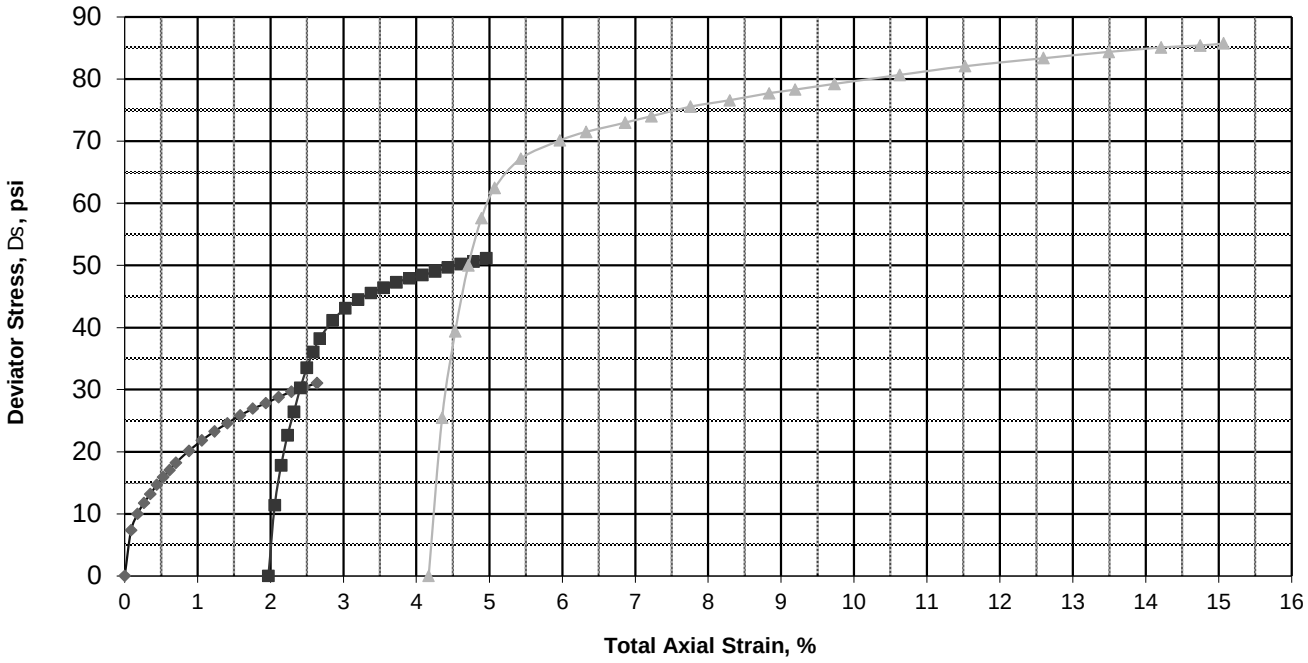
Location	-	Additional Info	-

Deviator Stress - Strain Graph



		REMARKS	DESCRIPTION
Balance ID Number	563/700	Material from shelby tube was not homogeneous and/or not long enough to select 3 uniform specimens 6" long each. Most representative portion of sample (2" above the bottom of shelby tube) was selected for multi-stage triaxial testing (per ASTM STP 883).	Yellowish Brown Clayey Sand
Oven ID Number	496/610		
Deformation Indicator ID #	178/349/689		
Digital Caliper ID #	370/458		
Load Cell ID #	11/347/692		
Apparatus ID #	10/293/693		

NOTES:
1. Method for Saturation
2. Method for determination of cross-sectional area after consol.
3. Final moisture content (Stage 3) obtained from entire sample

WET	
B	

LL	-
PL	-
PI	-
Gs	-

USCS (ASTM D2487: D2488)

SC

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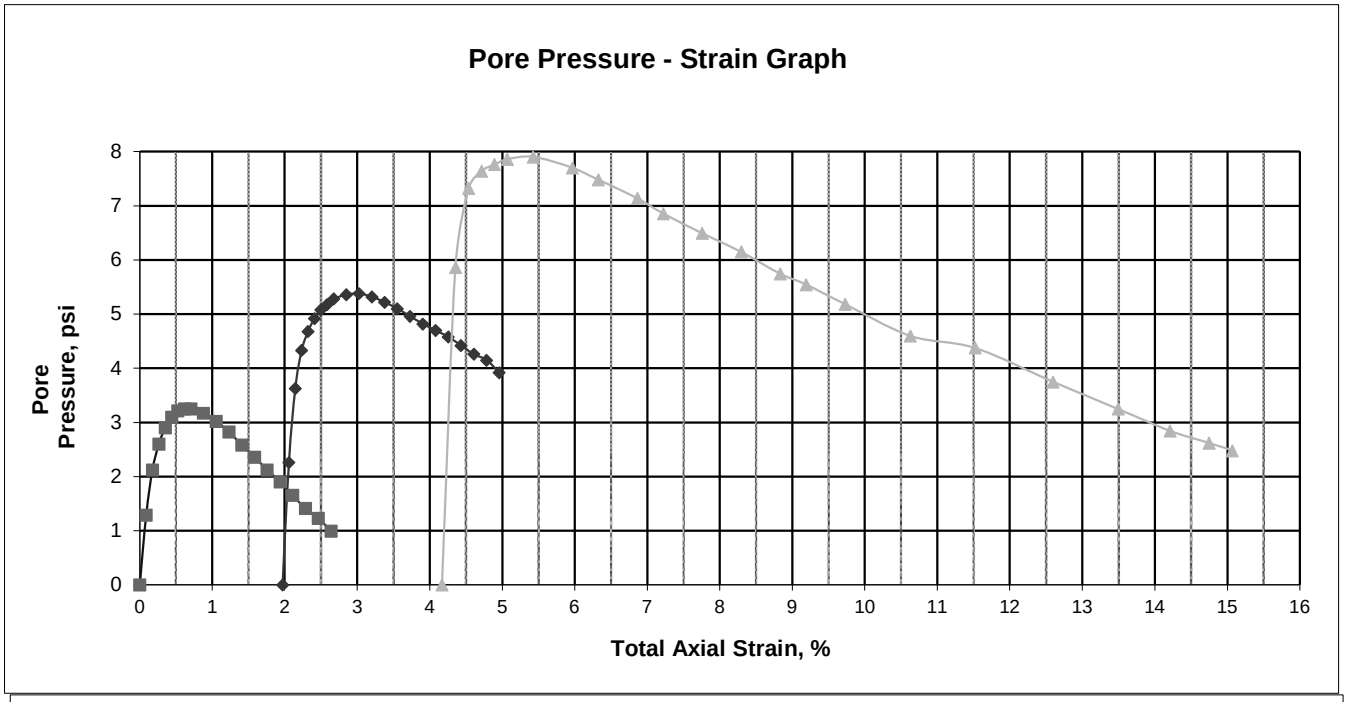

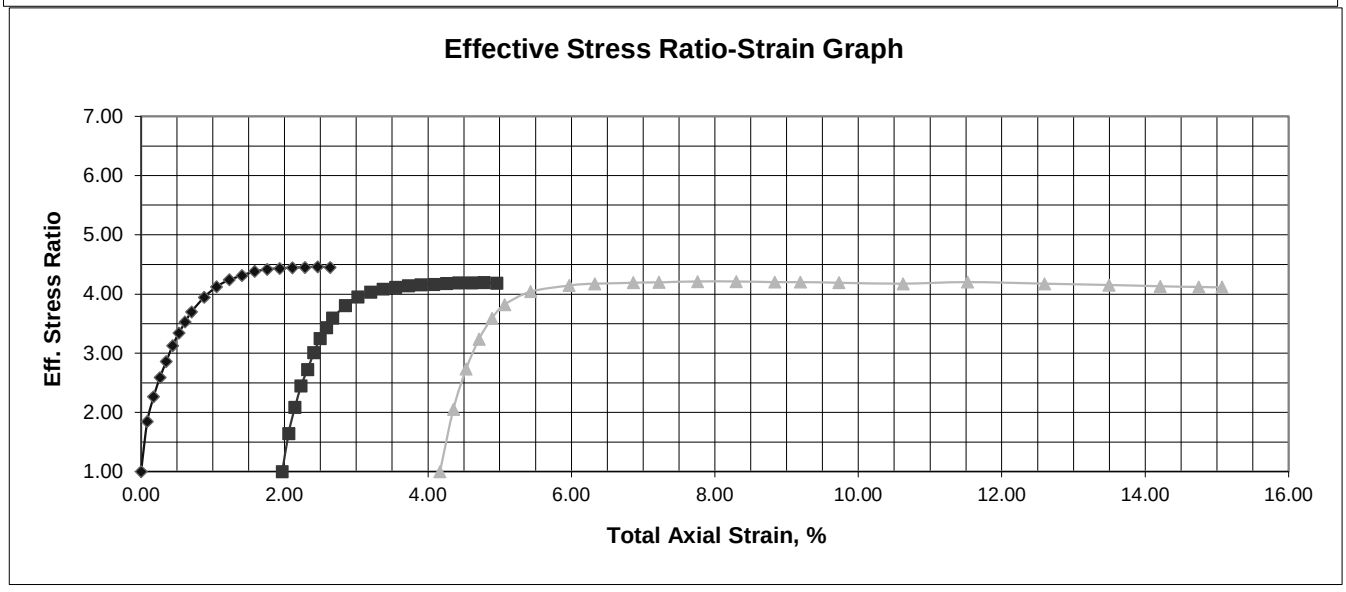

Bid Form

Town of Wake Forest
Public Safety Warehouse
September 27, 2024

PAY ITEM	SPEC SECTION	DESCRIPTION	UNIT	UNIT PRICE	QTY	AMOUNT
		ON-SITE PARKING LOT IMPROVEMENTS				
1	NCDOT 800	MOBILIZATION	LS		1	
2	NCDOT 801	CONSTRUCTION SURVEYING	LS		1	
3	03000/02200	SITE CLEARING AND GRUBBING	AC		0.3	
4	PSP	LANDSCAPE BERM REMOVAL (DEMO)	LS		1	
5	PSP	CURB AND GUTTER REMOVAL (DEMO)	LF		175	
6	PSP	CONCRETE PAVEMENT REMOVAL (DEMO)	SY		715	
7	PSP	CONCRETE SIDEWALK REMOVAL (DEMO)	SY		19	
8	PSP	STORM PIPE REMOVAL-18" RCP (DEMO)	LF		212	
9	PSP	DROP INLET REMOVAL-18" RCP (DEMO)	EA		1	
10	PSP	EX FH-REMOVAL (DEMO)	EA		1	
11	11000	EX 6" DIP FIRE LINE REMOVE AND REPLACE-EX FIRE STATION	LF		60	
12	11000	EX WATER SERVICE REMOVE AND REPLACE-EX FIRE STATION	LF		35	
13	11000	REMOVE AND REPLACE EX FIRE BACKFLOW ASSEMBLY/HOT BOX AND FDC-EX FIRE STATION	EA		1	
14	11000	REMOVE AND REPLACE EX DOMESTIC METER AND BACKFLOW ASSEMBLY/HOT BOX-EX FIRE STATION	EA		1	
15	PSP	RELOCATE FLAGPOLES	EA		3	
16	04000/02200	SOIL IMPORT	CY		2100	
17	04000/02200	ON-SITE CUT-TO-FILL	CY		2600	
18	04000/02200	ROCK REMOVAL (MASS ROCK)	CY		100	
19	04000/02200	UNDERCUT (REMOVE AND REPLACE UNSUITABLES)	CY		260	
20	04000/02200	FINE GRADING	SY		6500	
21	PSP	MODULAR BLOCK RETAINING WALL	SF		623	
22	PSP	VEHICULAR GUARDRAIL AT RETAINING WALL	LF		115	
23	06100/02700	6" PVC ROOF DRAIN PIPE (<7-FT)	LF		185	
24	06100/02700	8" PVC ROOFDRAIN PIPE (<7-FT)	LF		150	
25	06100/02700	STORM CLEANOUTS	EA		7	
26	06000/02700	15" RCP PIPE (<7-FT)	LF		210	
27	06000/02700	15" RCP PIPE (<15-FT)	LF		95	
28	06000/02700	18" RCP PIPE (<7-FT)	LF		60	
29	06000/02700	DROP INLET (<7- FT)	EA		1	
30	06000/02700	CATCH BASINS (<7- FT)	EA		4	
31	06000/02700	CATCH BASINS (<15- FT)	EA		1	
32	06000/02700	STORM MANHOLE	EA		2	
33	06000/02700	CATCH BASIN FRAME WITH GRATE & HOOD, STD 840.03, TYPE E	EA		4	
34	06000/02700	STORM MANHOLE FRAME WITH COVER, EAST JORDAN V-1384	EA		2	
35	06000/02700	DROP INLET FRAME AND GRATE-EAST JORDAN V-4867-2	EA		1	
36	06000/02700	FLARED END SECTION-18" RCP	EA		1	
37	16000/02700	RIPRAP, CLASS B	TON		5	
38	16000	EROSION CONTROL MEASURES	LS		1	
39	PSP	STORMWATER WET POND	LS		1	
40	PSP	STORMWATER WET POND CONTROL STRUCTURE	EA		1	
41	11000	WATER SERVICE - 1.5" COPPER	LF		135	
42	11000	WATER SERVICE - 6" DIP FIRE LINE	LF		255	
43	11000	DUCTILE IRON WATER PIPE FITTINGS	LS		1	
44	11000	GATE VALVE-6"	EA		1	
45	11000	TAPPING SLEEVE AND VALVE-12" x 6"	EA		2	
46	11000	WATER METER-1.5" DOMESTIC	LS		13	
47	11000	BACKFLOW PREVENTER-FIRE LINE; 6" RPDA WITH HOT BOX AND STORZ FDC	EA		1	
48	11000	BACKFLOW PREVENTER-DOMESTIC; 1.5" DCV WITH HOT BOX	EA		1	
49	11000	FIRE HYDRANT ASSEMBLY	EA		1	
50	11000	4" PVC SANITARY SEWER	LF		155	
51	11000	SANITARY SEWER CLEANOUTS	LS		3	
52	11000	SANITARY SEWER CONNECTION TO MANHOLE	EA		1	
53	07000/02400	CONCRETE CURB AND GUTTER-24"	LF		630	
54	07000/02400	CONCRETE SIDEWALK	SY		264	
55	07000/02400	CONCRETE TRUCK PAVEMENT AREA (HEAVY DUTY-6" PCC OVER 6" ABC)	SY		875	
56	07000/02400	CONCRETE ADA RAMP (CURB RAMP)	EA		5	
57	PSP/02400	CONCRETE ADA RAMP FOR CONNECTION TO ROW	SY		41	
58	PSP/02400	ADA RAMP HANDRAILS	LF		140	
59	PSP	CAST IN PLACE RETAINING WALL FOR ADA RAMP	LF		25	
60	PSP	WHEEL STOPS	EA		2	

Bid Form

Town of Wake Forest
Public Safety Warehouse
September 27, 2024

PAY ITEM	SPEC SECTION	DESCRIPTION	UNIT	UNIT PRICE	QTY	AMOUNT
61	08000/02500/02600	STANDARD DUTY ASPHALT PAVEMENT (3" TYPE S9.5B, 6" ABC)	SY		267	
62	08000/02500/02600	HEAVY DUTY ASPHALT PAVEMENT (1.5" TYPE S9.5B, 2.5" I19.0C, 8" ABC)	SY		315	
63	PSP	BOLLARDS	EA		9	
64	PSP	BICYCLE RACKS	EA		2	
65	19000	ADA SIGNAGE	EA		2	
66	19000	STOP SIGNS	EA		2	
67	15000	PAVEMENT STRIPING-4" WHITE PARKING SPACE LINES	LF		335	
68	15000	PAVEMENT STRIPING-ADA PARKING SYMBOLS	EA		2	
69	15000	PAVEMENT STRIPING-24" STOP BAR	LF		50	
70	15000	PAVEMENT STRIPING-HI VIZ CROSSWALK MARKINGS (24" CROSSWALK LINE, 5' WIDTH)	LF		26	
71	07000/02400	ELECTRIC TRANSFORMER PAD (TRANSFORMER BY OTHERS)	EA		1	
		ON-SITE PARKING LOT-LANDSCAPING				
72	PSP	STREETWISE TRIDENT MAPLE	EA		16	
73	PSP	AMERICAN HORNBEAM MULTI-TRUNK	EA		35	
74	PSP	SAVANNAH HOLLY	EA		5	
75	PSP	BRACKEN'S BEAUTY SOUTHERN MAGNOLIA	EA		23	
76	PSP	SAUCER MAGNOLIA MULTI-TRUNK	EA		9	
77	PSP	HIGHTOWER WILLOW OAK	EA		17	
78	PSP	ALLEE LACEBARK ELM	EA		9	
79	PSP	RADIANCE GLOSSY ABELIA	EA		23	
80	PSP	AUTUMN SPIRIT CAMELLIA	EA		62	
81	PSP	OCTOBER MAGIC CARPET CAMELLIA	EA		28	
82	PSP	DUKE GARDENS PLUM YEW	EA		21	
83	PSP	FROSTPROOF GARDENIA	EA		86	
84	PSP	NIGRA INKBERRY HOLLY	EA		40	
85	PSP	CRIMSON FIRE FRINGE FLOWER	EA		17	
86	PSP	BURKWOOD OSMANTHUS	EA		75	
87	PSP	NANTUCKET VIBURNUM	EA		81	
88	PSP	TIF 419 BERMUDAGRASS (SOD)	SF		29161	
89	PSP	BIG BLUE LILYTURF	EA		113	
90	PSP	PINK MUHLY GRASS	EA		16	
91	PSP	HAMELN FOUNTAIN GRASS	EA		145	
92	PSP	THREEWAY SEDGE	EA		133	
93	PSP	GOLDENCLUB	EA		84	
94	PSP	PICKEREL WEED	EA		170	
95	PSP	ARROW ARUM	EA		204	
96	PSP	BROADLEAF ARROWHEAD	EA		44	
97	PSP	DOUBLE SHREDDED HARDWOOD MULCH (3" DEPTH)	CY		470	
98	PSP	STONE MULCH (3" DEPTH)	CY		6	
99	PSP	TOPSOIL / SOIL AMENDMENTS (2"-12" DEPTH)	CY		1150	
		OFF-SITE ROADWAY IMPROVEMENTS				
100	03000/02200	GRADING	LS		1	
101	5000	FOUNDATION CONDITIONING MATERIAL, MINOR STRUCTURES	TON		40	
102	06000/02700	15" RC PIPE CULVERTS, CLASS IV	LF		81	
103	06000/02700	18" RC PIPE CULVERTS, CLASS IV	LF		288	
104	08000/02500/02600	MILLING ASPHALT PAVEMENT, 1 1/2" DEPTH	SY		865	
105	08000/02500/02600	ASPHALT CONC. BASE COURSE, TYPE B25.0C	TON		425	
106	08000/02500/02600	ASPHALT CONC. INTERMEDIATE COURSE, TYPE I9.0C	TON		275	
107	08000/02500/02600	ASPHALT CONC. SURFACE COURSE, TYPE S9.5C	TON		405	
108	08000/02500/02600	ASPHALT BINDER FOR PLANT MIX, GRADE PG 64-22	TON		60	
109	06000/02700	MASONRY DRAINAGE STRUCTURES	EA		5	
110	06000/02700	FRAME AND GRATES, STD. 840.03 TYPE G	EA		4	
111	06000/02700	FRAME AND GRATES, STD. 840.16	EA		1	
112	07000/02400	2'-6" CONCRETE CURB & GUTTER	LF		532	
113	07000/02400	4" CONCRETE SIDEWALK	SY		315	
114	07000/02400	CONCRETE CURB RAMP	EA		2	
115	07000/02400	6" CONCRETE DRIVEWAY	SY		480	

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Public Safety Warehouse
September 27, 2024

PAY ITEM	SPEC SECTION	DESCRIPTION	UNIT	UNIT PRICE	QTY	AMOUNT
116	16000/02700	CLASS B RIP RAP	TON		30	
117	16000/02700	GEOTEXTILE FOR DRAINAGE	SY		85	
118	19000	CONTRACTOR FURNISHED, TYPE "E" SIGN	SF		7	
119	19000	SUPPORTS, 3-LB STEEL U-CHANNEL	LF		45	
120	19000	SIGN ERECTION, TYPE E	EA		4	
121	NCDOT 907	DISPOSAL OF SIGN SUPPORT, U-CHANNEL	EA		3	
122	14000	TEMPORARY TRAFFIC CONTROL	LS		1	
123	15000	THERMOPLASTIC PAVEMENT MARKING LINES (4", 90 MILS)	LF		1830	
124	15000	THERMOPLASTIC PAVEMENT MARKING LINES (12", 90 MILS)	LF		320	
125	15000	THERMOPLASTIC PAVEMENT MARKING LINES (24", 90 MILS)	LF		325	
126	16000	EROSION CONTROL	LS		1	
		TOTAL				

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete standards.
2. Concrete materials.
3. Admixtures.
4. Vapor retarders.
5. Liquid floor treatments.
6. Concrete mixture materials.
7. Concrete mixing.

1.2 ACTION SUBMITTALS

A. Product data.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Compressive strength at 28 days or other age as specified.
3. Slump or slump flow limit.
4. Air content.
5. Nominal maximum aggregate size.
6. Steel-fiber reinforcement content.
7. Intended placement method.
8. Submit adjustments to design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant changes.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1.3 INFORMATIONAL SUBMITTALS

A. Material certificates.

B. Material test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer who employs Project personnel qualified as an ACI-certified Concrete Flatwork Associate and Concrete Flatwork Finisher and a supervisor who is a certified ACI Advanced Concrete Flatwork Finisher/Technician or an ACI Concrete Flatwork Finisher with experience installing and finishing concrete.

B. Laboratory Testing Agency Qualifications: Third Party by Owner.

C. Field Quality-Control Testing Agency Qualifications: Third Party by Owner.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 7 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE STANDARDS

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Refer to Structural Drawings.
2. Silica Fume: ASTM C1240.

B. Normal-Weight Aggregates:

1. Coarse Aggregate: ASTM C33/C33M, Class 3M.
2. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
3. Fine Aggregate: ASTM C33/C33M.
4. Recycled Aggregate: Provide documentation of characteristics of recycled aggregate and mechanical properties and durability of proposed concrete, which incorporates recycled aggregate to conform to appliable requirements for the class of concrete and approved by the Structural Engineer.

2.3 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Chemical Admixtures: As approved by the Structural Engineer. Do not use calcium chloride or admixtures containing calcium chloride.

1.

2.4 VAPOR RETARDERS

A. Sheet Vapor Retarder/Termite Barrier: ASTM E1745, Class A, except with maximum water-vapor permeance of 0.03 perms; complying with ICC Acceptance Criteria AC380. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Low-Temperature Flexibility: Pass at minus 15 deg F (minus 26 deg C); ASTM D146/D146M.
2. Puncture Resistance: 224 lbf (996 N) minimum; ASTM E154/E154M.
3. Water Absorption: 0.1 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D570.
4. Hydrostatic-Head Resistance: 231 ft. (70 m) minimum; ASTM D5385/D5385M.

2.5 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.6 CONCRETE MIXTURE MATERIALS

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland or hydraulic cement in concrete assigned to Exposure Class F3 as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Silica Fume: 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish delivery ticket.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before placing concrete, verify that installation of concrete forms, accessories, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 TOLERANCES

A. Comply with ACI 117 (ACI 117M).

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

3.4 INSTALLATION OF VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

3.5 INSTALLATION OF CAST-IN-PLACE CONCRETE

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

B. Notify testing and inspection agencies 24 hours prior to commencement of concrete placement.

3.6 INSTALLATION OF JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints per Structural drawings.

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3 mm). Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch (3-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

C. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.7 APPLICATION OF FINISHING FLOORS AND SLABS

A. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.

3.8 APPLICATION OF CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 (ACI 301M) for cold weather protection during curing.
2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305R, before and during finishing operations.

3.9 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
3. Rinse with water; remove excess material until surface is dry.
4. Apply a second coat in a similar manner if surface has received a float finish or abrasive surface preparation.

B.

3.10 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

3.11 PROTECTION

A. Protect concrete surfaces.

B. Protect from petroleum stains.

C. Prohibit vehicles from interior concrete slabs.

D. Prohibit placement of steel items on concrete surfaces.

END OF SECTION 033000

SECTION 040110 - MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cleaning the following:

1. Unit masonry surfaces.
2. Stone surfaces.

1.2 DEFINITIONS

A. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

PART 2 - PRODUCTS

2.1 PAINT REMOVERS

A. Low-Odor, Solvent-Type Paste Paint Remover: Manufacturer's standard low-odor, water-rinsable, solvent-type paste, gel, or foamed emulsion formulation, for removing paint coatings from masonry; containing no methanol or methylene chloride.

2.2 CLEANING MATERIALS

A. Water: Potable.

B. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.

C. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.

D. Mild-Acid Cleaner: Manufacturer's standard mild-acid cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.

2.3 CHEMICAL CLEANING SOLUTIONS

A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.

PART 3 - EXECUTION

3.1 PROTECTION

A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent paint removers and chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.

1. Cover adjacent surfaces with materials that are proven to resist paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents according to manufacturer's written instructions. Do not apply liquid strippable masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.

3.2 CLEANING MASONRY, GENERAL

A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet (6 m).

B. Proceed with cleaning in an orderly manner; work from top to bottom and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.

C. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.

D. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to the "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.

E. Water-Spray Application Method: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from masonry surface and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

END OF SECTION 040110

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Brick.
3. Mortar and grout materials.
4. Ties and anchors.
5. Embedded flashing.
6. Accessories.
7. Mortar and grout mixes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For reinforcing steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R.

C. Samples: For each type and color of exposed masonry unit and colored mortar.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product and for masonry units, include data on material properties material test reports substantiating compliance with requirements.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.4 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for sills, corners, jambs, movement joints, and headers.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed CMU's.

C. CMUs: ASTM C90, normal weight.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi (13.8 MPa).

D. Decorative CMUs: ASTM C90, normal weight.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi (13.8 MPa).
2. Pattern and Texture: Scored vertically to appear square in stacked bond, smooth finish. Use block shown on Architectural Sheet A-3c.

2.3 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C216 or hollow brick complying with ASTM C652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area).
   1. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
   2. Size (Actual Dimensions): Use brick shown on Architectural Sheet A-3c.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide color to match adjacent Fire Station #3.

   1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

G. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime masonry cement, sand, mortar pigments, water repellents, and admixtures and complying with ASTM C1714/C1714M.

H. Aggregate for Mortar: ASTM C144.

I. Aggregate for Grout: ASTM C404.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

K. Water: Potable.

2.5 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.

3. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

C. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf (445 N) load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch (1.6 mm).
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0785-inch- (1.99-mm-) thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized-steel wire unless otherwise indicated.

2.6 EMBEDDED FLASHING

A. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 40 mil (1.0 mm).

2. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.

B. Drainage Plane Flashing: Fabricate from rubberized asphalt or elastomeric membrane and drainage membrane. Provide flashing materials as follows:

1. Rubberized Asphalt: 40 mil (1.0 mm) thick.
2. Elastomeric Membrane: PVC or TPO, 40 mil (1.0 mm).
3. Fabricate continuous flashings in sections 60 inches (1524 mm) long, minimum.

2.7 ACCESSORIES

A. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

B. Weep/Cavity Vents: Use the following unless otherwise indicated:

1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (10 by 38 by 89 mm) long.

2. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint.

2.8 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270. Provide the following types of mortar for applications stated:

1. For masonry below grade or in contact with earth, use Type M.
2. For exterior, above-grade, load-bearing, non load-bearing walls, and parapet walls; for interior load-bearing walls; for interior non load-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

E. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (13 mm) or minus 1/4 inch (6.4 mm).

2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (13 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6.4 mm) in a story height or 1/2 inch (13 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm), with a maximum thickness limited to 1/2 inch (13 mm).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (10 mm) or minus 1/4 inch (6.4 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3.2 mm).

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (102-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.4 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated.
2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

3.5 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape.
2. At lintels and shelf angles, extend flashing 6 inches (152 mm) minimum at each end. At heads and sills, extend flashing 6 inches (152 mm) minimum, and turn ends up not less than 2 inches (51 mm) to form end dams.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep vent products to form weep holes.
2. Space weep holes 24 inches (610 mm) o.c. unless otherwise indicated.
3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

3.6 CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

END OF SECTION 042000

SECTION 044313.16 - ADHERED STONE MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stone masonry adhered to wood framing and sheathing.

B. Related Requirements:

   1. Section 042000 "Unit Masonry" for concealed flashing.

1.2 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Sustainable Design Submittals:

C. Samples:

   1. For each stone type indicated.
   2. For each color of mortar required.

1.3 FIELD CONDITIONS

A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work.

B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried.

C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 ADHERED STONE VENEER

A. Varieties and Sources: Subject to compliance with requirements, use stone as referenced on Architectural Sheet A-3c.

2.2 MORTAR MATERIALS

A. See Specification 042000 – Unit Masonry for mortar requirements.

2.3 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing in accordance with Specification 04200 – Unit Masonry for embedded flashing.

2.4 MASONRY CLEANERS

A. See Specification 040110 – Masonry Cleaning.

2.5 MORTAR MIXES

A. See Specification 042000 – Unit Masorny for Mortar Mixes.

PART 3 - EXECUTION

3.1 SETTING STONE MASONRY

A. Perform necessary field cutting and trimming as stone is set.

1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

D. Install embedded flashing and weep holes at obstructions to downward flow of water in wall, and where indicated on the Architectural drawings.

3.2 INSTALLATION OF ADHERED STONE MASONRY VENEER

A. Coat backs of stone units and face of masonry backup with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar, so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between units and masonry backup.

3.3 POINTING

A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch (10 mm) deep until a uniform depth is formed.

B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch (10 mm) deep. Compact each layer thoroughly, and allow to it become thumbprint hard before applying next layer.

3.4 ADJUSTING AND CLEANING

A. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.

END OF SECTION 044313.16

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of process and factory-fabricated product.
2. For preservative-treated wood products.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Engineered wood products.
3. Shear panels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

B. Maximum Moisture Content:

1. Boards: 15 percent.

2. Dimension Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, are to meet or exceed those indicated. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 PRESERVATIVE TREATMENT

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

2.3 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions by Grade: see Structural Drawings.

B. Framing Other Than Non-Load-Bearing Partitions by Grade: see Structural Drawings.

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Furring.

B. Dimension Lumber Items: Stud grade lumber of any species.

C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine.
2. Eastern softwoods.

2.5 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Do not splice structural members between supports unless otherwise indicated.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

3.2 PROTECTION

A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061516 - WOOD ROOF DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glued-laminated wood roof decking

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Research/Evaluation Reports: For glued-laminated wood roof decking indicated to be of diaphragm design and construction, from ICC-ES.

PART 2 - PRODUCTS

2.1 WOOD ROOF DECKING, GENERAL

A. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

2.2 GLUED-LAMINATED WOOD ROOF DECKING

A. Face Species: See Structural Drawings.

B. Roof Decking Nominal Size: See Structural Drawings.

C. Moisture Content: Provide wood roof decking with 15 percent maximum moisture content at time of dressing.

2.3 ACCESSORY MATERIALS

A. Fastener Material: Hot-dip galvanized steel.

B. Sealants: Latex, complying with applicable requirements in Section 079200 "Joint Sealants" and recommended by sealant manufacturer and manufacturer of substrates for intended application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install laminated wood roof decking to comply with manufacturer's written instructions and the Structural Drawings.

3.2 PROTECTION

A. Provide water-resistive barrier over roof decking as the Work progresses to protect roof decking until roofing is applied.

END OF SECTION 061516

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood roof trusses.

1.2 ACTION SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

C. Delegated-Design Submittals: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.

B. Evaluation Reports: For the following, from ICC-ES:

1. Metal-plate connectors.
2. Metal truss accessories.

1.4 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design metal-plate-connected wood trusses.

B. Structural Performance: Metal-plate-connected wood trusses are to be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1.

C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Provide dry lumber with 15 percent maximum moisture content at time of dressing.

B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

A. Fabricate connector plates to comply with TPI 1.

B. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.

2.4 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
2. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

A. Allowable design loads, as published by manufacturer, are to comply with or exceed those indicated of products of manufacturers. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors are to be punched for fasteners adequate to withstand same loads as framing anchors.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.

2.6 FABRICATION

A. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

B. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

F. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Section 061000 "Rough Carpentry."

G. Install wood trusses within installation tolerances in TPI 1.

H. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

I. Replace wood trusses that are damaged or do not comply with requirements.

END OF SECTION 061753

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Molded (expanded) polystyrene foam-plastic board insulation.
3. Graphite-polystyrene foam-plastic board insulation.
4. Glass-fiber board insulation.

1.2 ACTION SUBMITTALS

A. Product Performance data.

B. Material Safety data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than values required by current building code when tested in accordance with ASTM E84.

B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

D. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

E. Thermal-Resistance Value (R-Value): R-value as indicated on Drawings and in accordance with ASTM C518.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (XPS)

A. Extruded Polystyrene Board Insulation, Type IV, Drainage Panels: ASTM C578, Type IV, 25 psi (173 kPa) minimum compressive strength; unfaced.

2.3 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

B. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

C. Glass-Fiber Blanket Insulation, Kraft Faced: ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

D. Glass-Fiber Blanket Insulation, Reinforced-Foil Faced: ASTM C665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

E. Glass-Fiber Blanket Insulation, Foil Faced: ASTM C665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
3. Polyurethane Pour-In-Place Insulation: Closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84, specifically formulated for pour-in-place applications.

B. Miscellaneous Application Accessories:

1. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
2. Crack Sealer: Closed-cell insulating foam in aerosol dispenser recommended in writing by insulation manufacturer for filling gaps in board insulation.
3. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.
4. Detailing Foam Insulation for Voids: Urethane foam complying with AAMA 812, low expansion pressure suitable for filling insulation gaps and voids adjacent to openings to protect against water, air, and sound intrusion.
5. Tapes for Reflective Insulation and Barriers:

    a. Aluminum-foil tape for repairs or splicing material.
    b. Double-sided tape for adhering to metal framing or overlapping material.

c. Reinforced-foil tape for sealing tears or cuts in sheet vapor barrier.

6. Clip-and-Pin Components:

a. Tube Clips: For wood beams and metal tubular framing.
b. Locking Washers: Aluminum; white to match reflective bubble insulation facing colors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or those that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive in accordance with manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For wood-framed construction, install blankets in accordance with ASTM C1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward interior of construction.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Detailing Foam Insulation for Voids: Apply in accordance with manufacturer's written instructions.

3.5 INSTALLATION OF BOARD INSULATION

A. Install board insulation in accordance with manufacturer's written instructions per project applications and conditions.

B. Install interior radiation control coating system in accordance with ASTM C1321.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

072419 – WATER-DRAINAGE EXTERIOR INSULATION & FINISHING SYSTEM (IEFS)

GENERAL

1.1 SUMMARY

A. Section Includes:

1. EIFS-clad drainage-wall assemblies that are field applied over substrate.
2. Water-resistive barrier coatings.

1.2 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory, including water-resistive barrier coatings.

B. Shop Drawings:

1. Include details for EIFS buildouts.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer certificates.

B. Product certificates.

C. Field quality-control reports.

D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Parex USA, Inc.
2. Sto Corp.

2.2 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E2568 and with the following:

1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
2. Impact Performance: ASTM E2568, Medium impact resistance.
3. Drainage Efficiency: 90 percent average minimum when tested in accordance with ASTM E2273.

2.3 EIFS MATERIALS

A. Water-Resistive Barrier Coating: EIFS manufacturer's standard formulation and accessories for use as water-resistive barrier coating; compatible with substrate.

1. Water-Resistance: Comply with physical and performance criteria of ASTM E2570/E2570M.

B. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt, and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

C. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly; compatible with substrate.

D. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M.

1. Foam Buildouts: Provide with profiles and dimensions indicated on Drawings.

E. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) in accordance with ASTM E2098/E2098M.

F. Base Coat: EIFS manufacturer's standard mixture.

G. Water-Resistant Base Coat: EIFS manufacturer's standard water-resistant formulation.

H. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

I. Finish Coat: EIFS manufacturer's standard acrylic-based coating with enhanced mildew resistance**.**

1. Colors: To match existing.
2. Textures: To match existing.

J. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784, manufacturer's standard cell class for use intended, and ASTM C1063.

PART 3 - EXECUTION

3.1 EIFS INSTALLATION

A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

B. Water-Resistive Barrier Coating: Apply over Dense Glass sheathing to provide a water-resistive barrier.

C. Flexible-Membrane Flashing: Install over water-resistive barrier coating, applied and lapped to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

D. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at exterior openings, and elsewhere as indicated.

E. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C1397.

1. Apply adhesive to insulation by notched-trowel method, with notches oriented vertically to produce drainage channels that remain functional after the insulation is adhered to substrate.
2. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) from surface of insulation and to remove yellowed areas due to

sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm). Prevent airborne dispersal and immediately collect insulation raspings or sandings.

3. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier coating.

F. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer.

G. Water-Resistant Base Coat: Apply full-thickness coverage to exposed insulation**.**

H. Base Coat: Apply full coverage to exposed insulation with not less than 1/16-inch (1.6-mm) dry-coat thickness.

I. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches (200 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

J. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C1397 in same manner as first application. Do not apply until first base coat has cured.

K. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.

L. Foam Buildouts: Fully embed reinforcing mesh in base coat.

M. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

N. Finish Coat: Apply full-thickness coverage over dry primed base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

O. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.2 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform.

B. EIFS Tests and Inspections: In accordance with ASTM E2359/E2359M.

C. EIFS will be considered defective if it does not pass tests and inspections.

END OF SECTION 072419

074113.16 – STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vertical-rib, snap-joint, standing-seam metal roof panels.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For standing-seam metal roof panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates for portable roll-forming equipment.

B. Product Test Reports: For standing-seam metal roof panels, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Qualification Statements: For roof installers.

E. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels.

1.5 QUALITY ASSURANCE

A. Qualifications: For roof Installer.

B. Portable Roll-Forming Equipment Certification: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of Work.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads As indicated on Drawings.

B. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E1646.

C. Watertightness: No water penetration when tested in accordance with ASTM E2140 for hydrostatic-head resistance.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS, GENERAL

A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically

attaching panels to supports using concealed fasteners in side laps. Include all accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.

2.3 VERTICAL-RIB, SNAP-JOINT, STANDING-SEAM METAL ROOF PANELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ATAS International, Inc.
2. CENTRIA, a Nucor Brand.
3. Innovative Metals Company, Inc.

B. Panels: Formed with vertical ribs at panel edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.

1. Structural Support: Over open framing.
2. Material: Metallic-coated steel.
3. Panel Profile: Flat pan.
4. Panel Coverage: 16 inches (406 mm), 18 inches (457 mm), or 24 inches (610 mm).
5. Panel Height: 1.5 inches (38 mm).
6. Clips: Designed to accommodate thermal movement.

a. Steel Clips: 0.028-inch- (0.71-mm) nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
b. Clip Spacing: As indicated on Manufacture’s Drawings.

2.4 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Prepainted by the coil-coating process to comply with ASTM A755/A755M.

1. Surface: Smooth, flat finish.

2.5 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate in

accordance with equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal panel manufacturer's written installation instructions.

3.2 INSTALLATION OF STANDING-SEAM METAL ROOF PANELS

A. Install metal panels in accordance with manufacturer's written installation instructions and approved Shop Drawings in orientation, sizes, and locations indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Concealed Clip, Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

E. Panel Joints: Fasten panel joints to substrate in accordance with manufacturer's instructions.

1. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
2. Watertight Installation:

a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommended in writing by manufacturer as needed to make panels watertight.
b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
c. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements and manufacturer's written installation instructions. Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of

intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.

1. Connect downspouts to underground drainage system indicated.

3.3 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.16

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including gutters and downspouts.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).

B. ASTM B32 - Standard Specification for Solder Metal 2020.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021.

1.03 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit one sample, 12 by 12 inch (304.8 by 304.8 mm) in size illustrating material of typical standing seam.

D. Samples: Submit one samples 12 by 12 inch (304.8 by 304.8 mm) in size illustrating metal finish color.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Maintain one copy of each document on site.

C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with ten years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sheet Metal Flashing and Trim Manufacturers or equal:
   1. ALUCOBOND USA: www.alucobondusa.com/#sle.
   2. Fairview Architectural LLC: www.fairview-na.com/#sle.
   3. Petersen Aluminum Corporation: www.pac-clad.com/#sle.

2.02 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM) Rectangular profile.

B. Downspouts: Rectangular profile.

C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 50 years in accordance with SMACNA (ASMM).

D. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Gutter Supports: Straps.
   3. Downspout Supports: Straps.

E. Downspout Boots: Plastic.

F. Seal metal joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.4 mm).

3.03 INSTALLATION

A. Secure gutters and downspouts in place with concealed fasteners.

B. Slope gutters 1/4 inch per 10 feet (2.1 mm per m), minimum.

C. Connect downspouts to downspout boots, and seal connection watertight.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.
B. Self-leveling pourable joint sealants.
C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015.

B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants 2018.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

D. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2016.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2018.

G. ASTM C1311 - Standard Specification for Solvent Release Sealants 2014.

H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.

I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).

J. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).

K. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
2. List of backing materials approved for use with the specific product.
3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.
6. Substrates for which laboratory adhesion and/or compatibility testing is required.
7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
8. Sample product warranty.
9. Certification by manufacturer indicating that product complies with specification

requirements.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least five years of documented experience and approved by manufacturer.

C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.

1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Stain Testing: In accordance with ASTM C1248; required only for masonry substrates.
4. Allow sufficient time for testing to avoid delaying the work.
5. Deliver to manufacturer sufficient samples for testing.
6. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
7. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five-year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.

1. Bostik Inc: www.bostik-us.com/#sle.
2. Dow: www.dow.com/#sle.
3. Hilti, Inc: www.us.hilti.com/#sle.
4. Momentive Performance Materials, Inc (formerly GE Silicones) : www.momentive.com/#sle.
5. Pecora Corporation: www.pecora.com/#sle.
6. Sika Corporation: www.usa.sika.com/#sle.
7. Specified Technologies Inc: www.stifirestop.com/#sle.
8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
   1. Bostik Inc: www.bostik-us.com/#sle.
   2. Dow: www.dow.com/#sle.
   3. Pecora Corporation: www.pecora.com/#sle.
   4. Sika Corporation: www.usa.sika.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Other joints indicated below.
   3. Do not seal the following types of joints.
      a. Intentional weepholes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      d. Joints where installation of sealant is specified in another section.
      e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
   1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
   2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
   3. Masonry Control Joints.
   3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
   1. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
   2. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.

D. Interior Wet Areas: Bathrooms and restrooms; fixtures in wet areas include plumbing fixtures, countertops, and cabinets.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
3. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
4. Color: To be selected by Architect from manufacturer's full range.
5. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).
6. Manufacturers:
   a. Dow; DOWSIL 790 Silicone Building Sealant: www.dow.com/#sle.
   b. Dow; DOWSIL 791 Silicone Weatherproofing Sealant: www.dow.com/#sle.
   c. Dow; DOWSIL 795 Silicone Building Sealant: www.dow.com/#sle.
   d. Momentive Performance Materials, Inc/GE Silicones; SCS9000 SilPruf NB - Non-Staining Silicone Weatherproofing Sealant: www.siliconeforbuilding.com/#sle.
   e. Pecora Corporation; Pecora 890 NST (Non-Staining Technology): www.pecora.com/#sle.
   f. Sika Corporation; Sikasil WS-290: www.usa.sika.com/#sle.
   g. Sika Corporation; Sikasil WS-295: www.usa.sika.com/#sle.
   h. Sika Corporation; Sikasil 728NS: www.usa.sika.com/#sle.
   i. Substitutions: See Section 01 60 00 - Product Requirements.

B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's full range.
4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
5. Manufacturers:
   a. Pecora Corporation; DynaTrol II: www.pecora.com/#sle.
   b. Sika Corporation; Sikaflex-15 LM: www.usa.sika.com/#sle.
   c. Sika Corporation; Sikaflex-2c NS: www.usa.sika.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.

1. Movement Capability: Plus and minus 35 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's full range.
4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
5. Manufacturers:
   a. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
   b. Sika Corporation; Sikaflex-2c NS: www.usa.sika.com/#sle.
   c. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   d. Pecora Corporation: www.pecora.com/#sle
   e. Substitutions: See Section 01 60 00 - Product Requirements.

D. Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.

1. Manufacturers:
   a. Pecora Corporation; Pecora BA-98 Non-Skinning Butyl Sealant: www.pecora.com/#sle.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 SELF-LEVELING SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-

component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.

1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's full range.
4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
5. Manufacturers:
   a. Pecora Corporation: www.pecora.com/#sle.
   b. Sherwin-Williams Company; Stampede 2SL Polyurethane Sealant: www.sherwin-williams.com/#sle.
   c. Sika Corporation; Sikaflex-2c SL: www.usa.sika.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M, and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.

1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's full range.
4. Tensile Strength: 200 to 250 psi (1.38 to 1.72 MPa) in accordance with ASTM D412.
5. Manufacturers:
   a. Pecora Corporation: www.pecora.com/#sle.
   b. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   c. Sika Corporation: www.usa.sika.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.

1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's full range.
4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
5. Manufacturers:
   a. Sika Corporation; Sikaflex-2c SL: www.usa.sika.com/#sle.
   b. W. R. MEADOWS, Inc: www.wrmeadows.com/#sle.
   c. Pecora Corporation[<>]: www.pecora.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

1. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
2. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
3. Manufacturers:
   a. ADFAST Corporation; ADSEAL BR-2600 (Backer Rod): www.adfastcorp.com/#sle.
   b. Nomaco, Inc[<>]: www.nomaco.com/#sle.
   c. W. R. MEADOWS, Inc: www.wrmeadows.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Overlay Extrusion for Glazing System Joint Protection: Rubber profiled extrusions placed over joints in glazing system and provided with watertight seal.

1. Profile: As required to match existing metal glazing cap requirements.
2. Color: As required to match existing conditions.
3. Durometer Hardness, Type A: 65, minimum, when tested in accordance with ASTM D2240.
4. Tensile Strength: 1139 psi (7.8 MPa), in accordance with ASTM D412.

C. Preformed Extruded Silicone Joint Seal: Pre-cured low-modulus silicone extrusion, in sizes to fit applications indicated on drawings, combined with a neutral-curing liquid silicone sealant for bonding joint seal to substrates.
1. Size: 1 inch (25.4 mm) wide, in rolls 100 feet (30.5 m) long.
2. Thickness: 0.78 inch (19.8 mm), with ridges along outside bottom edges for bonding area.
3. Color: Anodized aluminum.
4. Durometer Hardness, Type A: 26 to 32, minimum, when tested in accordance with ASTM D2240.
5. Tensile Strength: 218 psi (1.5 MPa), in accordance with ASTM D412.
6. Elongation at Break: 554 percent, in accordance with ASTM D412.

D. Preformed Extruded Polyurethane Joint Seal: Medium-modulus, preformed polyurethane extrusion used to bridge joints under elastomeric wall coatings, in sizes to fit applications indicated on drawings, combined with polyurethane sealant for bonding joint seal to substrates.
1. Size: 1-1/2 inch (38 mm) wide, in rolls 100 feet (30.5 m) long.
2. Thickness: 0.051 inch (1.3 mm), with ridges along outside bottom edges for bonding area.
3. Color: Light gray.
4. Durometer Hardness, Type A: 55, minimum, when tested in accordance with ASTM D2240.
5. Tensile Strength: 532 psi (3.67 MPa), in accordance with ASTM D412.
6. Elongation at Break: 690 percent, in accordance with ASTM D412.

E. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

F. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

G. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

H. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.
B. Verify that backing materials are compatible with sealants.
C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

3.05 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.
3. Interior custom hollow-metal doors and frames.
4. Exterior custom hollow-metal doors and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.3 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following or equal:

1. Ceco Door; AADG, Inc.; ASSA ABLOY.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection

ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with R-factor of not less than R-2.5 when tested in accordance with ASTM C1363 or ASTM E1423.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with SDI standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Standard-Duty Doors and Frames: ANSI/SDI A250.8, Level 1; ANSI/SDI A250.4, Level C.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Factory primed steel sheet, minimum thickness of 0.032 inch (0.8 mm).
d. Edge Construction: Model 1, Full Flush.
e. Core: Manufacturer's standard.
f. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.

2. Frames:

a. Materials: Factory primed metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
b. Construction: Full profile welded.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with SDI standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches (44.5 mm).

c. Face: Factory primed steel sheet, minimum thickness of 0.042 inch (1.0 mm), with minimum A60 (ZF180) coating.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges per ANSI/SDI A250.8.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Manufacturer's standard.
i. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.

2. Frames:

a. Materials: Factory Primed metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180) coating.
b. Construction: Full profile welded.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

E. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

F. Glazing: Comply with requirements in Section 088000 "Glazing."

2.7 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
3. Smoke-Control Doors: Install doors in accordance with NFPA 105.

C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

C. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core Five-Ply flush wood doors for opaque finish.
2. Fire-rated wood door frames.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Door frame construction.
6. Factory-machining criteria.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Apply AWI Quality Certification or WI Certified Compliance Program label to Shop Drawings.

C. Samples: For all door, hardware, and frame types.

1.3 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification or WI Certified Compliance Program certificates.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.4 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program or WI's Certified Compliance Program.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.2 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with "Architectural Woodwork Standards." or ANSI/WDMA I.S. 1A.

1. Provide labels from AWI or WI certification program indicating that doors and frames comply with requirements of grades specified.

2.3 SOLID-CORE FIVE-PLY FLUSH WOOD DOORS FOR OPAQUE FINISH

A. Interior Doors, Solid-Core Five-Ply for Opaque Finish:

1. Performance Grade: ANSI/WDMA I.S. 1A Standard Duty.
2. Performance Grade by Location:

    a. ANSI/WDMA I.S. 1A Standard Duty: Offices, Closets, Storage Rooms, and Toilet Rooms.
3. Faces: Any closed-grain hardwood of mill option.

    a. Hardboard Faces: ANSI A135.4, Class 1 (tempered) or Class 2 (standard).

4. Exposed Vertical Edges: Any closed-grain hardwood.

    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.

b. Fire-Rated Pairs of Doors:

1) Provide formed-steel edges and astragals with intumescent seals.

5. Core for Non-Fire-Rated Doors:

a. ANSI A208.1, Grade LD-1 or Grade LD-2 particleboard.

6. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 FIRE-RATED WOOD DOOR FRAMES

A. Interior Fire-Rated Door Frames:

1. Architectural Woodwork Standards or ANSI/WDMA I.S. 1A Grade: Custom.
2. Wood Moisture Content: 5 to 10 percent.
3. Profile: Double rabbet.
4. Construction: Solid lumber, fire-retardant particleboard, or fire-retardant medium density fiberboard (MDF) with veneered exposed surfaces and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated on Drawings.

2.5 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware".

B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.
3. Install fire-rated doors and frames in accordance with NFPA 80.
4. Install smoke- and draft-control doors in accordance with NFPA 105.

3.2 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sectional-door assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction**.**

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.

C. Windborne-Debris Impact Resistance: Provide sectional doors complying with the following requirements:

1. Garage-Door Glazed Openings: Pass DASMA 115.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches (610 mm) apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance and storefront systems.

1.2 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
3. Point-to-point wiring diagrams.

C. Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

1.3 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Authorized representative who is trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated

by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.6 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

B. Structural Loads:

1. Wind Loads: As indicated on Structural Drawings.

C. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.

D. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure.

E. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system in accordance with NFRC 100.
b. Entrance Doors: U-factor in accordance with NFRC 100.

2. Solar Heat-Gain Coefficient (SHGC):

a. Fixed Glazing and Framing Areas: SHGC for the system in accordance with NFRC 200.
b. Entrance Doors: SHGC in accordance with NFRC 200.

3. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system in accordance with ASTM E283.

4. Condensation Resistance Factor (CRF):

a. Fixed Glazing and Framing Areas: CRF for the system in accordance with AAMA 1503.
b. Entrance Doors: CRF in accordance with AAMA 1503.

F. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Finish: Color anodic finish.
4. Fabrication Method: Field-fabricated stick system.
5. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
6. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

2. Door Design: Narrow stile; 3-inch (127-mm) nominal width.
3. Glazing Stops and Gaskets: Beveled snap-on, extruded-aluminum stops and preformed gaskets.

2.3 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and schedule for each entrance door, to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.

a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 15 lbf (67 N) to open the door to its minimum required width.
b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.

C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.

D. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

1. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
2. Exterior Hinges: Stainless steel, with stainless steel pin.
3. Quantities:

a. Provide three hinges per leaf.

E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

F. Manual Flush Bolts: BHMA A156.16, Grade 1.

G. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.

H. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.

I. Cylinders:

1. As specified in Section 087100 "Door Hardware.

J. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

K. Operating Trim: BHMA A156.6.

L. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

M. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.

N. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

O. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

P. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

Q. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

2.4 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.5 MATERIALS

A. Sheet and Plate: ASTM B209 (ASTM B209M).

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).

C. Structural Profiles: ASTM B308/B308M.

2.6 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.7 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, or thicker.

1. Color: Dark bronze.

PART 3 - EXECUTION

3.1 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

K. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

L. Install glazing as specified in Section 088000 "Glazing."

3.2 FIELD QUALITY CONTROL

A. Tests: Perform the following test on representative areas of aluminum-framed entrance and storefront systems.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect to be tested in accordance with AAMA 501.2 and to not evidence water penetration.

a. Perform tests at main entrance and office exterior window.

B. Aluminum-framed entrance and storefront systems will be considered defective if they are not square, plum, and include tight fitting connections.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hinges.
2. Mechanical locks and latches.
3. Surface bolts.
4. Manual flush bolts.
5. Automatic flush bolts.
6. Self-latching flush bolts.
7. Exit devices and auxiliary items.
8. Lock cylinders.
9. Keying.
10. Operating trim.
11. Surface closers.
12. Wall- and floor-mounted stops.
13. Overhead stops and holders.
14. Door gasketing.
15. Thresholds.
16. Metal protective trim units.
17. Finishes.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Keying Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings:

1. Indicate locations and mounting heights of each type of hardware, schedules, and catalog cuts.
2. Details of interface of electrified door hardware and building safety and security systems.

C. Samples: For each exposed product in each finish specified.

D. Door hardware schedule.

E. Keying schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedule.
2. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested in accordance with UL 1784 and installed in compliance with NFPA 105.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

2.3 HINGES

A. Hinges: ANSI/BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.

C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.

D. Lock Trim:

1. Levers: Cast.

a. To match existing.

2. Escutcheons (Roses): Cast].
3. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

F. Mortise Locks: ANSI/BHMA A156.13; stamped steel case with steel parts; Series 1000.

2.5 SURFACE BOLTS

A. Surface Bolts: ANSI/BHMA A156.16.

2.6 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: ANSI/BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

2.7 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic Flush Bolts: ANSI/BHMA A156.3, Type 25; minimum 3/4-inch (19-mm) throw; with dust-proof strikes; designed for mortising into door edge.

B. Self-Latching Flush Bolts: ANSI/BHMA A156.3, Type 27; minimum 3/4-inch (19-mm) throw; with dust-proof strikes; designed for mortising into door edge.

2.8 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: ANSI/BHMA A156.3.

2.9 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from stainless steel. Provide cylinder from same manufacturer of locking devices.

B. Standard Lock Cylinders: ANSI/BHMA A156.5, permanent cores; face finished to match lockset.

1. Core Type: Removable.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.10 KEYING

A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix. Provide three extra key blanks for each lock. Incorporate decisions made in keying conference.

1. Existing System:

a. Master key or grand master key locks to Owner's existing system.

2. Keyed Alike: Key all cylinders to same change key.

2.11 OPERATING TRIM

A. Operating Trim: ANSI/BHMA A156.6; stainless steel unless otherwise indicated.

2.12 SURFACE CLOSERS

A. Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.13 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.

2.14 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: ANSI/BHMA A156.8.

2.15 DOOR GASKETING

A. Door Gasketing: ANSI/BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.

2.16 THRESHOLDS

A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.

2.17 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

2.18 FINISHES

A. Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated on Drawings unless otherwise indicated or required to comply with governing regulations.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (760 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.

E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant.

F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.2 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product; 12 inches (300 mm) square.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.

B. Product test reports.

C. Sample warranties.

1.5 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.6 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated

glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Structural Drawings.

B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
2. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
3. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.2 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass . Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass . Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

D. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

2.4 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

2.5 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks:

1. Silicone with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

C. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

D. Edge Blocks:

1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-

glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

END OF SECTION 088000

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.

1.2 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: For each finish indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:

a. CertainTeed; SAINT-GOBAIN.
b. Gold Bond Building Products, LLC provided by National Gypsum Company.
c. USG Corporation.

2. Thickness: 5/8 inch (15.9 mm).

3. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:

a. CertainTeed; SAINT-GOBAIN.
b. Gold Bond Building Products, LLC provided by National Gypsum Company.
c. USG Corporation.

2. Thickness: 5/8 inch (15.9 mm).
3. Long Edges: Tapered.

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:

a. CertainTeed; SAINT-GOBAIN.
b. Gold Bond Building Products, LLC provided by National Gypsum Company.
c. USG Corporation.

2. Core: 5/8 inch (15.9 mm).
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C1396/C1396M, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:

a. CertainTeed; SAINT-GOBAIN.
b. Gold Bond Building Products, LLC provided by National Gypsum Company.

2. Core: 5/8 inch (15.9 mm).

B. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal:

a. CertainTeed; SAINT-GOBAIN.
b. Gold Bond Building Products, LLC provided by National Gypsum Company.
c. USG Corporation.

2. Core: 5/8 inch (15.9 mm).

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. L-Bead: L-shaped; exposed long flange receives joint compound.
    d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    e. Expansion (control) joint.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
1.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

3.2 FINISHING OF GYPSUM BOARD

A. Prefill open joints**,** rounded or beveled edges, and damaged surface areas.

B. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

C. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

D. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.3 APPLICATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical tiles.
2. Metal suspension system.
3. Accessories.

B. Related Requirements:

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Refer to structural drawings.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 ACOUSTICAL TILES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Armstrong World Industries, Inc.
2. CertainTeed; SAINT-GOBAIN.
3. USG Corporation.

B. Acoustical Tile Standard: Manufacturer's standard tiles of configuration indicated that comply with ASTM E1264.

C. Color: White.

D. Edge/Joint Detail: Square edge.

E. Thickness: 3/4 inch (19 mm).

F. Modular Size: 24 by 24 inches (610 by 610 mm).

2.3 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: 15/16” Manufacturer's standard, direct-hung, fully concealed, metal suspension system that complies with applicable requirements in ASTM C635/C635M.

B. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation.

1. Structural Classification: Intermediate-duty system.
2. Access: Upward and end pivoted, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.

a. Initial Access Opening: In each module, 24 by 24 inches (610 by 610 mm)

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated.

B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings in accordance with ASTM C636/C636M, seismic design requirements**,** and manufacturer's written instructions.

B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

3.3 FIELD QUALITY CONTROL

A. Inspect grid and tiles to be plumb with straight runs parallel and perpendicular. Tiles to be seated flush in grid. Replace broken, scratched, and dented tiles.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl base.
2. Vinyl accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 VINYL BASE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Armstrong World Industries, Inc.
2. Johnsonite; a Tarkett company.
3. Roppe Corporation; Roppe Holding Company.

B. Product Standard: ASTM F1861, Type TV (vinyl, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style:

a. Style B: Cove.

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors and Patterns: As selected by Owner from product samples.

2.2 VINYL MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Armstrong World Industries, Inc.
2. Johnsonite; a Tarkett company.
3. Roppe Corporation; Roppe Holding Company.

B. Description: Vinyl carpet transition strips

C. Locations: Carpet transition locations to other floor finishes.

D. Colors and Patterns: As selected by Owner from product samples.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

    a. Cope corners to minimize open joints.

3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

END OF SECTION 096513

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Finish coatings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of topcoat product.

1.3 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following or equivalent:

1. Benjamin Moore

2. Glidden Professional.

3. Sherwin Williams.

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.

B. Colors: As selected by Owner from samples.

2.3 PRIMERS

A. Surface-Tolerant Metal Primer: Corrosion-resistant, solvent-based metal primer formulated for use on structural steel and metal fabrications that have been minimally prepared.

B. Quick-Drying, Alkyd Metal Primer: Corrosion-resistant, solvent-based, modified-alkyd primer; lead and chromate free; formulated for quick-drying capabilities and for use on cleaned, exterior steel surfaces.

2.4 FINISH COATINGS

A. Exterior Latex Paint, Gloss: Water-based, pigmented, acrylic-copolymer-emulsion coating formulated for alkali, mold, microbial, scrub, blocking (sticking of two painted surfaces), and water resistance and for use on exterior, primed, wood and metal trim, sashes, frames, and doors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.

B. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions.

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Water-based finish coatings.
3. Solvent-based finish coatings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of topcoat product.

C. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

PART 2 - PRODUCTS

2.1 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As selected by Owner from product samples.

2.2 PRIMERS

A. Interior/Exterior Latex Block Filler: Water-based, high-solids, emulsion coating formulated to bridge and fill porous surfaces of interior concrete masonry units in preparation for specified subsequent coatings.

B. Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum wallboard surfaces.

C. Alkyd Quick-Dry Primer for Metal: Corrosion-resistant, solvent-based, modified-alkyd primer; lead and chromate free; formulated for quick-drying capabilities and for use on cleaned, interior steel surfaces.

2.3 WATER-BASED FINISH COATS

A. Interior, Latex, Eggshell: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

2.4 SOLVENT-BASED FINISH COATS

A. Interior, Alkyd, Semigloss: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

B. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

C. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099123

SECTION 123213 – MANUFACTURED WOOD VENNE FACED CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood-veneer-faced casework.
2. Hardware and accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For wood-veneer-faced casework.

C. Samples: For casework and hardware finishes.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For casework manufacturer and Installer.

B. Sample warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer and licensed participate in AWI's Quality Certification Program.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CIF Lab Solutions LP.
2. ICIscientific.
3. Kewaunee Scientific Corporation.
4. TMI Systems Corporation.

2.2 GENERAL REQUIREMENTS FOR CASEWORK

A. Quality Standard: Unless otherwise indicated, comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI or WI certification program indicating that casework complies with requirements of grades specified.

2.3 WOOD-VENEER-FACED CASEWORK

A. Design: Frameless cabinet construction with the following door and drawer-front style:

1. Flush overlay.

B. Wood Species: As selected by Owner from samples.

1. Wood Stain Colors and Finishes: As selected by Owner from samples.

C. Face Veneer Cut: As selected by Owner from samples.

2.4 MATERIALS

A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

B. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.

C. Softwood Plywood: DOC PS 1.

D. Particleboard: ANSI A208.1, Grade M-2.

E. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.

F. Hardboard: ANSI A135.4, Class 1 tempered.

G. PVC Edgebanding for Wood: Rigid PVC extrusions, through color with satin finish, 3.0 mm thick at doors and drawer fronts, 1.0 mm thick elsewhere.

H. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper.

1. Edgebanding for Thermally Fused Laminate (TFL) Panels: PVC or polyester edgebanding matching thermally fused laminate panels.

2.5 FINISH

A. Stain: Provide uniform color and to match approved Samples.

B. Finish: Manufacturer's standard, baked, clear finish consisting of a thermosetting catalyzed sealer and a thermosetting catalyzed conversion varnish.

2.6 HARDWARE AND ACCESSORIES

A. Match existing hardware.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grade: Install casework to comply with same quality standard grade as item to be installed.

B. Install casework level, plumb, and true in line; shim as required using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch (1.5 mm) of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch (1.5 mm). Bolt adjacent cabinets together with joints flush, tight, and uniform.

D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch (1.5 mm) of a single plane. Fasten cabinets to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch (1.5 mm).

E. Fasten casework to adjacent units and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards."

F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

G. Adjust operating hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

H. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish.

3.2 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work to be complete, operable, dust free, and new condition.

1. Replace any broken, scratched, or otherwise defective casework or hardware.

END OF SECTION 123213

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad countertops.
2. Accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plastic-laminate-clad countertops.

1. Apply AWI Quality Certification or WI Certified Compliance Program label to Shop Drawings.

C. Samples: Plastic laminates in each type, color, pattern, and surface finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For the following:

1. Composite wood products.
2. High-pressure decorative laminate.
3. Adhesives.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program or WI Certified Compliance Program.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: AWI's Quality Certification Program accredited participant or WI's Certified Compliance Program licensee.

1.5 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install wood countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 FABRICATORS

A. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work.

2.2 PLASTIC-LAMINATE-CLAD COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.

B. Grade: Custom.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Owner from manufacturer's full range in the following categories:

a. Solid and pattern colors, gloss and matte finish.

D. Edge Treatment: Same as laminate cladding on horizontal surfaces.

E. Core Material: Particleboard or MDF.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.

1. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Softwood Plywood: DOC PS 1.

2.4 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Plastic Laminate: Type I waterproof type as selected by fabricator to comply with requirements.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated for the following:

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops level and true in line. Use concealed shims as required to maintain a straight, level plane.
2. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

F. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches (1220 mm) o.c. Remove protection at Substantial Completion.

END OF SECTION 123623.13