PROJECT MANUAL FOR

COMMUNITY CENTER AND GYMNASIUM
For
Alice Keene District Park

4561 County Home Rd, Greenville, NC 27858

Hite associates

ARCHITECTURE / PLANNING / TECHNOLOGY

2600 Meridian Drive / Greenville, NC 27834 / tel 252.757.0333 / www.hiteassoc.com

CIVIL ENGINEERING CONSULTANT: Rivers and Associates, Inc.

107 East 2nd Street, Greenville, NC 27858, (252) 752-4135

STRUCTURAL ENGINEERING CONSULTANT: Queen Engineering & Design, P.A.

5530 Munford Road, Raleigh, NC 27612, (919) 420-0480

MECHANICAL / ELECTRICAL ENGINEERING CONSULTANT: Engineering Source of NC, P.A.

102-A2 Regency Blvd., Greenville, NC 27859, (252) 439-0338

July 2023

DIVISION 16 - ELECTRICAL

DIVISION 17 INTERGRATED COMMUNICATIONS

END OF TABLE OF CONTENTS

NOTICE TO BIDDERS

Sealed proposals from invited bidders will be received by the County of Pitt, at the office of the Pitt County Community Schools and Recreations Building, 4561 County Home Road, Greenville, NC 27858. Single Prime Bids will be accepted up to 3:00 p.m. for the furnishing of labor, material, and equipment, entering into the construction of the COMMUNITY CENTER AND GYMNASIUM FOR Alice Keene District Park. Bids shall be marked "SEALED BID", addressed to the attention of Mr. Tim Corley, County Engineer, Pitt County and shall include the Name, Address, and License Number of the Bidder, and the type proposal enclosed.

Bids will be received as follows:

1. Single Prime Contract (All Work)

Complete plans, specifications and contract documents are available on the Hite Associates website, www.hiteassoc.com ; or may be purchased by contacting Speedyblue Reprographics at (252) 758-1616, print@speedyblue.com.

There will be a Pre-Bid Conference and Open Meeting at the project site, Community Schools & Recreation Center, 4561 County Home Road, Greenville, NC 27858 on Tuesday, August 29, 2023, at 3:00 p.m.

All Contractors are hereby notified that they must have proper license under the State laws governing their respective trades.

General Contractors are notified that Chapter 87, Article I, General Statutes of North Carolina, will be observed in receiving bids and awarding the General Contract. General Contractors submitting bids on this project must have proper license classification.

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company insured by the Federal Deposit Insurance Corporation, of an amount equal to not less than five percent (5%) of the proposal, or in lieu thereof, a bidder may offer a bid bond of five percent (5%) of the bid executed by a surety company licensed under the laws of North Carolina to execute such bonds, conditioned that the surety will, upon demand forthwith make payment to the obligee upon said bond if the bidder fails to execute the contract in accordance with the bid bond. Said deposit shall be retained by the Owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten days after the award or to give satisfactory surety as required by law. In determining the value of the bid bond, additive or deductive alternates shall be considered as they are accepted by the Owner.

A Performance Bond and a Labor and Materials Payment Bond will be required for one hundred percent (100%) of the contract price.

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

No bid may be withdrawn after the scheduled closing time for the receipt of bids for a period of 30 days after the bid date.

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

SIGNED: Mr. Tim Corley, PE, Assistant County Manager / County Engineer
County of Pitt
Greenville, North Carolina

DESIGNER: HITE ASSOCIATES, P.C.
2600 Meridian Drive
Greenville, North Carolina 27834

GO TO NEXT PAGE

AIA® Document A701® – 2018

Instructions to Bidders

for the following Project:
(Name, location, and detailed description)

Alice Keene Park Gymnasium
Alice Keene District Park
4561 County Home Road
Greenville, NC 27858

THE OWNER:
(Name, legal status, address, and other information)

Pitt County Schools Board of Education
1717 West 5th Street
Greenville, NC 27858

THE ARCHITECT:
(Name, legal status, address, and other information)

Hite Associates, P.C.
2600 Meridian Drive
Greenville, NC 27834
Telephone Number: 252-757-0333

TABLE OF ARTICLES

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- **.1** the Bidder has read and understands the Bidding Documents;
- **.2** the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- **.3** the Bid complies with the Bidding Documents;
- **.4** the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- **.5** the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- **.6** the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount

of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:
(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents listed below:
(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

Additions and Deletions Report for
AIA® Document A701® – 2018

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 10:19:16 ET on 02/28/2023.

PAGE 1

Alice Keene Park Gymnasium
Alice Keene District Park
4561 County Home Road
Greenville, NC 27858

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Pitt County Schools Board of Education
1717 West 5th Street
Greenville, NC 27858

...

Hite Associates, P.C.
2600 Meridian Drive
Greenville, NC 27834
Telephone Number: 252-757-0333

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 10:19:16 ET on 02/28/2023 under Order No. 4104237868 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ - 2018, Instructions to Bidders, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

ARTICLE 3

ADD subparagraph 3.4: In addition to obtaining Bidding Documents from the Hite Associates website, qualified bidders, subcontractors, material suppliers may obtain complete or partial sets of the Drawings Bidding Documents and specifications from SpeedyBlue Printers for the cost of printing and mailing.

ARTICLE 4

ADD: Bidders must identify the type of proposal clearly on the Bid Envelope, and include State License number thereon.

ARTICLE 7

ADD: Furnish a Performance Bond and a Labor and Materials Payment Bond in the amount of the Contract Price, covering faithful performance of contract and payment of all obligations arising thereunder on AIA Document A312.

F O R M OF P R O P O S A L

From: _____ Contract: GENERAL

Address: _____

To: County of Pitt Date: _____

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud.

The bidder further declares that he has examined the site of the work and informed himself fully with regard to all conditions pertaining to the places where the work is to be done, that he has examined the specifications for the work and the contract documents relative thereto and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed.

The Bidder proposes and agrees if this proposal is accepted to contract with the ***County of Pitt*** in the form of contract specified below, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of the: ***COMMUNITY CENTER AND GYMNASIUM For Alice Keene District Park*** in full and complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of the Owner and / or Architect, with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and the Contract Documents, for the sum of:

SINGLE PRIME CONTRACT (ALL WORK)

Base Bid:

_____ Dollars($)_____

Plumbing Subcontractor: _____

Electrical Subcontractor: _____

Mechanical Subcontractor: _____

ALTERNATES:

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be added to the base bid.

ALTERNATE NO. G-1: Shall be the amount added to the Base Bid to provide all work for construction of the Activity Room Wing complete, rooms/spaces 119 thru 125, as indicated on A-101 Alternate and Drawings, and shall include all manufacturer preferred alternates.

(Add) _____ Dollars($)

ALTERNATE NO. G-2: Shall be the amount added to the Base Bid to provide preferred manufacturer ASI Accurate for toilet partitions, with vandal resistant anti-graffiti surface texture, Tough Texture (TT) raised profile dimple texture, in lieu of other equivalent manufacturers, as per Specification 10900.

(Add) _____ Dollars($)

ALTERNATE NO. G-3: Shall be the amount added to the Base Bid to provide preferred manufacturer Trans-Lux Fair-Play for Gymnasium Scoreboards, in lieu of other equivalent manufacturers, as per Specification 11150.

(Add) _____ Dollars($)

ALTERNATE NO. P-1: Shall be the amount added to the Base Bid to provide preferred manufacturers Elkay, Kohler, Zurn, Woodford and as scheduled for the plumbing fixtures.

(Add) _____ Dollars($)

ALTERNATE NO. M-1: Shall be the amount added to the Base Bid to provide preferred manufacturers Trane or Carrier for the conventional DX HVAC equipment..

(Add) _____ Dollars($)

ALTERNATE NO. M-2: Shall be the amount added to the Base Bid to provide preferred manufacturers Mitsubishi or Daikin for the Mini-Split HVAC equipment..

(Add) _____ Dollars($)

ALTERNATE NO. E-1: Shall be the amount added to the Base Bid to provide preferred manufacturer Square D for the electrical gear and safety switches.

(Add) _____ Dollars ($)

ALTERNATE NO. E-2: Shall be the amount added to the Base Bid to provide preferred manufacturers Notifier or Gamewell for the New Gym Addition Fire Alarm System.

(Add) _____ Dollars ($)

ALTERNATE NO. E-3: Shall be the amount added to the Base Bid to provide New Fire Alarm devices in the existing building that will be part of the New Gym Addition Fire Alarm as shown on Drawing FA-101.

(Add) _____ Dollars ($)

UNIT PRICES:

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices will include all costs, and shall be applied, as appropriate, to compute the total value of changes in the scope of the installed work, all in accordance with the contract documents. Unit prices listed shall include all overhead and profit costs.

ITEM #	DESCRIPTION	UNIT PRICE
1	4" Thick Concrete Sidewalk	_____ s.y. (square yard)
2	Mass Under Cut Excavation (Disposal **OFF** Site)	_____ c.y. (cubic yard)
3	Off-Site Select Borrow Fill	_____ c.y. (cubic yard)
4	Foundation Undercut Excavation (Disposal **OFF** Site)	_____ c.y. (cubic yard)
5	#57 or #67 Stone (Building foundations)	_____ c.y. (cubic yard)
6	8" deep undercut and backfill with CABC (drives and parking)	_____ c.y. (cubic yard)
7	Tensar BX-1100 Geogrid	_____ s.y. (square yard)
8	Conflict Box	_____ Each
9	Fire Alarm Voice Notification Device	_____ Per Device
10	Fire Alarm Duct Mounted Smoke Detector	_____ Per Device
11	Fire Alarm Smoke Detector	_____ Per Device
12	Fire Alarm Multi-Function Smoke-CO Device	_____ Per Device

NOTE: "Installed" means undercut and fill materials are measured compacted and in place, not by truckload or prior to compaction.

TIME

The Bidder further proposes and agrees hereby to commence work on a date specified in the Architect's Notice to Proceed, and to complete all work according to the schedule of dates set under Article 8 "Time" of the Supplementary Conditions, WHICH ARE DATES CERTAIN, with no allowance for delays except as may be caused by the Owner. Applicable liquidated damages shall be as stated in the Supplementary General Conditions.

HUB PARTICIPATION REQUIREMENTS;

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

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

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

An Affidavit (**C**) that includes a description of the portion of work to be executed by HUB businesses, expressed as a percentage of the total contract price, which is equal to or more than the 10% goal established. This affidavit shall give rise to the presumption that the bidder has made the required good faith effort and Affidavit **D** is not necessary;

OR

If less than the 10% goal, Affidavit (**D**) of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations and other specific actions demonstrating recruitment and selection of HUB businesses for participation in the contract.

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

Proposal Signature Page

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

Respectfully submitted this day of _____

_____
(Name of firm or corporation making bid)

WITNESS:

By:_____
Signature

_____
(Proprietorship or Partnership)

Name: _____
Print or type

Title_____
(Owner / Partner / President / Vice President)

Address_____

ATTEST:

_____

By:_____

License No._____

Title:_____
(Corp. Sec. or Asst. Sec. only)

Federal I.D. No. _____

(CORPORATE SEAL)

Addendum received and used in computing bid:

Addendum No. 1 _____ Addendum No. 2 _____ Addendum No. 3_____ Addendum No. 4__

Addendum No. 5_____ Addendum No. 6 _____

GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES FOR PARTICIPATION IN CONSTRUCTION CONTRACTS

In accordance with G.S. 143-128.2 (effective January 1, 2002) these guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, and alternative contracting methods. The legislation provides that the Public Owner shall have a verifiable ten percent (10%) goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These requirements are published to accomplish that end.

SECTION A: INTENT

It is the intent of these guidelines that the Owner, as awarding authority for construction projects, and the contractors and subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper and reasonable to achieve the statutory goal of ten percent (10%) for participation by minority businesses in each construction project as mandated by GS 143-128.2. Nothing in these guidelines shall be construed to require contractors or awarding authorities to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who do not submit the lowest responsible, responsive bid or bids.

SECTION B: DEFINITIONS

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

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

3. Socially and economically disadvantaged individual - means the same as defined in 15 U.S.C. 637. "Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities". "Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged".

4. Public Entity - means the Owner and all public subdivisions and local governmental units.

5. Owner - The public institution named in the contract.

6. Designer – Any person, firm, partnership, or corporation, which has contracted with the Owner to perform architectural or engineering work.

7. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.

8. Contract - A mutually binding legal relationship or any modification thereof, obligating the seller to furnish equipment, materials or services, including construction, and obligating the buyer to pay for them.

9. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the State of North Carolina to perform construction work or repair.

10. Subcontractor - A firm under contract with the prime contractor or construction manager at risk for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract.

SECTION C: RESPONSIBILITIES

1. Office for Historically Underutilized Businesses, Department of Administration (hereinafter referred to as HUB Office).

   The HUB Office has established a program, which allows interested persons or businesses qualifying as a minority business under G.S. 143-128.2, to obtain certification in the State of North Carolina procurement system. The information provided by the minority businesses will be used by the HUB Office to:
   a. Identify those areas of work for which there are minority businesses, as requested.
   b. Make available to interested parties a list of prospective minority business contractors and subcontractors.
   c. Assist in the determination of technical assistance needed by minority business contractors.

   In addition to being responsible for the certification/verification of minority businesses that want to participate in the State construction program, the HUB Office will:
   (1) Maintain a current list of minority businesses. The list shall include the areas of work in which each minority business is interested.
   (2) Inform minority businesses on how to identify and obtain contracting and subcontracting opportunities through the State and other public entities.
   (3) Inform minority businesses of the contracting and subcontracting process for public construction building projects.
   (4) Work with the North Carolina trade and professional organizations to improve the ability of minority businesses to compete in the State construction projects.
   (5) The HUB Office also oversees the minority business program by:
      a. Monitoring compliance with the program requirements.
      b. Assisting in the implementation of training and technical assistance programs.
      c. Identifying and implementing outreach efforts to increase the utilization of minority businesses.
      d. Reporting the results of minority business utilization to the Secretary of the Department of Administration, the Governor, and the General Assembly.

2. The Owner
   The Owner will be responsible for the following:

a. Reviewing the apparent low bidders' statutory compliance with the requirements listed in the proposal prior to award of contracts. The Owner reserves the right to reject any or all bids and to waive informalities.
b. Monitoring of contractors' compliance with minority business requirements in the contract documents during construction.
c. Providing statistical data and required reports to the HUB Office.
d. Resolving any protest and disputes arising after implementation of the plan.

3. Constituent Institutions of The State of North Carolina
Before awarding a contract, a constituent institution shall do the following:

a. Implement the constituent institution HUB plan.
b. Attend the scheduled prebid conference.
c. At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from the public entity for public construction or repair work and minority businesses that otherwise indicated to the Office for Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:
    1. A description of the work for which the bid is being solicited.
    2. The date, time, and location where bids are to be submitted.
    3. The name of the individual within the owner's organization who will be available to answer questions about the project.
    4. Where bid documents may be reviewed.
    5. Any special requirements that may exist.
d. Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought.
e. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
f. Review, jointly with the designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.
g. Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award.
h. Review prime contractors' pay applications for compliance with minority business utilization commitments prior to payment.
i. Document evidence of implementation of Owner's responsibilities.

4. Designer
Under the single-prime bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the designer will:

a. Attend the scheduled prebid conference to explain minority business requirements to the prospective bidders.
b. Assist the owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
c. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
d. Review jointly with the owner, all requirements of G.S. 143-128.2(c) and G.S.143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.

e. During construction phase of the project, review "MBE Documentation for Contract Payment" – (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the owner and forward copies to the Owner.
f. Make documentation showing evidence of implementation of Designer's responsibilities available for review by the Owner and HUB Office, upon request.

5. Prime Contractor(s), CM at Risk, and Its First-Tier Subcontractors
Under the single-prime bidding, the separate-prime bidding, construction manager at risk and alternative contracting methods, contractor(s) will:

a. Attend the scheduled prebid conference.
b. Identify or determine those work areas of a subcontract where minority businesses may have an interest in performing subcontract work.
c. At least ten (10) days prior to the scheduled day of bid opening, notify minority businesses of potential subcontracting opportunities listed in the proposal. The notification will include the following:
   (1) A description of the work for which the subbid is being solicited.
   (2) The date, time and location where subbids are to be submitted.
   (3) The name of the individual within the company who will be available to answer questions about the project.
   (4) Where bid documents may be reviewed.
   (5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.

   If there are more than three (3) minority businesses in the general locality of the project who offer similar contracting or subcontracting services in the specific trade, the contractor(s) shall notify three (3), but may contact more, if the contractor(s) so desires.
d. During the bidding process, comply with the contractor(s) requirements listed in the proposal for minority participation.
e. Identify on the bid**,** the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).
f. Make documentation showing evidence of implementation of PM, CM-at-Risk and First-Tier Subcontractor responsibilities available for review by the constituent institution and HUB Office, upon request.
g. Upon being named the apparent low bidder, the Bidder shall provide one of the following: (1) an affidavit (Affidavit C) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal; (2) if the percentage is not equal to the applicable goal, then documentation of all good faith efforts taken to meet the goal. Failure to comply with these requirements is grounds for rejection of the bid and award to the next lowest responsible and responsive bidder.
h. The contractor(s) shall identify the name(s) of minority business subcontractor(s) and corresponding dollar amount of work on the schedule of values. The schedule of values shall be provided as required in Article 31 of the General Conditions of the Contract to facilitate payments to the subcontractors.
i. The contractor(s) shall submit with each monthly pay request(s) and final payment(s), "MBE Documentation for Contract Payment" – (Appendix E), for designer's review.
j. During the construction of a project, at any time**,** if it becomes necessary to replace a minority business subcontractor, immediately advise the Owner, and the Director of the HUB Office in writing**,** of the circumstances involved. The prime contractor shall make a good faith effort to replace a minority business subcontractor with another minority business subcontractor.
k. If during the construction of a project additional subcontracting opportunities become available, make a good faith effort to solicit subbids from minority businesses.
l. It is the intent of these requirements apply to all contractors performing as prime contractor and first tier subcontractor under construction manager at risk on state projects.

6. Minority Business Responsibilities
   While minority businesses are not required to become certified in order to participate in the State construction projects, it is recommended that they become certified and should take advantage of the appropriate technical assistance that is made available. In addition, minority businesses who are contacted by owners or bidders must respond promptly whether or not they wish to submit a bid.

SECTION D: DISPUTE PROCEDURES
It is the policy of this state that disputes that involves a person's rights, duties or privileges, should be settled through informal procedures. To that end, minority business disputes arising under these guidelines should be resolved as governed under G.S. 143-128(g).

SECTION E: These guidelines shall apply upon promulgation on University construction projects. Copies of these guidelines may be obtained from:
http://www.NorthCarolina.edu/finance/projects/projects.cfm#attachments

SECTION F: In addition to these guidelines, there will be issued with each construction bid package provisions for contractual compliance providing MBE participation in State building projects. An explanation of the process follows, titled "MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)" along with relevant forms for its implementation ("Identification of Minority Business Participation" form, Affidavits A, B, C, D and Appendix E).

MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts** are hereby made a part of these contract documents. These guidelines shall apply to all contractors regardless of ownership. Copies of these guidelines may be obtained from: http://www.NorthCarolina.edu/finance/projects/projects.cfm#attachments

MINORITY BUSINESS SUBCONTRACT GOALS:

The goals for participation by minority firms as subcontractors on this project have been set at 10%.

The bidder must identify on its bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit (Affidavit A) listing good faith efforts **or** affidavit (Affidavit B) of self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).

The lowest responsible, responsive bidder must provide Affidavit C, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal.

OR

Provide Affidavit C, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, **with documentation of Good Faith Effort, if the percentage is not equal to the applicable goal.**

OR

Provide Affidavit B, which includes sufficient information for the State to determine that the bidder does not customarily subcontract work on this type project.

The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.

MINIMUM COMPLIANCE REQUIREMENTS:

All written statements, affidavits or intentions made by the Bidder shall become a part of the agreement between the Contractor and the Owner for performance of this contract. Failure to comply with any of these statements, affidavits, or intentions, or with the minority business Guidelines shall constitute a breach of the contract. A finding by the Owner that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the Owner whether to terminate the contract for breach.

In determining whether a contractor has made Good Faith Efforts, the Owner will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. Good Faith Efforts include:

(1) Contacting 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 or proposal date and notifying them of the nature and scope of the work to be performed.

(2) Making 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 bid or proposals are due.

(3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.

(4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.

(5) Attending any prebid meetings scheduled by the public owner.

(6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.

(7) Negotiating in good faith with interested minority businesses and not rejecting 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) Providing 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. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.

(9) Negotiating 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) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

Identification of Minority Business Participation

I, _____,
(Bidder)

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

Firm Name, Address and Phone #	Work type	*Minority Category

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

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

AFFIDAVIT A – Listing of the Good Faith Effort

County of _____

Affidavit of_____
(Bidder)

I have made a good faith effort to comply under the following areas checked:
(A minimum of 5 areas must be checked in order to have achieved a "good faith effort")

- ❑ **1 -** 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** -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** - Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ❑ **4** - 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** - Attended prebid meetings scheduled by the public owner.
- ❑ **6** - Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ❑ **7** - 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** - 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** - 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** - Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

In accordance with GS143-128.2(d) the undersigned will enter into a formal agreement with the firms Listed, in the Identification of Minority Business Participation schedule conditional upon execution of a contract with the Owner. Failure to abide by this statutory provision will constitute a breach of the contract.

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

Date:_____Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of _____
Subscribed and sworn to before me this _____day of_____ 20
Notary Public _____
My commission expires_____

AFFIDAVIT B – Intent to Perform Contract with Own Workforce.

County of_____

Affidavit of_____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the_____contract.
(Name of Project)

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

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

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

Date:_____ Name of Authorized Officer_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of _____
Subscribed and sworn to before me this _____day of _____20___
Notary Public_____
My commission expires_____

AFFIDAVIT C - Portion of the Work to be Performed by Minority Firms

Project _____

********(**NOTE: THIS FORM IS NOT TO BE SUBMITTED WITH THE BID PROPOSAL)*********

If the portion of the work to be executed by minority businesses as defined in GS143-128.2(g) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit. This affidavit shall be provided by the apparent lowest responsible, responsive bidder within 72 hours after notification of being low bidder.

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

_____
(Project Name)

Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority Businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below.

Attach additional sheets if required.

Name and Phone Number	*Minority Category	Work description	Dollar Value

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

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

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

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____

SEAL

State of North Carolina, County of _____
Subscribed and sworn to before me this _____ day of _____ 20____
Notary Public _____
My commission expires _____

AFFIDAVIT D – Good Faith Efforts

Project _____

If the goal of 10% participation by minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts

(Bidder

Affidavit of: _____)

I do certify the attached documentation as true and accurate representation of my good faith efforts.

(Attach additional sheets if required)

Name and Phone Number	*Minority Category	Work description	Dollar Value

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

Documentation of the Bidder's good faith efforts to meet the goals set forth in these provisions. Examples of documentation shall include the following evidence:

A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.

B. Copies of quotes or responses received from each firm responding to the solicitation.

C. A telephone log of follow-up calls to each firm sent a solicitation.

D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.

E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.

F. Copy of pre-bid roster.

G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.

H. Letter detailing reasons for rejection of minority business due to lack of qualification.

I. Letter documenting proposed assistance offered to minority businesses in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

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

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of _____

Subscribed and sworn to before me this _____day of _____20_____

Notary Public _____

My commission expires_____

APPENDIX E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments to be made to minority business contractors on this project for the above-mentioned period.

Firm Name	***Minority Category**	**Payment Amount** (List invoice number and amount)	**Owner Use Only**

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

Date: _____ Approved/Certified By: _____
Name

_____
Title

_____
Signature

****THIS DOCUMENT MUST BE SUBMITTED WITH EACH PAY REQUEST & FINAL PAYMENT****

Standard Form of Agreement Between Owner and Contractor

where the basis of payment is a
STIPULATED SUM

AGREEMENT made as of the « » day of « » in the year «2023 »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

«County of Pitt »
«1717 West Fifth Street »
«Greenville, NC 27834»
« »

and the Contractor:
(Name, legal status, address and other information)

«xyz »«CONTRACTOR »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

« COMMUNITY CENTER AND GYMNASIUM FOR Alice Keene District Park »
«4561 County Home Rd »
«Greenville, NC 27858 »

The Architect:
(Name, legal status, address and other information)

«Hite Associates, PC »« »
«2600 Meridian Drive »
«Greenville, NC 27834 »
« »

The Owner and Contractor agree as follows.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

"Each Prime Contractor shall execute the entire Work described in the Contract Documents and reasonably inferable from them as being necessary to produce the intended results. In general, the Work includes but is not limited to the furnishing of all labor, materials, equipment, tools, services and supervision to perform the Work for the project".

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.
(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

Seven days from receipt of Notice to Proceed.

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

« »

§ 3.2 The Contract Time shall be measured from the date of commencement.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than « » (« ») days from the date of commencement, or as follows:
(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

In accordance with the schedule of COMPLETION DATES set forth in the Supplementary Conditions, under Article 8, "Time", all of which are DATES CERTAIN, with no delays allowed except as caused by the Owner.

« »

Portion of Work	Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.
(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

«
Substantial Completion liquidated damages- $1,000 per day.

Final Completion liquidated damages - $1,000 per day.

See Section 9.11 of the General and Article 8 of Supplemental Conditions for additional provisions regarding liquidated damages.
»

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

« »

§ 4.3 Unit prices, if any: See Form of Proposal
(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price Per Unit ($0.00)

§ 4.4 Allowances included in the Contract Sum, if any: See Form of Proposal
(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Price

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« One calendar month ending on the twenty-fifth day of the month. »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the « » day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the « » day of the « » month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than « » (« ») days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage as outlined in Section 9.3.1.3 of the General and Supplemental Conditions . Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction, as amended;

.2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage as outlined in Section 9.3.1.3 of the General and Supplemental Conditions;

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007, as amended.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007, as amended.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:
(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

«
See Section 9.3 of the General and Supplemental Conditions.
»

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 FINAL PAYMENT

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007, as amended, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, as amended, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

«
The Architect shall be the Initial Decision Maker as outlined in Article 15 of the General and Supplemental Conditions.
»
« »
« »
« »

§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, as amended, the method of binding dispute resolution shall be as follows:
(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

[«X»] Litigation in a court of competent jurisdiction

« »

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007, as amended.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007, as amended.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007, as amended or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall not bear interest.
(Insert rate of interest agreed upon, if any.)

« Zero » % «0% »

§ 8.3 The Owner's representative:
(Name, address and other information)

« »
« »
« »
« »
« »
« »

§ 8.4 The Contractor's representative:
(Name, address and other information)

« »
« »
« »
« »
« »
« »

§ 8.5 Neither the Owner's nor the Contractor's representative shall be changed without ten days written notice to the other party.

§ 8.6 Other provisions:

« »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction, as amended. The amended version of AIA Document A201-2007 is included in the Project Manual.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
Section 01010	General Conditions	October 11, 2021	pp.1-54
Section 01012	Supplementary General Conditions	October 11, 2021	pp. 1-4

§ 9.1.4 The Specifications:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

«See Exhibit A »

Section	Title	Date	Pages

§ 9.1.5 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

«See Exhibit B »

Number	Title	Date

§ 9.1.6 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

.1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

« »

.2 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

«FORM OF PROPOSAL »

ARTICLE 10 INSURANCE AND BONDS
The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007, as amended.

This Agreement entered into as of the day and year first written above.

Pitt County Board of Education
1717 West Fifth Street
Greenville, NC 27834

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
« »«Board Chairperson »	« »«President »
(Printed name and title)	*(Printed name and title)*
Attest	Attest
Superintendent	Corporate Secretary
[Corporate Seal]	[Corporate Seal]

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

_____
Finance Officer/Date

CORONAVIRUS STATE AND LOCAL FISCAL RECOVERY FUNDS ADDENDUM

This **CORONAVIRUS STATE AND LOCAL FISCAL RECOVERY FUNDS ADDENDUM** (this "Addendum") is entered into by and between _____, a professional corporation existing under the laws of the State of North Carolina ("Contractor"), and County of Pitt, a body politic and corporate existing under the laws of the State of North Carolina ("Unit"), and forms an integral part of the Contract (as defined in Section I hereof).

RECITALS

WHEREAS, Unit has received, either as a Recipient or Subrecipient (as each such term is defined in Section I hereof) a payment from the Coronavirus State Fiscal Recovery Fund ("State Fiscal Recovery Fund") or Coronavirus Local Fiscal Recovery Fund ("Local Fiscal Recovery Fund" and, together with the State Fiscal Recovery Fund, the "Fiscal Recovery Funds") established pursuant to Sections 602 and 603, respectively, of the Social Security Act, as added by Section 9901 of the American Rescue Plan Act of 2021, Pub. L. No. 117-2 ("ARPA"); and

WHEREAS, Unit intends to pay, in part or in whole, for the cost of the Contract (as defined in Section I hereof) using monies received from the Fiscal Recovery Funds; and

WHEREAS, in using such funds, Unit must comply with the terms of ARPA, regulations issued by the U.S. Department of the Treasury ("Treasury") governing the expenditure of monies distributed from the Fiscal Recovery Funds (including, without limitation, the Interim Final Rule (86 Fed. Reg. 26,786 (May 17, 2021) and Final Rule (87 Fed. Reg. 4,338 (Jan. 27, 2022)), the Award Terms and Conditions applicable to the Fiscal Recovery Funds, and such other guidance as Treasury has issued or may issue governing the expenditure of monies distributed from the Fiscal Recovery Funds (collectively, the "Regulatory Requirements"); and

WHEREAS, pursuant to the Regulatory Requirements, Unit must comply with the Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, 2 C.F.R. Part 200, other than such provisions as Treasury has determined or may determine are inapplicable to the Fiscal Recovery Funds; and

WHEREAS, pursuant to 2 C.F.R. § 200.327, Unit must include within the Contract applicable provisions described in Appendix II to 2 C.F.R. Part 200, each of which is contained in this Addendum; and

WHEREAS, Unit shall not enter into the Contract or make any distributions of funds to Contractor using monies from the Fiscal Recovery Funds absent Contractor's agreement and adherence to each term and condition contained herein.

NOW THEREFORE, Contractor and Unit do mutually agree as follows:

AGREEMENTS

I. Definitions

A. Unless otherwise defined in this Addendum, capitalized terms used in this Addendum shall have the meanings ascribed thereto in this Section I.

1. "ARPA" shall mean the American Rescue Plan Act of 2021, Pub. L. No. 117-2, as amended.

2. “Administering Agency” shall have the meaning specified in 41 C.F.R. § 60-1.3.

3. “Applicant” shall have the meaning specified in 41 C.F.R. § 60-1.3, which is provided here for ease of reference: (“An applicant for Federal assistance involving a construction contract, or other participant in a program involving a construction contract as determined by regulation of an administering agency. The term also includes such persons after they become recipients of such Federal assistance.”).

4. “Construction Work” shall have the meaning specified in 41 C.F.R. § 60-1.3, which is provided here for ease of reference: (“[T]he construction, rehabilitation, alteration, conversion, extension, demolition or repair of buildings, highways, or other changes or improvements to real property, including facilities providing utility services. The term also includes the supervision, inspection, and other onsite functions incidental to the actual construction.”).

5. “Contract” shall mean the legal instrument by which Unit, as a Recipient or Subrecipient, shall purchase from Contractor property or services needed to carry out a project or program under a federal award, and of which this Addendum shall constitute an integral part.

6. “Contractor” shall mean the entity named as “Contractor” in this Addendum that has received a Contract from Unit.

7. “Federally Assisted Construction Contract” shall have the meaning specified in 41 C.F.R. § 60-1.3, which is provided here for ease of reference: (“[A]ny agreement or modification thereof between any applicant and a person for construction work which is paid for in whole or in part with funds obtained from the Government or borrowed on the credit of the Government pursuant to any federal program involving a grant, contract, loan, insurance, or guarantee, or undertaken pursuant to any federal program involving such grant, contract, loan, insurance, or guarantee, or any application or modification thereof approved by the government of the United States of America for a grant, contract, loan, insurance, or guarantee under which the applicant itself participates in the construction work.”).

8. “Government” shall have the meaning specified in 41 C.F.R. § 60-1.3, which is provided here for ease of reference: (“[T]he government of the United States of America.”).

9. “Laborer” or “Mechanic” shall have the meaning specified in 29 C.F.R. § 5.2(m), which is provided here for ease of reference: (“The term *laborer* or *mechanic* includes at least those workers whose duties are manual or physical in nature (including those workers who use tools or who are performing the work of a trade), as distinguished from mental or managerial. The term *laborer* or *mechanic* includes apprentices, trainees, helpers, and, in the case of contracts subject to the Contract Work Hours and Safety Standards Act, watchmen or guards. The term does not apply to workers whose duties are primarily administrative, executive, or clerical, rather than manual. Persons employed in a bona fide executive, administrative, or professional capacity as defined in part 541 of [Title 40 of the United States Code] are not deemed to be laborers or mechanics. Working foremen who devote more than 20 percent of their time during a workweek to mechanic or laborer duties, and who do not meet the criteria of [Title 40 of the United States Code], are laborers and mechanics for the time so spent.”).

10. “Recipient” shall mean an entity that receives a federal award directly from a federal awarding agency. The term does not include subrecipients or individuals that are beneficiaries of an award.

11. “Subcontract” shall mean any agreement entered into by a Subcontractor to furnish supplies or services for the performance of this Contract or a Subcontract. It includes, but is not limited to, purchase orders and changes and modifications to purchase orders.

12. “Subcontractor” shall mean an entity that receives a Subcontract.

13. “Subrecipient” shall mean an entity that receives a subaward from a pass-through entity to carry out part of a federal award; but it does not include an individual that is a beneficiary of such award. A subrecipient may also be a recipient of other federal awards directly from a federal awarding agency.

14. “Tier” shall have the meaning indicated in 2 C.F.R. Part 180 and illustrated in 2 C.F.R. Part 180, Appendix II.

15. “Unit” shall have the meaning indicated in the preamble to this Addendum.

II. Equal Employment Opportunity

A. If this contract is a Federally Assisted Construction Contract exceeding $10,000, during the performance of this Contract, Contractor agrees as follows:

1. Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. Contractor will take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

2. Contractor will, in all solicitations or advertisements for employees placed by or on behalf of Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

3. Contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee’s essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding,

hearing, or action, including an investigation conducted by the employer, or is consistent with Contractor's legal duty to furnish information.

4. Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

5. Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

6. Contractor will furnish to the Administering Agency and the Secretary of Labor all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Administering Agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

7. In the event of Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended, in whole or in part, and Contractor may be declared ineligible for further Government contracts or Federally Assisted Construction Contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965. Such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

8. Contractor will include the portion of the sentence immediately preceding paragraph A.1. of this Section II and the provisions of paragraphs A.1. through A.7. in every Subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each Subcontractor or vendor. Contractor will take such action with respect to any Subcontract or purchase order as the Administering Agency may direct as a means of enforcing such provisions, including sanctions for noncompliance.

   Provided, however, that in the event Contractor becomes involved in, or is threatened with, litigation with a Subcontractor or vendor as a result of such direction by the Administering Agency, Contractor may request the United States to enter into such litigation to protect the interests of the United States.

   Unit further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work. Provided, that if Unit so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality, or subdivision of such government which does not participate in work on or under the Contract.

9. Unit agrees that it will assist and cooperate actively with the Administering Agency and the Secretary of Labor in obtaining the compliance of Contractor and any Subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor; that it will furnish the Administering Agency and the Secretary of Labor such

information as they may require for the supervision of such compliance; and that it will otherwise assist the Administering Agency in the discharge of the agency's primary responsibility for securing compliance.

10. Unit further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and Federally Assisted Construction Contracts pursuant to the Executive Order and that it will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon Contractor and any Subcontractors by the Administering Agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, Unit agrees that if it fails or refuses to comply with these undertakings, the Administering Agency may take any or all of the following actions: Cancel, terminate, or suspend, in whole or in part, this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

B. If this Contract is not a Federally Assisted Construction Contract exceeding $10,000, the provisions of Section II.A. of this Addendum shall not apply.

III. Copeland "Anti-Kickback" Act

A. Contractor and any Subcontractors performing work under the Contract shall comply with 18 U.S.C. § 874. Unit shall report all suspected or reported violations to Treasury.

IV. Contract Work Hours and Safety Standards Act

A. *Overtime Requirements.* No Contractor or Subcontractor contracting for any part of the Contract work which may require or involve the employment of Laborers or Mechanics shall require or permit any such Laborer or Mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such Laborer or Mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

B. *Violation; Liability for Unpaid Wages; Liquidated Damages*. In the event of any violation of the clause set forth in Section IV.A. (*Overtime Requirements*), above, Contractor and any Subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and Subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual Laborer or Mechanic, including watchmen and guards, employed in violation of the clause set forth in Section IV.A. (*Overtime Requirements*), above, in the sum of $27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without

payment of the overtime wages required by the clause set forth in Section IV.A. (*Overtime Requirements*), above.

C. *Withholding for Unpaid Wages and Liquidated Damages*. Unit shall, upon its own action or upon written request of an authorized representative of the Department of Labor, withhold, or cause to be withheld, from any moneys payable on account of work performed by Contractor or Subcontractor under any such contract or any other federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of Contractor or Subcontractor for unpaid wages and liquidated damages as provided in Section IV.B. (*Violation; Liability for Unpaid Wages; Liquidated Damage*s) of this section.

D. *Subcontracts*. Contractor or Subcontractor shall insert in any Subcontract the clauses set forth in Sections IV.A. through IV.D. and also a clause requiring Subcontractors to include these clauses in any lower-Tier Subcontracts. Contractor shall be responsible for compliance by any first-Tier Subcontractor or lower-Tier Subcontractor with the clauses set forth in Sections IV.A. through IV.D.

E. *Payroll and Records*. Contractor or Subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the Contract for all Laborers and Mechanics, including guards and watchmen, working on the Contract. Such records shall contain the name and address of each such employee, Social Security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Records to be maintained under this provision shall be made available by Contractor or Subcontractor for inspection, copying, or transcription by authorized representatives of the Department of the Treasury and the Department of Labor, and Contractor or Subcontractor will permit such representatives to interview employees during working hours on the job.

F. *Exceptions*. None of the requirements of Section IV of this Addendum shall apply if this Contract is a Contract (1) for transportation by land, air, or water; (2) for the transmission of intelligence; (3) for the purchase of supplies, materials, or articles ordinarily available in the open market; or (4) in an amount that is equal to or less than $100,000.

V. Rights to Inventions Made Under a Contract or Agreement

A. The Government reserves a royalty-free, non-exclusive and irrevocable license to reproduce, publish, or otherwise use, and to authorize others to use for "Government purposes," any subject data or copyright described below. "Government purposes" means use only for the direct purposes of the Government. Without the copyright owner's consent, the Government may not extend its federal license to any other party.

1. Any subject data developed under the Contract, whether or not a copyright has been obtained, and

2. Any rights of copyright purchased by Contractor using federal assistance funded in whole or in part by the Department of the Treasury.

B. Unless Treasury determines otherwise, a Contractor performing experimental, developmental, or research work required as part of this Contract agrees to permit Treasury to make available to the public either (1) Treasury's license in the copyright to any subject data developed in the course of the Contract or (2) a copy of the subject data first produced under the Contract for which a copyright has not been obtained. If the experimental, developmental, or research work which is the subject of this Contract is not completed for any reason whatsoever, all data developed under the Contract shall become subject data as defined herein and shall be delivered as the Government may direct.

C. Unless prohibited by North Carolina law, upon request by the Government, Contractor agrees to indemnify, save, and hold harmless the Government, its officers, agents, and employees acting within the scope of their official duties against any liability, including costs and expenses, resulting from any willful or intentional violation by Contractor of proprietary rights, copyrights, or right of privacy arising out of the publication, translation, reproduction, delivery, use, or disposition of any data furnished under the Contract. Contractor shall be required to indemnify the Government for any such liability arising out of the wrongful act of any employee, official, or agent of the Contractor.

D. Nothing contained in this clause shall imply a license to the Government under any patent or be construed as affecting the scope of any license or other right otherwise granted to the Government under any patent.

E. Data developed by Contractor and financed entirely without using federal assistance provided by the Government that has been incorporated into work required by the underlying Contract is exempt from the requirements herein, provided that Contractor identifies those data in writing at the time of delivery of the Contract work. Contractor agrees to include these requirements in each Subcontract for experimental, developmental, or research work financed in whole or in part with federal assistance.

F. For the purposes of this Section V, "subject data" means "recorded information, whether or not copyrighted, . . . that is delivered or specified to be delivered as required by the Contract." Examples of "subject data" include, but are not limited to, "computer software, standards, specifications, engineering drawings and associated lists, process sheets, manuals, technical reports, catalog item identifications, and related information, but do not include financial reports, cost analyses or other similar information used for performance or administration of the Contract."

VI. Clean Air Act and Federal Water Pollution Control Act

A. *Clean Air Act*. Contractor agrees to comply with all applicable standards, orders, and regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. §§ 7401 *et seq.* Contractor agrees to report each violation to Unit and understands and agrees that Unit will, in turn, report each violation as required to Treasury and the appropriate Environmental Protection Agency Regional Office. Contractor agrees to include these requirements in each Subcontract exceeding $150,000 financed, in whole or in part, with federal assistance provided by Treasury.

B. *Federal Water Pollution Control Act.* Contractor agrees to comply with all applicable standards, orders, and regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. §§ 1251 *et seq.* Contractor agrees to report each violation to Unit and understands and agrees

that Unit will, in turn, report each violation as required to assure notification to Treasury and the appropriate Environmental Protection Agency Regional Office. Contractor agrees to include these requirements in each Subcontract exceeding $150,000 financed, in whole or in part, with federal assistance provided by Treasury.

VII. Debarment and Suspension

A. Due to its receipt of Fiscal Recovery Funds, Unit is a participant in a nonprocurement transaction (defined at 2 C.F.R. § 180.970) that is a covered transaction pursuant to 2 C.F.R. § 180.210 and 31 C.F.R. § 19.210. Therefore, this Contract is a lower-Tier covered transaction for purposes of 2 C.F.R. Part 180 and 31 C.F.R. Part 19 if (1) the amount of this Contract is greater than or equal to $25,000 (2 C.F.R. § 180.220(b)(1); 31 C.F.R. § 19.220(b)(1)); (2) the Contract requires the consent of an official of the Department of the Treasury (2 C.F.R. § 180.220(b)(2); 31 C.F.R. § 19.220(b)(2)); or (3) this Contract is for federally required audit services (2 C.F.R. § 180.220(b)(3); 31 C.F.R. § 19.220(b)(3)).

B. If this Contract is a covered transaction as set forth in Section VII.A., above, Contractor hereby certifies as of the date hereof that Contractor, Contractor's principals (defined at 2 C.F.R. § 180.995), and the affiliates (defined at 2 C.F.R. § 180.905) of both Contractor and Contractor's principals are not excluded (defined at 2 C.F.R. § 180.935) and are not disqualified (defined at 2 C.F.R. § 180.935). If any of the foregoing persons are excluded or disqualified and the Secretary of the Treasury has not granted an exception pursuant to 31 C.F.R. § 19.120(a), (1) this Contract shall be void, (2) Unit shall not make any payments of federal financial assistance to Contractor, and (3) Unit shall have no obligations to Contractor under this Contract.

C. Contractor must comply with 2 C.F.R. Part 180, Subpart C and 31 C.F.R. Part 19 and must include a requirement to comply with these regulations in any lower-Tier covered transaction into which it enters. This certification is a material representation of fact relied upon by Unit, and all liability arising from an erroneous representation shall be borne solely by Contractor.

D. If it is later determined that Contractor did not comply with 2 C.F.R. Part 180, Subpart C and 31 C.F.R. Part 19, in addition to remedies available to Unit, the Government may pursue available remedies, including but not limited to suspension and/or debarment.

VIII. Byrd Anti-Lobbying Amendment

A. Contractor certifies to Unit, and Contractor shall cause each Tier below it to certify to the Tier directly above such Tier, that it has not used and will not use federally appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any federal contract, grant, or any other award covered by 31 U.S.C. § 1352. Contractor shall, and shall cause each Tier below it, to disclose any lobbying with non–federally appropriated funds that takes place in connection with obtaining any federal award. Such disclosures (to be set forth on Standard Form-LLL, contained in 31 C.F.R. Part 21, Appendix B) shall be forwarded from Tier to Tier up to the Unit, which will, in turn, forward the certification(s) to Treasury. Contractor shall cause the language of this Section VIII.A. to be included in all Subcontracts. This certification is a material representation of fact upon which Unit

has relied when entering into this Contract, and all liability arising from an erroneous representation shall be borne solely by Contractor.

B. Contractors that bid or apply for a contract exceeding $100,000 (including this Contract, if applicable) also must file with Unit the certification in Attachment 1 to this Addendum, which is attached hereto and incorporated herein.

C. Contractor also shall cause any Subcontractor with a Subcontract (at any Tier) exceeding $100,000 to file with the Tier above it the certification in Attachment 1 to this Addendum, which is attached hereto and incorporated herein.

IX. Procurement of Recovered Materials

A. Section IX.B. shall apply if (1) this Contract involves the purchase of an item designated by the Environmental Protection Agency ("EPA") in 40 C.F.R. Part 247 that exceeds $10,000 or (2) the total value of such designated items acquired during Unit's preceding fiscal year exceeded $10,000.

B. In the performance of the Contract, Contractor shall make maximum use of products containing recovered materials that are EPA-designated items, unless the product cannot (1) be acquired competitively within a timeframe providing for compliance with the Contract performance schedule, (2) meet Contract performance requirements, or (3) be acquired at a reasonable price. Information about this requirement, along with the list of EPA-designated items, is available on EPA's website. Contractor also agrees to comply with all other applicable requirements of Section 6002 of the Solid Waste Disposal Act.

X. Prohibition on Contracting for Covered Telecommunications Equipment or Services

A. *Definitions*. Unless otherwise defined in this Contract, capitalized terms used in this Section X shall have the meanings ascribed thereto in this Section X.A.

1. "Backhaul" means intermediate links between the core network, or backbone network, and the small subnetworks at the edge of the network (e.g., connecting cell phones/towers to the core telephone network). Backhaul can be wireless (e.g., microwave) or wired (e.g., fiber optic, coaxial cable, Ethernet).

2. "Covered Foreign Country" means the People's Republic of China.

3. "Covered Telecommunications Equipment or Services" means (a) telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities); (b) for the purpose of public safety, security of Government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities); (c) telecommunications or video surveillance services provided by such entities or using such equipment; or (d) telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity

owned or controlled by, or otherwise connected to, the government of a Covered Foreign Country.

4. "Critical Technology" means (1) defense articles or defense services included on the United States Munitions List set forth in the International Traffic in Arms Regulations under subchapter M of chapter I of title 22, Code of Federal Regulations; (2) items included on the Commerce Control List set forth in Supplement No. 1 to part 774 of the Export Administration Regulations under subchapter C of chapter VII of title 15, Code of Federal Regulations and controlled (a) pursuant to multilateral regimes, including for reasons relating to national security, chemical and biological weapons proliferation, nuclear nonproliferation, or missile technology, or (b) for reasons relating to regional stability or surreptitious listening; (3) specially designed and prepared nuclear equipment, parts and components, materials, software, and technology covered by part 810 of title 10, Code of Federal Regulations (relating to assistance to foreign atomic energy activities); (4) nuclear facilities, equipment, and material covered by part 110 of title 10, Code of Federal Regulations (relating to export and import of nuclear equipment and material); (5) select agents and toxins covered by part 331 of title 7, Code of Federal Regulations; part 121 of title 9 of such Code; or part 73 of title 42 of such Code; or (6) emerging and foundational technologies controlled pursuant to section 1758 of the Export Control Reform Act of 2018 (50 U.S.C. § 4817).

5. "Interconnection Arrangements" means arrangements governing the physical connection of two or more networks to allow the use of another's network to hand off traffic where it is ultimately delivered (e.g., connection of a customer of telephone provider A to a customer of telephone company B) or sharing data and other information resources.

6. "Roaming" means cellular communications services (e.g., voice, video, data) received from a visited network when unable to connect to the facilities of the home network either because signal coverage is too weak or because traffic is too high.

7. "Substantial or Essential Component" means any component necessary for the proper function or performance of a piece of equipment, system, or service.

8. "Telecommunications Equipment or Services" means telecommunications or video surveillance equipment or services, such as, but not limited to, mobile phones, land lines, internet, video surveillance, and cloud services.

B. Prohibitions.

1. Section 889(b) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No. 115-232, and 2 C.F.R. § 200.216 prohibit the head of an executive agency on or after August 13, 2020, from obtaining or expending grant, cooperative agreement, loan, or loan guarantee funds on certain telecommunications products or from certain entities for national security reasons.

2. Unless an exception in Section X.C. applies, Contractor and any Subcontractors may not use grant, cooperative agreement, loan, or loan guarantee funds (including, without limitation, Fiscal Recovery Funds) received from a federal government to:

a. Procure or obtain any equipment, system, or service that uses Covered Telecommunications Equipment or Services as a Substantial or Essential Component of any system or as Critical Technology of any system;

b. Enter into, extend, or renew a contract to procure or obtain any equipment, system, or service that uses Covered Telecommunications Equipment or Services as a Substantial or Essential Component of any system or as Critical Technology of any system;

c. Enter into, extend, or renew contracts with entities that use Covered Telecommunications Equipment or Services as a Substantial or Essential Component of any system or as Critical Technology as part of any system; or

d. Provide, as part of its performance of this Contract, any Subcontract; any other contractual instrument; or any equipment, system, or service that uses Covered Telecommunications Equipment or Services as a Substantial or Essential Component of any system or as Critical Technology as part of any system.

C. Exceptions.

1. This clause does not prohibit Contractor or Subcontractors from providing:

a. A service that connects to the facilities of a third party, such as Backhaul, Roaming, or Interconnection Agreements, or

b. Telecommunications equipment that cannot route or redirect user data traffic or permit visibility into any user data or packets that such equipment transmits or otherwise handles.

2. By necessary implication and regulation, the prohibitions also do not apply to:

a. Covered telecommunications equipment that:

i. Is not used as a Substantial or Essential Component of any system and

ii. Is not used as Critical Technology of any system.

b. Other telecommunications equipment or services that are not considered Covered Telecommunications Equipment or Services.

D. Reporting Requirement

1. In the event Contractor identifies, during contract performance, covered Telecommunications Equipment or Services used as a Substantial or Essential Component of any system or as Critical Technology as part of any system, or if Contractor is notified of such by a Subcontractor at any Tier or by any other source, Contractor shall report the information in paragraph D.2(d)(2) of this Section X to Unit, unless procedures for reporting the information are established elsewhere in this Contract.

2. Contractor shall report the following information to Unit pursuant to paragraph D.1 of this Section X:

   a. Within one business day from the date of such identification or notification: contract number; order number(s), if applicable; supplier name; supplier unique entity identifier (if known); supplier Commercial and Government Entity (CAGE) code (if known); brand; model number (original equipment manufacturer number, manufacturer part number, or wholesaler number); item description; and any readily available information about mitigation actions undertaken or recommended.

   b. Within ten business days of submitting the information in paragraph D.2.a. of this Section: any further available information about mitigation actions undertaken or recommended. In addition, Contractor shall describe (i) the efforts it undertook to prevent use or submission of Covered Telecommunications Equipment or Services and (ii) any additional efforts that will be incorporated to prevent future use or submission of Covered Telecommunications Equipment or Services.

E. *Subcontractor*. Contractor shall cause to be inserted into all Subcontracts and other contractual instruments relating to the performance of this Contract the substance of this Section X, including this paragraph E.

XI. Domestic Preferences for Procurements

A. For purposes of this Section XI, the terms below are defined as follows:

   1. "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coating, occurred in the United States.

   2. "Manufactured Products" means items and construction materials composed, in whole or in part, of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

B. As applicable, and to the extent consistent with law, Contractor should, to the greatest extent practicable, provide a preference for the purchase, acquisition, or use of goods, products or materials Produced in the United States. This includes, but is not limited to, iron, aluminum, steel, cement, and other Manufactured Products. Contractor shall cause any Subcontractors to include the requirements of this Section XI in any Subcontracts.

XII. Solicitation of Minority and Women-Owned Business Enterprises

A. If Contractor intends to let any Subcontracts, Contractor shall (1) place qualified small and minority businesses and women's business enterprises on its solicitation lists; (2) assure that small and minority businesses and women's business enterprises are solicited whenever they are potential sources; (3) divide total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses and women's business enterprises; (4) establish delivery schedules, where the requirement permits, which encourage participation by small and minority businesses and women's business enterprises; (5) use the

services and assistance, as appropriate, of the Small Business Administration, the Minority Business Development Agency of the Department of Commerce, and the North Carolina Office for Historically Underutilized Businesses.

B. For the purposes of Section XII.A., an entity shall qualify (1) as a "minority business" or "women's business enterprise" if it is currently certified as a North Carolina "historically underutilized business" under Chapter 143, Section 128.4(a) of the N.C. General Statutes (hereinafter G.S.), and (2) as a "small business" if it is independently owned and operated and is qualified under the Small Business Administration criteria and size standards at 13 C.F.R. Part 21.

XIII. Access to Records

A. Contractor agrees to provide Unit, the Department of the Treasury, the Treasury Office of Inspector General, the Government Accountability Office, and the Comptroller General of the United States, or any authorized representatives of these entities, access to any records (electronic and otherwise) of Contractor which are directly pertinent to this Contract to conduct audits or any other investigations. Contractor agrees to permit any of the foregoing parties to reproduce such records by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

B. Contractor agrees to retain all records covered by this Section XIII through December 31, 2031, or such longer period as is necessary for the resolution of any litigation, claim, negotiation, audit, or other inquiry involving the Contract.

XIV. Conflicts of Interest; Gifts and Favors

A. Contractor understands that (1) Unit will use Fiscal Recovery Funds to pay for the cost of this Contract and (2) the expenditure of Fiscal Recovery Funds is governed by the [*Conflict of Interest Policy*] of the Unit, the Regulatory Requirements (including, without limitation, 2 C.F.R. § 200.318(c)(1)), and North Carolina law (including, without limitation, G.S. 14-234(a)(1) and -234.3(a)).

B. Contractor certifies to Unit that as of the date hereof, to the best of its knowledge after reasonable inquiry, no employee, officer, or agent of Unit involved in the selection, award, or administration of this Contract (each a "Covered Individual"); no member of a Covered Individual's immediate family; no partner of a Covered Individual; and no organization (including Contractor) which employs or is about to employ a Covered Individual has a financial or other interest in, or has received a tangible personal benefit from, Contractor. Should Contractor obtain knowledge of any such interest or any tangible personal benefit described in the preceding sentence after the date hereof, Contractor shall promptly disclose the same to Unit in writing.

C. Contractor certifies to Unit that it has not provided, nor offered to provide, any gratuities, favors, or anything of value to an officer, employee, or agent of Unit. Should Contractor obtain knowledge of the provision, or offer of any provision, of any gratuity, favor, or anything of value to an officer, employee, or agent described in the preceding sentence after the date hereof, Contractor shall promptly disclose the same to Unit in writing.

XV. Assurances of Compliance with Title VI of the Civil Rights Act of 1964

A. Contractor and any Subcontractor, or the successor, transferee, or assignee of Contractor or any Subcontractor, shall comply with Title VI of the Civil Rights Act of 1964, which prohibits recipients of federal financial assistance from excluding from a program or activity, denying benefits of, or otherwise discriminating against a person on the basis of race, color, or national origin (42 U.S.C. §§ 2000d *et seq*.), as implemented by the Department of the Treasury's Title VI regulations, 31 C.F.R. Part 22, which are herein incorporated by reference and made a part of this Contract. Title VI also provides protection to persons with "Limited English Proficiency" in any program or activity receiving federal financial assistance, 42 U.S.C. §§ 2000d *et seq*., as implemented by Treasury's Title VI regulations, 31 C.F.R. Part 22, and herein incorporated by reference and made a part of this Contract.

XVI. Other Non-Discrimination Statutes

A. Contractor acknowledges that Unit is bound by and agrees, to the extent applicable to Contractor, to abide by the provisions contained in the federal statutes enumerated below and any other federal statutes and regulations that may be applicable to the expenditure of Fiscal Recovery Funds:

1. The Fair Housing Act, Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§ 3601 *et seq*.), which prohibits discrimination in housing on the basis of race, color, religion, national origin, sex, familial status, or disability;

2. Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794), which prohibits discrimination on the basis of disability under any program or activity receiving federal financial assistance;

3. The Age Discrimination Act of 1975, as amended (42 U.S.C. §§ 6101 *et seq*.), and Treasury's implementing regulations at 31 C.F.R. Part 23, which prohibit discrimination on the basis of age in programs or activities receiving federal financial assistance; and

4. Title II of the Americans with Disabilities Act of 1990, as amended (42 U.S.C. §§ 12101 *et seq*.), which prohibits discrimination on the basis of disability in programs, activities, and services provided or made available by state and local governments or instrumentalities or agencies thereto.

XVII. Miscellaneous

A. *Increasing Seat Belt Use in the United States*. Pursuant to Executive Order 13043, 62 Fed. Reg. 19,216 (Apr. 18, 1997), Unit encourages Contractor to adopt and enforce on-the-job seat belt policies and programs for its employees when operating company-owned, rented, or personally owned vehicles.

B. *Reducing Text Messaging While Driving*. Pursuant to Executive Order 13513, 74 Fed. Reg. 51,225 (Oct. 6, 2009), Unit encourages Contractor to adopt and enforce policies that ban text messaging while driving.

XVIII. Conflicts and Interpretation

A. To the extent that any portion of this Addendum conflicts with any term or condition of this Contract expressed outside of this Addendum, the terms of this Addendum shall govern.

XIX. Remedies

A. The Unit reserves all rights and privileges under applicable federal law and laws of the State of North Carolina should Contractor breach or violate any terms of this Addendum or Contract.

B. If the Unit waives any right or remedy in this Addenudm or the Contract or fails to insist on strict performance by the Contractor, it will not affect, extend or waive any other right or remedy of the Unit, or affect the later exercise of the same right or remedy by the Unit for any other default by the Contractor.

C. All claims, counter-claims, disputes and other matters in question between the Unit and the Contractor arising out of or relating to this Addendum or the Contract, or the breach of it, that cannot be resolved by and between the parties after conferring in good faith, will be decided by a court of competent jurisdiction pursuant to North Carolina law. If such dispute is in state court, venue shall be in the 3A Judicial District in Pitt County, North Carolina. If in federal court, venue shall be in the U.S. District Court for the Eastern District of North Carolina, Greenville Division.

XX. Termination

A. Termination for Covenience. The Unit by written notice, may terminate the Contract and this Addendum, in whole or in part, when it is in the Unit's interest. If the Contract and this Addendum is terminated, the Unit shall be liable only for payment under the payment provisions of the Contract for services rendered and products delivered before the effective date of termination

B. Termination for Cause. If the a party fails to perform its obligations under the Contract within the time specified in the Contract or any extension, or if the a party fails to comply with any other provisions of this Contract or this Addendum, the non-defaulting party may terminate the Contract and this Addenddum for cause. The non-defaulting party shall terminate by delivering to the defaulting party a Notice of Termination, specifying the nature of just cause. If the Contractor is the defaulting party, the Contractor will only be paid the contract price for supplies delivered and accepted, or services performed in accordance with the manner or performance set forth in this Contract. If, after termination for failure to fulfill Contract obligations or obliations under this Addendum, it is determined that the Contractor was not in default, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the Unit.

[*Remainder of Page Intentionally Left Blank*]

CONTRACTOR: _____

By: _____
Name: _____
Title: _____

UNIT: County of Pitt

By: _____
Name: _____
Title: _____

ATTACHMENT 1
TO
CORONAVIRUS STATE AND LOCAL FISCAL RECOVERY FUNDS ADDENDUM
APPENDIX A, 31 C.F.R. PART 21 – CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of the undersigned's knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, or the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

4. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31 of the U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

The Contractor, _____, certifies and affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. Chapter 38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

_____
Signature of Contractor's Authorized Official

_____
Name and Title of Contractor's Authorized Official

_____
Date

for the following PROJECT:
(Name and location or address)
COMMUNITY CENTER AND GYMNASIUM For Alice Keene District Park
4561 COUNTY HOME ROAD
Greenville, NC 27858

THE OWNER:
(Name and address)
County of Pitt
1717 West Fifth Street
Greenville, NC 27834

THE ARCHITECT:
(Name and address)
Hite Associates, PC
2600 Meridian Drive
Greenville, NC 27834

TABLE OF ARTICLES

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(Numbers and Topics in Bold are Section Headings)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor except to the extent that these Contract Documents, or portions of these Contract Documents, have been incorporated into the Agreement(s) between the Owner and the Architect. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.5.1 Dimensions indicated on the Drawings shall be followed. Do not scale drawings. Conflicts, discrepancies, and omissions shall be resolved prior to ordering or installing materials and equipment.

§ 1.1.5.2 The Contractor shall provide critical clearances, tolerances, and dimensions as indicated on the Drawings. These critical dimensions are not optional. The Architect shall be advised immediately if existing conditions do not permit critical dimensions as shown. No consideration will be given to any claim based on differences between the actual dimensions and those indicated on the drawings.

§ 1.1.5.3 Any modifications to the Drawings shall be approved b the Architect. The Architect's decision in matters relating to artistic effect and structural integrity will be final if consistent with the intent of the Contract Documents.

§ 1.1.5.4 The Drawings are developed to communicate design intent. Assemblies or components required to achieve this design intent are subject to approval by the Architect.

§ 1.1.6 THE SPECIFICATIONS
The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 INSTRUMENTS OF SERVICE
Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS
§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and with terms reasonably inferable from them, though not expressly included in them, as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 CAPITALIZATION
Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION AND EXECUTION OF THE CONTRACT DOCUMENTS
§ 1.4.1 In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement. These Contract Documents periodically refer to 2007 Editions of AIA Documents A201 and/or B101. In the interest of brevity, the Contract Documents may not always specify that each such reference is to AIA Documents A201 and/or B101 only as modified and amended by the Owner. Nonetheless, each reference to AIA Documents A201and/or B101 is only to those documents as modified and amended by the Owner.

§ 1.4.2 The Contract Documents shall be signed by the Owner and Contractor in the places designated for their signatures. If either the Owner or Contractor or both do not sign all Contract Documents, the Architect shall identify such unsigned Documents and notify the Owner and Contractor.

§ 1.4.3 In the Contract Documents, where discrepancies are apparent, detailed information is lacking, or interpretation is not clear, the Contractor shall secure required information from the Architect in writing before proceeding with the work. Items that are detailed and/or specified, but not distinctly located on the drawings shall be located by the Architect upon the written request of the Contractor.

§ 1.5
OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVIC E
§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and joint owners with the Owner of their respective Instruments of Service, including the Drawings and Specifications, and will retain, with the Owner, all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or

claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM
If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall do so as provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER
§ 2.1 GENERAL
§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner may designate in its written policies or otherwise in writing a representative who may have express authority to bind the Owner with respect to identified matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or, where specifically authorized in writing, the Owner's authorized representative.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER
§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence within fifteen (15) days after its receipt of a request demonstrating the existence of one or more of the contractual bases for the request.

§ 2.2.2 Payment for permits and fees is the responsibility of the Contractor under the Contract Documents, including the payment of fees specified under Section 3.7.1. The Owner shall only pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities about which the Contractor notified the Owner in writing in advance of the execution of this Agreement..

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and any known utility locations for the site of the Project, and a legal description of the site. The information shown on the Drawings is based upon field surveys, plans from previous construction projects, and other information provided by the Owner. It is the Contractor's responsibility to verify locations of items that may impact the construction of the work. The Contractor shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish other relevant information or services under the Owner's exclusive control, not also under the Architect's and/or Contractor's control, after the Contractor demonstrates to the Owner's satisfaction in writing that such other information or service under the Owner's exclusive control is necessary to the Contractor's performance of the Work and provides the Owner with a written request for such information or service. .

§ 2.2.4.1 The Owner shall not be responsible or have control over or charge of the construction means, methods, techniques, sequences, or procedures or for safety precautions and programs in connection

with the work, and the Owner will not be responsible for the Contractor's failure to carry out the Work in accordance with the contract documents.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2. Additional sets will be furnished at the cost of reproduction, postage and handling.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after service of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor or surety shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Owner or the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Specifications, Drawings and other Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents. The Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's

review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.2.1 The Contractor shall verify all grades, lines, levels and dimensions indicated or shown on the plans and specifications prior to beginning the Work and shall immediately report in writing any errors or inconsistencies to the Architect before commencing the Work.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations and makes the reports required in Sections 3.2.2 and 3.2.3, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below in this section, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Architect shall be solely responsible for any loss or damage arising solely from those Architect-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be solely responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.3.4 The general contractor shall be the project expediter for the project. In addition to the duties and responsibilities stated in this Agreement, the general contractor/project expediter shall perform the duties and obligations imposed on the general contractor and project expediter by State law.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.1.1 The Contractor shall use only new materials for the work of this Project. Reuse of existing materials or the use of other salvaged materials is acceptable only where specifically noted in the Construction Documents.

§ 3.4.1.2 The Contractor shall provide all special trims, moldings, and special shaped materials which are required for the satisfactory completion of the work. The Contractor shall provide all necessary fasteners, bracing, and supports required for the stable and secure installation of the Work.

§ 3.4.2 The Contractor may make substitutions only with the written consent of the Owner, after evaluation and approval by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.4.4 After the contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the Contract Documents.

§ 3.4.5 By making request for substitutions based on subparagraphs 3.4.3 above, the Contractor: (1) represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified; (2) represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified; (3) certifies that the cost data presented is complete and includes all related costs under this contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and (4) will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

§ 3.4.6 The Contractor shall provide the Owner at least two copies of all manufacturer's literature and operating manuals for all equipment and materials installed on the Project. The Contractor shall also demonstrate operation and maintenance of all mechanical and electrical equipment or apparatus installed as part of the contract.

§ 3.4.7. Contractor shall comply with all applicable laws and regulations in providing services under this Agreement. Contractor represents that it is aware of and in compliance with the Immigration Reform and Control Act, and that it will collect properly verified I-9 forms from each employee providing services under this Agreement. Contractor shall not employ any individuals to provide services to the Owner who are not authorized by federal law to work in the United States.

§ 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements, including substitutions not properly approved or authorized by the Owner, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by the Owner's abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES
The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.6.2 The Contractor shall provide documentation of all sales tax paid in a format acceptable to the Owner with each pay application.

§ 3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS
§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections performed or required by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.2.1 While the Contractor is not responsible for ensuring that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules, regulations, and lawful orders of public authorities, if the Contractor observes that portions of the Contract Documents are at variance with applicable laws, statutes, ordinances, codes, rules, regulations, or lawful orders of public authorities, the Contractor shall promptly notify the Architect and Owner in writing, and the Architect shall make necessary changes through an appropriate modification.

§ 3.7.3 If the Contractor performs Work that it knew or should have known to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than ten (10) days after first observance of the conditions. The Architect will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If the Contractor disputes the Architect's determination or recommendation, the Contractor may proceed as provided in Article 15, giving the required notice of his/her dispute and stating a claim in writing to the Owner and the Architect within 21 days after the Architect has given notice of its decision. . The Contractor's failure to submit said claim in strict conformance with Article 15 shall be deemed a waiver of the claim and the Contractor shall not be entitled to any compensation associated with the claim.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Architect shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Architect but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum

and Contract Time arising from the existence of such remains or features may be made as provided in Article 15. The Contractor's failure to submit said claim in strict conformance with Article 15 shall be deemed a waiver of the claim and the Contractor shall not be entitled to any compensation associated with the claim.

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.8.4 In any situations in which the Contractor has provided a unit price for an allowance quantity for soil, rock or any other item identified in the bid documents, the unit price shall include all of the costs identified in Section 3.8.2.1. and the costs for unloading and handling at the site, installation, overhead, profit and other expenses associated with the item. If the quantity of the items included in the allowance is not used or exceeded during the Project, the Contract Sum shall be decreased or increased based upon the unit price amount by Change Order.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent, site foreman and necessary assistants who shall be in attendance at the Project site at all times during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract but not more than 14 days after the award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of the proposed project manager and superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed project manager or superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection. Notwithstanding the above, the Owner and Architect reserve the right to notify the Contractor of their reasonable objection to the project manager and/or superintendent after the 14-day period based upon their performance or failure to perform their duties and responsibilities.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection and shall promptly replace a project manager and/or superintendent subsequently objected to by the Owner and Architect pursuant to Section 3.9.2.. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information and use and for the Owner's and Architect's approval as to the completion date a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for coordinated, expeditious and practicable execution of the Work and Project in cooperation with the other prime contractors on the Project. In the event the Project has been awarded as a multi-prime project, each of the prime contractors shall provide initial and updated schedule information to the Project Expediter as often and in any format reasonably requested by the Project Expediter.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.10.4 The general contractor shall be the project expediter for the Project. In addition to the duties and obligations stated in this Agreement, the general contractor/project expediter shall perform all duties and obligations imposed on the general contractor and project expediter by state law. It shall be the responsibility of the general contractor to integrate the construction schedules of the prime contractors into a project progress schedule that will show graphically, by a detailed bar chart, CPM, or other acceptable and approved methods, the projected progress of the Project from start to finish. The general contractor shall be responsible for providing adequate notice to all prime contractors to insure efficient continuity of all phases of the Project Work. All prime contractors shall review and conform their work to the approved progress schedule and fully inform the Project Expediter as to his work progress, including immediate notification of any work progress changes. The general contractor shall promptly notify Architect in writing of any Contractor's failure to progress the work in accordance with the schedule.

§ 3.10.5 All prime contractors shall be required to cooperate and consult with each other during the construction of this Project. Each prime contractor shall schedule and execute his work so as to cause no delay to other Contractors. Each prime contractor shall be financially responsible to the other prime contractors for delay caused by him to the other prime contractors on the Project.

§ 3.10.6 Each prime contractor is required to attend monthly job site progress conference called or scheduled by the Architect. Each prime contractor shall be represented at these job progress conferences by both home office and site personnel. These meetings shall be open to the subcontractors, materials suppliers, any others who can contribute toward maintaining required job progress. It shall be the principal purpose of these meetings, or conferences, to effect coordination, cooperation, and assistance in every practical way toward the end of maintaining progress the project on schedule and to complete the Project within the specified contract time. Each prime contractor shall be prepared to assess progress of the work as required in his particular contract and to recommend remedial measures for correction of progress as may be appropriate. The Architect or his representative shall be the coordinator of and preside over the conferences.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be

delivered to the Architect for inclusion in the submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the

Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents, but shall provide written notification to the Owner and Architect regarding any concerns or objections the Contractor may have regarding the design criteria.

§ 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, permits, the Contract Documents, and as allowed by the Owner and Architect and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.14.3 All patching shall be performed by mechanics of the trades dictated by the materials used in the patching operations.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.15.3 The general construction contractor shall leave the completed work in conditions for occupancy by the Owner such that no cleaning, waxing, polishing, or other janitorial operations are required.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

§ 3.18.1 The Contractor shall indemnify and hold harmless the Owner, Architect, and their agents and consultants, for damages, losses, or claims, including attorneys' fees and costs incurred in the defense of such claims, that arise solely from the negligent acts, errors and/or omissions, or failures to perform, by the Contractor, its employees, agents, or consultants. The parties agree that this indemnification clause is an "evidence of indebtedness" for purpose of N.C. Gen. Stat. § 6-21.2. The parties also specifically acknowledge that the Owner is a public body and it is the intent of the parties that the Owner not incur any expenses when the Contractor is solely responsible for the claims.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

§ 3.19 CONTRACTOR'S REPRESENTATIONS

§ 3.19.1 By entering into this contract with the Owner, the Contractor represents and warrants the following, together with all other representations and warranties in the Contract Documents:

.1 that he is experienced in and competent to perform the type of work required and to furnish the materials, supplies or equipment to be so performed or furnished by him;

.2 that he is financially solvent, able to pay his debts as they mature, and possessed of sufficient working capital to initiate and complete the work required under the contract;

.3 that he is familiar with all federal, state, county, and local laws, ordinances, permits, regulations, and resolutions which may in any way affect the work or those employed therein, including but not limited to any special laws or regulations relating to the work or any part thereof;

.4 that such temporary and permanent work required by the Contract Documents which is to be done by him will be satisfactorily constructed and fit for use for its intended purpose and that such construction will not injure any person, or damage any property;

.5 that he has carefully examined the Contract Documents and the site of the work and that from his own investigations, he has satisfied himself and made himself familiar with: (1) the nature and location of the work; (2) the character, quality, and quantity of surface and subsurface materials likely to be encountered, including but not limited to, all structures and obstructions on or at the project site, both natural and man-made; (3) the character of equipment and other facilities needed for the performance of the work; (4) the general and local conditions including without limitation its climatic conditions, the availability and cost of labor and the availability and cost of materials, tools, equipment, labor, and professional services necessary to complete the work in the manner required by the Contract Documents; and (6) all other matters or things which could in any manner affect the performance of the work;

.6 that he will fully comply with all requirements of the Contract Documents;

.7 that he will perform the work consistent with good workmanship, sound business practice, and in the most expeditious manner consistent with the best interests of the Owner;

.8 that he will furnish efficient business administration and experienced superintendence and an adequate supply of workmen/women, equipment, tools, and materials at all times;

.9 that he has carefully reviewed the work required and that the work can be planned and executed in a normal and orderly sequence of work and reasonably scheduled so as to ensure

completion of the project in accordance with the Contract Documents, allowing for normal and reasonably foreseeable weather, labor and other delays, interruptions and disruptions of the work;

.10 that he will complete the work within the contract time and all portions thereof within any required contract deadlines;

.11 that his contract price is based upon the labor, materials, systems and equipment required by the contract documents, without exception;

.12 that he will make a good faith effort to utilize minority business enterprises (MBEs) per N.C. Gen. Stat. § 143-128, et seq., and the Owner's policy, as subcontractors for the work; and

.13 that he and all others acting on his behalf and/or pursuant to a contract with the him have obtained and shall retain throughout the duration of this Agreement all required licenses and certifications required in order to perform the work identified in the Contract Documents, that he will not permit any such licenses or certifications to lapse at any time during the course of his work on this Project, and that he and all others acting on his behalf and/or pursuant to a contract with him are fully licensed and certified to perform all work required by the Contract Documents and this Agreement.

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 The Architect shall be lawfully licensed to practice architecture or shall be an entity lawfully practicing architecture in the jurisdiction where the Project is located. That lawfully-licensed person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner and Architect and notice, in advance, to the Contractor. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall in its sole discretion employ a successor architect whose status under the Contract Documents shall be that of the Architect.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate For Payment. The Architect will also be the Owner's representative from time to time during the period for correction of Work The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with the other provisions of the Contract.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect and Owner will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible to the Contractor for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION
Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Architect.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with an appropriate submittal schedule approved by the Architect such that the Architect's action will be taken with such reasonable promptness as to cause no delay in the Work or activities of the Owner, Contractor, or separate contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review, or, in the absence of an approved submittal schedule, with reasonable promptness as to cause no delay in the Work or activities of the Owner, Contractor, or separate contractors while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions, including as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion when in the Architect's professional opinion the Work or portion of Work is substantially complete and the date of final completion when in the Architect's professional opinion the Work or portion of the Work is finally complete; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10 and upon compliance with all other requirements of the Contract Documents.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon in writing or otherwise with reasonable promptness as to cause no delay in the Work or activities of the Owner, Contractor, or separate contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by the Owner, Contractor and any prime contractors will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon in writing or otherwise with reasonable promptness as to cause no delay in the Work or activities of the Owner, Contractor, or separate contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect shall reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection by the Architect.

§5.2.1.1 Notwithstanding Section 5.2.1, the Contractor shall identify in the list of names of the subcontractors proposed, those subcontractors that are minority business enterprises and the date each is planned to begin work on the Project. This list of subcontractors and materials suppliers shall be submitted to the Architect not later than 10 calendar days after the date the Contractor executes the Contract. The Contractor shall not use a different Contractor to perform the work of any subcontractor identified pursuant to this section without providing written notice to the Owner and Architect regarding the reason for the change and only after complying with any requirements in G.S. 143-128.2 to 128.4.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.2.5 If during the duration of the Project the Contractor effects a substitution for any subcontractor per subparagraph 5.2, or if additional subcontract opportunities become available, the Contractor shall make a good faith effort to utilize minority business enterprises. The Contractor shall provide written notification of all new subcontractors.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and future obligations under the subcontract, but the Owner does not assume liability for obligations incurred by the Contractor prior to assignment of the subcontract.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall not be legally responsible for any of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these. Failure by the Contractor to make a claim in any way associated with the Owner's right to perform construction and to award separate contracts in accordance with Article 15 shall forever waive the Contractor's right to pursue the claim against the Owner.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The general contractor/Project Expediter shall provide or designate who shall provide for coordination of the activities of the general contractor's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the general contractor/Project Expediter in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Project Expediter, Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Project Expediter and Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 Damages and costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor. The Contractor shall reimburse the Owner for any costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Contractor shall also reimburse the Owner for any other damages incurred by the Owner as a result of the Contractor's delays, improperly timed activities or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.2.6 In accordance with N.C. Gen. Stat. § 143-128, the Contractor shall be directly liable to the Owner and to the other separate prime contractors for the full performance of all duties and obligations due respectively under the terms of the separate contracts and in accordance with the plans and specifications of the Project.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible. This provision shall not impose any obligation on the Owner to clean up the site if the Owner is not performing separate construction activities related to the Project.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone with the prior written approval of the Owner.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 The execution of a Change Order by the parties shall represent a final resolution to all issues addressed by the Change Order and shall constitute a waiver of any claim the Contractor may have to additional compensation or any adjustment to the Contract Time. The Owner, however, reserves the right to audit and confirm that the quantity of work performed was equal to the quantity contained in any Change Order in which payment is based upon unit prices or time and materials. The Owner shall be entitled to receive a credit for any overage contained in the Change Order. In order to receive the credit, the Owner must initiate the audit within thirty (30) days of substantial completion of the Project. The Contractors shall provide the Owner with reasonable access to any documents required to conduct the audit.

§7.2.3 The methods used in determining adjustments to the Contract Sum shall be the same as noted in Section 7.3.3 below.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.7.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an allowance for overhead and profit in accordance with paragraph 7.3.11 and subparagraphs 7.3.11.1 through 7.3.11.6 below. . In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

.5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase or decrease.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment in amounts not in dispute for Work completed under the Construction Change Directive in Applications for Payment accompanied by a Change Order indicating the parties' agreement with part or all of such costs. For any portion of such cost that remains in dispute, the Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect shall prepare a Change

Order accurately recording the agreement. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 In subparagraphs 7.3.6 and 7.3.7, the allowance for the combined overhead and profit included in the total cost to the Owner, including bonds, insurance, bookkeeping, clerical, estimating, superintendence, project management, and all other indirect or overhead costs shall not exceed the following:

.1 for the Contractor, for work performed by the Contractor's own forces, 15 percent of the cost;

.2 for the Contractor, for work performed by the Contractor's subcontractor, 10 percent of the amount due the subcontractor;

.3 for each subcontractor or sub-subcontractor involved, for work performed by that subcontractor's or sub-subcontractor's own forces, 10 percent of the cost;

.4 for each subcontractor, for work performed by the subcontractor's sub-subcontractor, 10 percent of the amount due the sub-subcontractor;

.5 cost to which overhead and profit is to be applied shall be determined in accordance with subparagraph 7.3.7;

.6 in order to facilitate checking of quotations for extras for credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by complete itemization of costs including labor, materials, and subcontracts utilizing a format approved by the Architect. Labor and materials shall be itemized in the manner described above. Where major cost items are subcontracts, they shall be itemized also. In no case will a change involving over $100 be approved without such itemization.

§ 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents with the prior written approval of the Owner. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor. The Contractor shall carry out such orders promptly.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents and Contractor's construction schedule, as integrated by the general contractor and as approved by the Architect as to completion date, are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 The time during which the Contractor is delayed in the performance of the work by the acts or omissions of the Owner, Architect or their employees or agents, acts of God, unusually severe and abnormal climatic conditions, fires, floods, epidemics, quarantine restrictions, strikes, riots, civil commotions or freight embargoes, issuance of building permits by authorities having jurisdiction over the Project, or other conditions beyond the Contractor's control and which the Contractor could not reasonably have foreseen and provided against, shall be added to the time for completion of the Work (i.e. the contract time) stated in the Agreement; provided, however, that no claim by the Contractor for an extension of time for delays will be considered or allowed unless made in compliance with the requirements of the Contract Documents, including Article 15 of this Agreement.

§ 8.3.1.1 Should a time extension be granted for substantial completion, an equal extension shall be applied to the date for final completion, unless specifically stated otherwise.

§ 8.3.1.2 Neither the Owner nor the Architect shall be obligated or liable to the Contractor for, and the Contractor hereby expressly waives, any claims against the Owner and the Architect on account of any indirect or direct damages, costs, or expenses of any nature (including extended overhead or additional personnel costs) which the Contractor, its subcontractors, or sub-subcontractors or any other person may incur as a result of any delays, interferences, changes in sequence or the like, which are identified in Section 8.3.1 above or which are reasonable, foreseeable, contemplated, or avoidable by Contractor, arising from or out of any act or omission of any governmental representative (excluding the Owner) or any of the other multiple prime contractors, it being understood and agreed that the Owner's only obligation in any such events shall be an extension of the contract time, but only as determined in accordance with the provisions of the Contract Documents, including Article 15, unless said delay, interference or change in sequence is solely caused by the Owner and/or Architect. Under no circumstances shall the Contractor be entitled to additional compensation from the Owner or Architect for any claim for delays, interferences, changes in sequence or the like, unless said delay, interference or change in sequence is solely caused by the Owner and/or Architect, except under no circumstances shall the Contractor be entitled to additional compensation for lost profits, home office overhead or lost business opportunity.

§8.3.2. Subject to other provisions of the contract, the Contractor may be entitled to an extension of the contract time (but no increase in the contract sum) for delays arising from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, his subcontractors, or suppliers as follows:

.1 labor disputes and strikes (including strikes affecting transportation) that do, in fact, directly and critically affect the progress of the Work; however, and extension of contract time on account of an individual labor strike shall not exceed the number of days of said strike;

.2 acts of God, tornado, fire, hurricane, blizzard, earthquake, typhoon, or flood that damages completed work or stored materials;

.3 abnormal inclement weather; however, the contract time will not be extended due to normal inclement weather. The time for performance of this contract, as stated in the contract documents, includes an allowance for calendar days which may not be available for construction out-of-doors (prior to building dry-in), unless the Contractor can substantiate to the satisfaction of the Owner that there was greater than normal inclement weather considering the full term of the contract time for work to be performed out of doors (prior to building dry-in) using a ten year average of accumulated record mean values from climatological data compiled by the U.S. Department of Commerce National Oceanic and Atmospheric Administration for the locale of the Project and that such alleged greater than normal inclement weather actually delayed the work or portions thereof which had an effect upon the contract time, the Contractor shall only be entitled to an extension of time if the total accumulated number of calendar days lost due to inclement weather, from the start of work until building dry-in exceeds the total accumulated number to be expected for the same period based on the ten-year average. Time for completion will be extended by the number of calendar days needed to include the excess number of calendar days lost.

.4 Acts of the public enemy, acts of the State, federal, or local government in its sovereign capacity, and acts of another Contractor in the performance of a contract with the Owner relating to the Project.

§ 8.3.3 The burden of proof to substantiate a claim for an extension of the contract time shall rest with the Contractor, including evidence that the cause was beyond his control. The Architect shall base its findings of fact and decision on such justification and supporting evidence and shall advise the Contractor in writing thereof. If the Architect finds that the Contractor was delayed on activities that were on the schedule's critical path, the Architect's determination of the total number of days extension shall be based upon the currently approved progress schedule and on all data relevant to the extension. Such data will be incorporated into the schedule in the form of a revision thereto, accomplished in a timely manner. The Contractor acknowledges and agrees that delays in activities which, according to the schedule, do not affect the contract time of the schedule's critical path, do not have any effect upon the Project's contract time and therefore will not be the basis for an extension of time. The Contractor acknowledges and agrees that time extensions will be granted only to the extent that excusable delays adversely impact critical path activities on the Contractor's schedule. Notwithstanding the above, the Contractor further agrees that if the currently approved schedule is a recovery schedule intended to address delays caused by the Contractor or for which the Contractor was not entitled to an extension of time, the Architect shall be allowed to assess the impact of the delays caused by the Contractor in determining whether the Contractor shall be granted an extension to the contract times.

§ 8.3.4. Extensions in the contract time by Change Orders are subject to an extension-of-time audit by the Owner as follows: (1) The Contractor agrees that, even though the Owner, Contractor, and Architect have previously signed a Change Order containing an extension of time resulting from a change in or addition to the Work that extension in the contract time may be adjusted by an audit after the fact by the Owner. If such an audit is to be made, the Owner must undertake the audit and make a ruling within 30 days after the completion of the Work under the Change Order. (2) The Contractor agrees that any extension of the contract time to which he is entitled arising out of a Change Order undertaken on a force accounting (labor and materials) basis shall be determined by an extension-of-time audit by the Owner or Architect after the work of the Change Order is completed. Such rulings shall be made by the Owner or Architect within 30 days after a request for same is made, except said 30 days will not start until the work under the Change Order is completed.

§ 8.3.5. The Contractor shall not be entitled to and hereby expressly waives any extension of time resulting from any condition or cause unless said claim for extension of time is made in writing to the Architect as required by Article 15.2. Circumstances and activities leading to such claim shall be indicated or referenced in a daily field inspection report for the day(s) affected; otherwise, all such claims are waived by the Contractor. In every such written claim, the Contractor shall provide the following information: (1) nature of delay; (2) date (or anticipated date) of commencement of delay; (3) activities on the progress schedule affected by the delay and/or new activities created by the delay and their relationship with existing activities; (4) identification of person(s) or organization(s) or event(s) responsible for the delay; (5) anticipated extent of the delay; and (6) recommended action to avoid or minimize the delay.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

The Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values prepared as required under Section 9.2., for completed portions of the Work. Such application shall be notarized and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 The Owner will retain five percent of the amount of each progress payment on the Project for as long as is authorized by N.C. Gen. Stat. § 143-134.1. At all times during the Project, the Owner shall retain the maximum funds allowed by N.C. Gen. Stat. § 143-134.1. The Owner specifically reserves the right to withhold additional funds as authorized by this Agreement or N.C. Gen. Stat. § 143-134.1.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner in its sole discretion, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.3.4 The Contractor with each application for payment submitted shall include a list of those minority business enterprises subcontractors whose work is included in the application and the amount due each. By including the minority business enterprises on the list, the contractor certifies that the minority business enterprise performed the work or services or provided supplies under the contract and was not acting as a mere conduit.

§ 9.3.5 The Contractor shall submit with each application for payment documentation in a form acceptable to the Owner showing all sales tax paid by the Contractor for all work and materials covered by the application for payment.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within ten days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's observations and evaluation of the Work and the data comprising the

Contractor's Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated in the Application for Payment; that the quality of the Work is in accordance with the Contract Documents; and that the Work has been performed in a good workmanlike fashion, subject (1) to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, (2) to results of subsequent tests and inspections required by or performed under the Contract Documents, (3) to correction of minor deviations from the Contract Documents prior to completion, and (4) to specific qualifications expressed by the Architect in the Certificate for Payment. The issuance of a Certificate for Payment will further constitute a representation by the Architect that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has reviewed construction means, methods, techniques, sequences or procedures or made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or another contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
- **.7** failure to carry out the Work in accordance with the Contract Documents;
- **.8** failure to provide sales tax documentation in accordance with subparagraph 9.3.5;
- **.9** failure or refusal of the Contractor to submit the required information on minority business enterprises;
- **.10** additional services provided by the Architect pursuant to paragraph 9.6.8; or
- **.11** any other reason deemed necessary by the Architect to protect the Owner.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld. No interest shall be added to any amounts withheld pursuant to Article 9.5.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option and in its sole discretion, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment. No interest shall be added to any amounts withheld pursuant to this provision.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner and in accordance with N.C. Gen. Stat. § 143-134.1 the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner and in accordance with N.C. Gen. Stat. § 143-134.1.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.8 The Contractor shall reimburse the Owner or the Owner will retain from the compensation otherwise to be paid to the Contractor funds sufficient to cover the payment of the following additional services performed by the Architect: (1) services required pursuant to the Owner's dispute resolution policy; (2) expense of overtime work requiring higher than regular rates when such work is required due to the failure of the Contractor to perform in accordance with the Contract Documents; (3) review of the Contractor's submittal or shop drawing out of sequence of the submittal schedule agreed to by the Contractor and Architect; (4) responses to the Contractor's requests for information where such information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior project correspondence or documentation; (5) evaluation of an extensive number of substitutions proposed by the Contractor and making subsequent revisions to instruments of service resulting therefrom; (6) design services related to the default of the Contractor; (7) contract administration services provided 60 days after the date of substantial completion of the work if required due to the Contractor's failure to complete its punchlist work in a timely fashion; (8) more than two inspections or reviews of the same area or areas for the purpose of determining substantial completion of the area or areas; (9) more than two inspection or reviews of the same area or areas for the purpose of determining final completion of the area or areas; and (10) multiple reviews of an incomplete or deficient submittal or shop drawing from the Contractor.

§ 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within fourteen days after receipt of the Contractor's Application for Payment, or if the Owner absent just cause does not pay the Contractor within fourteen days after the date established in the Contract Documents the amount certified by the Architect, then the Contractor may, upon fourteen additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Project when the Project or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Project for its intended use.

§ 9.8.2 When the Contractor considers that the Project, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall in good faith prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete the Project in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Project or designated portion thereof is substantially complete. The Architect shall have no obligation to make an inspection to determine whether the Project is substantially complete until the Contractor prepares the Contractor's comprehensive list of items to be completed or corrected prior to final payment. If the Architect determines that the Contractor's list is excessive or through its observations it determines that the Project is not substantially complete, the Architect may require the Contractor to perform additional work prior to the Architect's inspection of the Project. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Project or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When in the Architect's professional opinion the Project or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Project and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Project or designated portion thereof unless otherwise provided by the Architect in the Certificate of Substantial Completion. The Architect shall be solely responsible for establishing the date of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Project or designated portion thereof. Such payment shall be adjusted for instances when the Project is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Project at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion of the Project is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Project and insurance, and have agreed in writing concerning the period for correction of the Project and commencement of warranties required by the Contract Documents. When the Contractor considers a portion of the Project substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Project shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Project to be used in order to determine and record the condition of the Project.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Project shall not constitute acceptance of portions of the Project not complying with the requirements of the Contract Documents.

§ 9.9.4 The Owner's partial use or occupancy of the Project shall not be construed as a declaration by the Owner or Architect that the building is substantially complete unless specifically stated in writing by the Owner or Architect. The Owner's partial occupancy or use of the Project shall not prevent the Owner from assessing liquidated damages for the entire Project through the actual date of substantial completion of the Project.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief and in his/her professional opinion, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner and (6) documentation regarding all of the sales tax paid by the Contractor in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Project, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Project fully completed and accepted. If the remaining balance for the Project or portion thereof not fully completed or corrected is less than retainage stipulated in the Contract Documents, the written consent of surety to payment of the balance due for that portion of the Project fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

.1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
.2 failure of the Work to comply with the requirements of the Contract Documents;
.3 terms of special warranties required by the Contract Documents;
.4 failure of the work to be performed in a good workmanlike manner;
.5 conditions not recognized by the Owner at the time of payment; or
.6 those claims reserved by the Owner at or before the time of payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified in writing by that payee as unsettled at the time of final Application for Payment.

§ 9.10.6 Application for final payment for each prime contract shall be accompanied by executed and notarized copies of AIA Document G706, Contractor's Affidavit of Payment of Debts and Claims, AIA Documents G706A, Contractor's Affidavit of Release of Liens, and AIA Document G707, Consent of Surety Company to Final Payment, and an affidavit that no materials containing asbestos were used on the Project. In addition, each prime contractor shall furnish separate releases or liens from each subcontractor and materials and equipment supplier involved in its portion of the Work.

§ 9.11 LIQUIDATED DAMAGES

§9.11.1 The damages incurred by the Owner due to the Contractor's failure to complete the work within the required contract time, including any extensions thereof, shall be in the amount set forth in the Contract Documents, for each consecutive day beyond the established contract time (Saturdays, Sundays and all holidays included) for which the Contractor shall fail to complete the work. Should the Contractor fail to substantially complete the Project on or before the date stipulated for substantial completion (or such later date as may result from extension of time granted by Owner), he shall pay the Owner, or the Owner will retain as liquidated damages, the sum identified in the Contract Documents for substantial completion for each consecutive calendar day that terms of the contract remain unfulfilled beyond the date allowed by the contract, which sum is agreed upon as a reasonable and proper measure of damages which the Owner will sustain per day by failure of the Contractor to complete the Project within time as stipulated; it being recognized by the Owner and the Contractor that the injury to the Owner which could result from a failure of the Contractor to complete on schedule is uncertain and cannot be computed exactly. In no way shall costs for liquidated damages be construed as a penalty on the Contractor.

§ 9.11.2 For each consecutive calendar day that the Work and/or Project remains incomplete after the date established for final completion, the Contractor shall pay or Owner will retain from the compensation otherwise paid to the Contractor the sum identified in the Contract Documents as final completion liquidated damages for each consecutive day that the Project remains incomplete. This amount is the minimum measure of damages the Owner will sustain due to the delay in the completion of all remedial work, the delay in the correction of deficient work, the disruption to the school and the learning environment, and the inability to use the facilities fully. This amount is in addition to the liquidated damages prescribed above for substantial completion.

§ 9.11.3 If it is determined that the Contractor was delayed at any time in the progress of the work by acts or omissions of the Owner, Architect or their employees or agents and no time extension was granted for the delay, then the Contractor shall not be assessed liquidated damages for any delay caused by the Owner, Architect or their employees or agents.

§ 9.11.4 The liquidated damages set forth in Articles 9.11.1 and 9.11.2 above or in the Supplementary Conditions shall be assessed cumulatively. This provision for liquidated damages does not bar Owner's right to enforce other rights and remedies against Contractor, including but not limited to, specific performance or injunctive relief.

§ 9.11.5 The liquidated damages set forth in Articles 9.11.1 and 9.11.2 above or in the Supplementary Conditions shall not include legal or additional design professional fees that result from termination for cause of the Contractor's contract. If such legal or additional design professional fees are incurred by the Owner, the Contractor shall be liable to the Owner for those costs in addition to the liquidated damages amount set forth above and in the Contract Documents.

§ 9.11.6 The liquidated damages set forth in Articles 9.11.1 and 9.11.2 above or in the Supplementary Conditions shall not include legal or additional design professional costs that are incurred by the Owner in responding to concerns with the Contractor's performance that result in the Owner sending notice of consideration of the termination of the Contractor's contract to the Surety and Contractor. If such legal or additional design professional costs are incurred by the Owner, the Contractor shall be liable to the Owner for those costs in addition to the liquidated damages amount set forth above and in the Contract Documents.

§ 9.11.7 The Owner's entitlement to liquidated damages shall not be considered a "Claim" subject to any time limitation for asserting Claims, but rather accrues automatically upon the Contractor's failure to meet the substantial completion date and/or final completion date.

§ 9.11.8 The Owner's partial use or partial occupancy of the Project shall not be construed as a declaration by the Owner or Architect that the building is substantially or finally complete, unless specifically stated in writing by the Owner or Architect. The Owner's partial occupancy or use of the Project shall not prevent the Owner from assessing liquidated damages for the entire Project through the actual dates of substantial and final completion.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- **.1** employees on the Project and other persons who may be affected thereby;
- **.2** the Project and all Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.4.1 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary, the Contractor shall give the applicable State and local government officials and the Owner reasonable advance notice.

§ 10.2.5 The Contractor shall promptly remedy damage and loss to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage, create an unsafe condition, or create a risk of endangering its safety.

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY
If the Contractor suffers injury or damage to person or property because of an act or omission of the Owner , or of others for whose acts the Owner is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the Owner within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the Owner to investigate the matter.

§ 10.2.9 Contractor acknowledges that he will be performing the Work on a school site and that a construction site might be an "attractive nuisance" which might draw children to said site. Contractor agrees that it will take reasonable precautions necessary to prevent children from entering the construction site or an area where materials are stored.

§ 10.2.10 Contractor and its subcontractors shall not bring any weapons, firearms or alcoholic beverages on any of the Owner's property.

§ 10.2.11 The Contractor will comply with the Occupational Safety and Health Act of 1970 (OSHA) including all federal and State standards and regulations which have been or shall be promulgated thereunder or in accordance therewith. The Contractor shall be responsible for all citations, assessments, fines, penalties, and delays in the performance of any work on the Project incurred by reason of failure or failure on the part of its agents, employees, assignees or subcontractors to comply. The Contractor shall also comply with all applicable laws, ordinances, rules, regulations, and lawful orders of any public authority having jurisdiction for the safety of persons or property.

§ 10.3 HAZARDOUS MATERIALS
§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such hazardous material or substance is found to be present, to cause it to be rendered harmless or to verify that it has already been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or

substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has a reasonable objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area after the Owner has been informed in writing of the presence of the material or substance, if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor or its subcontractor brings to the site.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and/or negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, unless the cost and expense are due to the Owner's fault or negligence.

§ 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- **.1** Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- **.2** Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- **.3** Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- **.4** Claims for damages insured by usual personal injury liability coverage;
- **.5** Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- **.6** Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- **.7** Claims for bodily injury or property damage arising out of completed operations; and
- **.8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages shall be written on an occurrence basis and, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.2.1 Liability insurance shall include all major divisions of coverage and be on a comprehensive basis including:

.1 premises operations (including X, C, and U coverages as applicable).
.2 independent contractor's protective.
.3 products and completed operations.
.4 personal injury liability with employment exclusion deleted.
.5 contractual, including specified provision for Contractor's obligation under Paragraph 3.18.
.6 owned, non-owned and hired motor vehicles.
.7 broad form property damage including completed operations.

§ 11.1.2.2 If the general liability coverages are provided by a commercial general liability policy on a claims-made basis, the policy date or retroactive date shall predate the contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment, certified in accordance with subparagraph 9.10.2.

§ 11.1.2.3 The insurance required by subparagraph 11.1.1 shall be written for not less than the following limits or greater if required by law:

1. Worker's Compensation:
    a. State: Statutory
    b. Applicable Federal: Statutory
    c. Employer's liability:
        i. $100,000 each accident
        ii. $1,000,000 disease policy limit
        iii. $100,000 disease, each employee
2. Comprehensive or Commercial General Liability
    a. Limits of Insurance (CSL)
        i. $1,000,000 each occurrence
        ii. $1,000,000 aggregate
    b. Products and Completed Operations to be Maintained for One Year After Final Payment
        i. $1,000,000 aggregate
    c. Property Damage Liability Insurance Shall Provide X, C, and U Coverage
    d. Broad Form Property Damage Coverage Shall Include Completed Operations
3. Contractual Liability (Hold Harmless Coverage):
    a. Limits of Insurance (CSL):
        i. $1,000,000 each occurrence
        ii. $1,000,000 aggregate
4. Personal Injury, with Employment Exclusion Deleted: $1,000,000 aggregate
5. Business Auto Liability (Including Owned, Non-Owned, and Hired Vehicles):
    a. Limits of Insurance (CLS):
        i. $500,000
6. If the General Liability Coverages are Provided by a Commercial Liability Policy, The:
    a. General aggregates shall be not less than $1,000,000 and it shall apply, in total, to this Project only;
    b. Fire damage limit shall be not less than $50,000 on any one fire; and
    c. Medical expense limit shall be not less than $5,000 on any one person.

7. Umbrella Excess Liability:
   a. $1,000,000 over primary insurance;
   b. $10,000 retention.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness. If this insurance is written on the comprehensive liability policy, the certificates shall be AIA Document G705, Certificate of Insurance. If this insurance is written on a commercial general liability policy form, accord form 25S will be acceptable.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner as additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.5 Each prime contractor shall either require each of his subcontractors to procure and maintain during the life of his subcontract insurance of the types and amounts described in Paragraph 11.1.2.1 above or he shall insure the activities of his subcontractors in his own policy.

§ 11.1.6 The Contractor shall not commence work under this contract until he has obtained all the insurance and bonds required hereunder and such insurance and bonds have been accepted by the Owner. Nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance and bonds required of the subcontractor have been so obtained and accepted. Acceptance of the insurance by the Owner shall not constitute an approval of the insurance as meeting the requirements of the Contract Documents nor relieve or decrease the liability of the Contractor hereunder.

§ 11.2 OWNER'S LIABILITY INSURANCE
The Owner may purchase and maintain the Owner's usual liability insurance, and the Contractor shall purchase and maintain insurance covering the Owner's contingent liability for claims which may arise from operations under the contract.

§ 11.3 PROPERTY INSURANCE
§ 11.3.1 The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project. The form of policy for this coverage shall be completed value. If the Owner is damaged by failure of the Contractor to maintain such insurance, then the Contractor shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.3 If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE
The Contractor shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE
The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused.

§ 11.3.6 Prior to commencement of the Work, the Contractor shall file with the Owner a certificate of insurance for the policy or policies providing the property insurance coverage required for this Project. The certificate of insurance shall contain a provision that the policy will not be cancelled or allowed to expire until at least 30 days prior written notice has been given to the Owner.

§ 11.3.7 WAIVERS OF SUBROGATION
The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered and reimbursed by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Contractor as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under this property insurance shall be adjusted by the Contractor as fiduciary and made payable to the Contractor as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate

agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Contractor as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Contractor's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Contractor shall deposit in a separate account proceeds so received, which the Contractor shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss due to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Contractor shall furnish bonds satisfactory to the Owner and from a company licensed by the State of North Carolina to issue such bonds covering the faithful performance of the contract and payment of obligations arising thereunder as required by law. The cost of the Contractor's bonds shall be included in the contract sum. The amount of the performance bond and the labor and material payment bonds shall each be equal to 100 percent of the contract sum. These bonds shall be maintained in full force and effect throughout the full term of the contract.

§ 11.4.1.1 The Contractor shall deliver the required bonds to the Owner when he delivers the executed contracts to the Architect, or if the work is to be commenced prior thereto, in response to a letter of intent, the Contractor shall, prior to the commencement of the work, submit evidence satisfactory to the Owner that such bonds will be furnished.

§ 11.4.1.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

§ 11.4.2 Upon the request to the Contractor of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.5 INSURANCE COMPANY QUALIFICATIONS

§ 11.5.1 All insurance and bonds required by this contract shall be written by a company or companies having a rating of "A" or above by A.M. Best Company and which are licensed and authorized to do business in North Carolina.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may, with the consent of the Owner, request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of

correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the party responsible shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK
§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION
The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION
§ 12.2.2.1 In addition to the Contractor's obligations under Sections 3.5 and 12.2.1, if, within one year after the date of Substantial Completion of the Project or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor or its surety shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's or its surety's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work pursuant to Section 12.2, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK
If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made. Any acceptance of nonconforming work must be in writing.

ARTICLE 13 MISCELLANEOUS PROVISIONS
§ 13.1 GOVERNING LAW
§ 13.1.1 The Contract shall be governed by the law of the State of North Carolina.

§ 13.1.2 Each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and the contract shall be read and enforced as though it were included herein. If, through mistake or otherwise, any such provisions are not inserted or are not correctly or fully inserted, then upon the application of either party, the contract shall forthwith be physically amended to make such insertion.

§ 13.1.3 Whenever possible, each provision of this Agreement shall be interpreted in a manner as to be effective and valid under applicable law. If, however, any provision of this Agreement, or portion thereof, is prohibited by law or found invalid under any law, only such provision or portion thereof shall be ineffective, without in any manner invalidating or affecting the remaining provisions of this Agreement or valid portions of such provisions, which are hereby deemed severable.

§ 13.2 SUCCESSORS AND ASSIGNS
§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to the local board of county commissioners or a lender providing construction financing for the Project, if the party assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE
Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES
§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as specifically stated in the Contract or as may be specifically agreed in writing.

§ 13.4.3 Each party hereto agrees to do all acts and things and to make, execute and deliver such written instruments, as shall from time to time be reasonably required to carry out the terms and provisions of the Contract Documents.

§ 13.4.4 Any specific requirements in this Contract that the responsibilities or obligations of the Contractor also apply to a Subcontractor is added for emphasis and are also hereby deemed to include a Subcontractor to any tier. The omission of a reference to a Subcontractor in connection with any of the Contractor's responsibilities or obligations shall not be construed to diminish, abrogate, or limit any responsibilities or obligations of a Subcontractor of any tier under the Contract Documents or the applicable subcontract.

§ 13.5 TESTS AND INSPECTIONS
§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such

tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals for which applicable laws or regulations expressly prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST
Payments due and unpaid under the Contract Documents shall not bear interest.

§ 13.8 CONDUCT ON SITE
§ 13.8.1 In accordance with N.C. Gen. Stat. § 14-269.2, the Contractor, its subcontractors and employees shall not possess or carry, whether openly or concealed, any gun, rifle, pistol, or explosive on any property owned by the Owner. This includes firearms locked in containers, vehicles or firearm racks within vehicles. The Contractor, its subcontractors and employees shall not cause, encourage or aid a minor, who is less than 18 years old to possess or carry, whether openly or concealed, any weapons on any property owned by the Owner.

§ 13.8.2 The Contractor, its subcontractors and employees, are prohibited from profane, lewd, obscene or offensive conduct or language, including engaging in sexual harassment.

§ 13.8.3 The Contractor and its subcontractors and their employees shall not manufacture, transmit, conspire to transmit, possess, use or be under the influence of any alcoholic or other intoxicating beverage, narcotic drug, hallucinogenic drug, amphetamine, barbiturate, marijuana or anabolic steroids, or possess, use, transmit or conspire to transmit drug paraphernalia on any property owned by the Owner.

§ 13.8.4 The Contractor, its subcontractors and employees shall not solicit from or sell to students or staff within the Owner's facilities or campuses, and shall not give gifts of any value to school system employees.

§ 13.8.5 The Contractor, its subcontractors and employees are prohibited from using access to the site pursuant to this Contract as a means to date, court, or enter into a romantic or sexual relationship with

any student enrolled in the Owner's school system. The Contractor agrees to indemnify the Owner for claims against the Owner resulting from relationships which have occurred or may occur between a student and an employee of the Contractor or subcontractor.

§ 13.8.6 The Contractor, its subcontractors and employees shall not interact with any students. However, nothing in this section shall be construed to prevent the Contractor, its subcontractors and employees from taking necessary measures to protect the safety of students, staff, or other employees.

§ 13.8.7 The Contractor shall at all times enforce strict discipline and good order among its employees and shall not employ any unfit person or anyone not skilled in the task assigned to it. The Owner may require the Contractor to remove any employee the Owner deems incompetent, careless or otherwise objectionable.

§ 13.9 COMPLIANCE WITH APPLICABLE LAWS

§ 13.9.1 Lunsford Act/Criminal Background Checks. The Contractor shall conduct at its own expense sexual offender registry checks on each of its owners, employees, agents, or subcontractors ("contractual personnel") who will engage in any service on or delivery of goods to school system property or at a school-system sponsored event, except checks shall not be required for individuals who are solely delivering or picking up equipment, materials, or supplies at: (1) the administrative office or loading dock of a school; (2) non-school sites; (3) schools closed for renovation; or (4) school construction sites.. The checks shall include at a minimum checks of the State Sex Offender and Public Protection Registration Program, the State Sexually Violent Predator Registration Program, and the National Sex Offender Registry ("the Registries"). For the Contractor's convenience only, all of the required registry checks may be completed at no cost by accessing the United States Department of Justice Sex Offender Public Website at http:// www. nsopw.gov/. The Contractor shall provide certification that the registry checks were conducted on each of its contractual personnel providing services or delivering goods under this Agreement prior to the commencement of such services or the delivery of such goods. The Contractor shall conduct a current initial check of the registries (a check done more than 30 days prior to the date of this Agreement shall not satisfy this contractual obligation). In addition, Contractor agrees to conduct the registry checks and provide a supplemental certification before any additional contractual personnel are used to deliver goods or provide services pursuant to this Agreement. Contractor further agrees to conduct annual registry checks of all contractual personnel and provide annual certifications at each anniversary date of this Agreement. Contractor shall not assign any individual to deliver goods or provide services pursuant to this Agreement if said individual appears on any of the listed registries. Contractor agrees that it will maintain all records and documents necessary to demonstrate that it has conducted a thorough check of the registries as to each contractual personnel, and agrees to provide such records and documents to the school system upon request. Contractor specifically acknowledges that the school system retains the right to audit these records to ensure compliance with this section at any time in the school system's sole discretion. Failure to comply with the terms of this provision shall be grounds for immediate termination of the Agreement. In addition, the Owner may conduct additional criminal records checks at the Owner's expense. If the school system exercises this right to conduct additional criminal records checks, Contractor agrees to provide within seven (7) days of request the full name, date of birth, state of residency for the past ten years, and any additional information requested by the school system for all contractual personnel who may deliver goods or perform services under this Agreement. Contractor further agrees that it has an ongoing obligation to provide the school system with the name of any new contractual personnel who may deliver goods or provide services under the Agreement. The Owner reserves the right to prohibit any contractual personnel of Contractor from delivering goods or providing services under this Agreement if the Owner determines, in its sole discretion, that such contractual personnel may pose a threat to the safety or well-being of students, school personnel or others.

§ 13.9.2. Compliance with Applicable Laws. Contractor shall comply with all applicable laws and regulations in providing services under this Agreement. In particular, Contractor shall not employ any individuals to provide services to the Owner who are not authorized by federal law to work in the United States. Contractor represents and warrants that it is aware of and in compliance with the Immigration

Reform and Control Act and North Carolina law (Article 2 of Chapter 64 of the North Carolina General Statutes) requiring use of the E-Verify system for employers who employ twenty-five (25) or more employees and that it is and will remain in compliance with these laws at all times while providing services pursuant to this Agreement. Contractor shall also ensure that any of its subcontractors (of any tier) will remain in compliance with these laws at all times while providing subcontracted services in connection with this Agreement. Contractor is responsible for providing affordable health care coverage to all of its full-time employees providing services to the School System. The definitions of "affordable coverage" and "full-time employee" are governed by the Affordable Care Act and accompanying IRS and Treasury Department regulations.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment in the amount approved by the Architect on a Certificate for Payment within the time stated in the Contract Documents and after an additional 30 days notice to the Owner and Architect and an opportunity to cure; or

.4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work solely by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon fifteen (15) days' written notice to the Owner and Architect and a reasonable opportunity to cure, terminate the Contract and recover from the Owner payment for Work executed prior to the date of termination as allowed in the Contract, including reasonable overhead and profit to the date of termination as allowed in the Contract, and actual and verifiable costs incurred by reason of such termination as allowed in the Contract and proven by the Contractor through valid documentation of such expenses incurred..

§ 14.1.4 If the Work is stopped for a period of 120 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon fourteen (14) additional days' written notice to the Owner and the Architect and an opportunity to cure, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority**.4** otherwise is guilty of substantial breach of a provision of the Contract Documents;

.5 refuses or fails to prosecute the work or any separable part thereof with such diligence as will ensure the Substantial or Final Completion of the Work within the Contract Time or fails to complete the Work or remedy a default within said period; or

6. refuses or fails to properly schedule, plan coordinate and execute the Work, as specified herein, so as to perform the Work within the specified milestone and completion dates, or to provide scheduling or related information, revisions and updates as required by the Contract Documents;

7. fails to comply with (1) the provisions of the Sedimentation and Pollution Control Act (N.C. Gen. Stat. §113A-50 *et seq.)*, and/or (2) any Notice of Violation issued by the North Carolina Department of Natural Resources.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Architect that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished, and the Contractor shall reimburse the Owner for any legal or architectural fees incurred by the Owner as a result of the Contractor's default.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's and legal services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor or its Surety. If such costs and damages exceed the unpaid balance, the Contractor or its Surety shall pay the difference to the Owner. The amount to be paid to the Contractor, Surety or Owner, as the case may be, shall be certified by theArchitect, upon application, and this obligation for payment shall survive termination of the Contract.

§14.2.5 If the Owner terminates the whole or any part of the Work pursuant to Section 14.2, the Owner may procure, upon such terms and in such manner as the Owner may deem appropriate, supplies or services similar to those so terminated, and the Contractor shall be liable to the Owner for any excess costs for such similar supplies or services. The Contractor shall continue the performance of the Contract to the extent not terminated hereunder.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 If a suspension, delay, or interruption ordered by the Owner pursuant to Section 14.3.1 exceeds fourteen consecutive days, an adjustment shall be made for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract in whole or in part for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders to the extent they relate to the Work terminated and enter into no further subcontracts and purchase orders.

§ 14.4.3 If the Owner terminates the whole or any portion of the Work pursuant to Section 14.4, then the Owner shall only be liable to the Contractor for those costs reimbursable to the Contractor in accordance with Section 14.4.4, plus a markup of 10 percent for profit and overhead on the actual fully accounted costs recovered under 14.4.4; provided however, that if there is evidence that the Contractor would have sustained a loss on the entire Contract had it been completed, no profit shall be included or allowed hereunder and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss.

§ 14.4.3.1 After receipt of a Notice of Termination for Convenience, the Contractor shall submit to the Owner its termination claim in the form and with certification prescribed by the Owner. Such claims shall be submitted promptly but in no event later than three (3) months from the effective date of termination, unless one or more extensions in writing are granted by the Owner upon request of the Contractor made in writing within such three (3) month period or authorized extension thereof. However, if the Owner determines that the facts justify such action, it may receive and evaluate any such termination claim at any time after such three (3) month period or any extension thereof. Upon failure of the Contractor to submit its termination claim within the time allowed, the Owner may determine, on the basis of information available to it, the amount, if any, due to the Contractor by reason of the termination.

§14.4.4 If the Owner terminates the whole or any portion of the Work pursuant to Section 14.4, the Owner shall pay the Contractor the amounts determined by the Owner as follows:

14.4.4.1 an amount for supplies, services, or property accepted by the Owner pursuant to Subparagraph 14.5.1.6 or sold or acquired pursuant to Subparagraph 14.5.1.7 and not heretofore paid for, and to the extent provided in the Contract such amount shall be equivalent to the aggregate price for such supplies or services computed in accordance with the price or prices specified in the Contract appropriately adjusted for any saving of freight or other charges;

14.4.4.2 the total of the cost incurred in the performance of the Work through the date of termination including initial costs and preparatory expense allocable thereto but exclusive of any costs attributable to supplies or services paid or to be paid for under Section 14.4.4.1; and

14.4.4.3 Provided, however, that neither the Owner nor the Design Consultant will be liable for payments to subcontractors pursuant to Section 14.4.4.2 unless each subcontractor contains termination provisions identical to those set forth in Article 14. The Owner and the Design Consultant will not be liable to the Contractor or any of its subcontractors for any costs associated with termination if the subcontract of the party involved does not include the proper termination clauses.

§ 14.4.5 In arriving at any amount due the Contractor pursuant to Section 14.4, there shall be deducted the following:

14.4.5.1 all unliquidated advance or other payments on account theretofore made to the Contractor applicable to the terminated portion of the Contract;

14.4.5.2 any claim which the Owner may have against the Contractor;

14.4.5.3 such amount as the Owner determines to be necessary to protect the Owner against loss because of outstanding or potential liens or claims; and

14.4.5.4 the agreed price for, or the proceeds of sale of, any materials, supplies or other things acquired by the Contractor or sold pursuant to the provision of Section 14.5.1.7 and not otherwise recovered by or credited to the Owner.

§14.4.6. The total sum to be paid to the Contractor and Section 14.4 shall not exceed the Contract Sum as reduced by the amount of payments otherwise made or to be made for Work not terminated and as otherwise permitted by the Contract. Except for normal spoilage, and except to the extent that the Owner shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor, as provided in Section 14.4.4, the fair value, as determined by the Owner, of property which is destroyed, lost, stolen or damaged so as to become undeliverable to the Owner, or to a buyer pursuant to Section 14.5.1.7

§14.5 GENERAL TERMINATION FOR CONVENIENCE PROVISIONS

§ 14.5.1 After receipt of a notice of termination for convenience from the Owner, pursuant to Section 14.4, and except as otherwise directed by the Owner, the Contractor shall:

§ 14.5.1.1 stop work under the Contract on the date and to the extent specified in the notice of termination;

§14.5.1.2 place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the work under the Contract as is not terminated;

§14.5.1.3 terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the notice of termination;

§ 14.5.1.4 at the option of the Owner, assign to the Owner in the manner, at the times and to the extent directed by the Owner, all of the rights in the contracts so terminated, in which case the Owner shall have the right, at its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

§ 14.5.1.5 settle all outstanding liabilities and all claims arising out of such termination or orders and subcontracts, with the approval or ratification of the Owner, to the extent it may require, which approval or ratification shall be final for all the purposes of this Article;

§ 14.5.1.6 transfer title and deliver to the entity or entities designated by the Owner, in the manner, at the times and to the extent directed by the Owner to the extent specifically produced or specifically acquired by the Contractor for the performance of such portion of the Work as had been terminated, the following:

(1) the fabricated or unfabricated parts, work in process, partially completed supplies and equipment, materials, parts, tools, dies, jigs and other fixtures, completed Work, supplies and other material produced as part of, or acquired in connection with the performance of, the Work terminated by the notice of termination; and

(2) the completed or partially completed plans, drawings, information, releases, manuals and other property related to the Work and which, if the Contract had been completed, would have been required to be furnished to the Owner;

§ 14.5.1.7 use its best efforts to sell, in the manner, at the times, to the extent and at the price or prices directed or authorized by the Owner, any property of the types referred to in Subparagraph 14.5.1.6; provided, however, that the Contractor:

(1) shall not be required to extend credit to any buyer, and

(2) may acquire any such property under the conditions prescribed by and at a price or prices approved by the Owner; and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the Owner to the Contractor under the Contract or shall otherwise be credited to the Contract Sum covered by the Contract or paid in such other manner as the Owner may direct;

§ 14.5.1.8 complete performance of such part of the Work as shall not have been terminated by the notice of termination; and

§ 14.5.1.9 take such action as may be necessary, or as the Owner may direct, for the protection and preservation of the property related to the Contract which is in the possession of the Contractor and in which the Owner has or may acquire an interest.

§ 14.5.2 The Contractor shall, from the effective date of termination until the expiration of three (3) years after final settlement under the Contract, preserve and make available to the Owner, at all reasonable times at the office of the Contractor, but without direct charge to the Owner, all its books, records, documents and other evidence bearing on the costs and expenses of the Contractor under the Contract and relating to the Work terminated hereunder, or, to the extent approved by the Owner, photographs, micro-photographs or other authentic reproductions thereof.

§ 14.5.3 If the termination for convenience, pursuant to Section 14.4, be partial, the Contractor may file with the Owner a claim for an equitable adjustment of the price or prices specified in the Contract relating to the continued portion of the Contract (the portion not terminated by the notice of termination), and such equitable adjustment as may be agreed upon shall be made in such price or prices. Any claim by the Contractor for an equitable adjustment under this Subparagraph must be asserted within three (3) months from the effective date of the notice of termination.

§ 14.5.4 The Contractor shall refund to the Owner any amounts paid by the Owner to the Contractor in excess of costs reimbursable under Section 14.4.

§ 14.5.5 The Contractor shall be entitled to only those damages and that relief from termination by the Owner as specifically provided in Section 14.4.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, adjustment of Contract terms, extension of time, or other relief with respect to the terms of the Contract. The term “Claim” also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 TIME LIMITS ON AND NOTICE OF CLAIMS

Claims by the Contractor must be initiated by written notice to the Owner and the Architect. Claims by the contractor must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. The Contractor’s failure to submit a claim in accordance with these time limits shall forever waive the Contractor’s right to pursue the claim. The Contractor shall indemnify and hold the Owner harmless from any claims by the Contractor’s subcontractors arising out of the Contractor’s failure to submit the claim in a timely fashion.

§ 15.1.2.1 The resolution of a claim by change order shall finally resolve any and all claims arising from the event giving rise to the claim.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE
Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments as requests for payment are substantiated by the Contractor and approved by the Architect. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with his/her exercise of professional judgment and the requirements of the Contract Documents, this Agreement, and AIA Document B101, 2007 Edition, as modified. The Contractor shall not slow or stop the progress of the Work while a claim or dispute is pending or under negotiation.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST
If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. The Contractor's failure to provide written notice of the Claim before proceeding to execute the Work shall be grounds for the denial of the Claim by the Architect and/or Owner. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME
§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary. The Contractor's claim shall specifically show the impact of the delay on the Project's critical path. The Contractor's failure to submit a claim in accordance with the time limits shall forever waive the Contractor's right to pursue the Claim.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled critical path construction.

§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES
The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- **.1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- **.2** damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14 except it shall not apply to limit the Owner's ability to recover additional architectural and legal fees resulting from a default by the Contractor. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION
§ 15.2.1 Claims by the Contractor, including those alleging an error or omission by the Architect but excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Architect for initial decision. The Architect will serve as the Initial Decision Maker. Except for those Claims excluded by this Section 15.2.1, an initial decision by the Architect shall be required as a condition precedent to litigation or mediation of any Claim by the Contractor arising prior to the date final payment is made, unless 30 days have passed after the Claim has been referred to the Architect with no decision

having been rendered. The Architect may be granted an extension of time to render a decision by mutual agreement of the parties. The Owner may, in its sole discretion, submit its claims to the Architect for an initial decision before instituting mediation or litigation.

§ 15.2.2 The Architect will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Architect is unable to resolve the Claim if the Architect lacks sufficient information to evaluate the merits of the Claim or if the Architect concludes that, in the Architect's sole discretion, it would be inappropriate for the Architect to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Architect may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Architect in rendering a decision. The Architect may request the Contractor to authorize retention of such persons at the Contractor's expense.

§ 15.2.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Architect when the response or supporting data will be furnished or (3) advise the Architect that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Architect will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Architect will render an initial decision approving or rejecting the Claim, or indicating that the Architect is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and/ or litigation.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.3 MEDIATION

§ 15.3.2 The parties shall endeavor to resolve their Claims by voluntary mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for voluntary mediation shall be made in writing, delivered to the other party to the Contract.

§ 15.3.3 If the parties voluntarily agree to mediate claims, the parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

NOTE: THESE CONDITIONS SUPERCEDE ANY CONFLICTING CONDITIONS IN THE GENERAL CONDITIONS.

SALES TAX

Itemized sales tax expenditures by the Contractor will be reimbursed to the Owner. BIDS MUST INCLUDE SALES TAX.

DELAYS / CLAIMS

Any contractor whose work is delayed for reasons beyond his control shall immediately notify the Architect as to the nature of the delay, the cause of the delay, and the immediate effect on the project, including cost effects. Verbal notification shall be followed with written notification to the Architect no later than 10 days following the delay; otherwise, no consideration for a claim will be given. For delays claimed by reason of weather, the Contractor shall be required to substantiate such claim by the submission of weather reports for the time period of the delay as well as national weather service reports for the project area for the last ten years, the average of which shall become the basis to determine the validity of such claim. Time extensions granted for reasons of weather or other reasons except as caused by the Owner, with exceptions and time limits for convenience of the Owner as indicated under Section 01011, do not entitle the Contractor to “extended overhead” or “lost profit” recovery.

Delays which do not affect activities on the Critical Path of the approved CPM Construction Schedule will not be considered reason to allow time extensions. Time extensions granted for reasons other than natural weather disasters do not entitle the Contractor to “lost profit” recovery. Time extensions granted for reasons other than natural weather disasters do not entitle the Contractor to “extended overhead” recovery.

CLEAN UP AND PROTECTION OF WORK

The Contractor shall replace any broken glass, remove stains, spots and dirt from decorated work, clean hardware, remove paint spots and smears from all surfaces, clean plumbing fixtures and wash all concrete, and clean and wax resilient tile floors and clean hard tile floors. The Contractor shall be responsible for leaving his work clean in all respects, and shall be responsible for protecting his work from damage by other parties.

CHANGES IN THE WORK

The cost or credit to the Owner resulting from a Change in the work shall be determined as follows:

1. Allowances for overhead and profit combined shall not exceed 15 percent of net cost except when the change involves a Subcontractor, in which case allowances shall not exceed 15 percent for the Subcontractor and 7-1/2 percent for the Prime Contractor.

2. The profit and overhead rates proposed by the Contractor for the initial Change in the Work shall not be changed or modified for the duration of the Contract, and shall apply equally for additive and / or deductive changes.

3. The term "net cost" as used herein shall mean the difference between all proper cost additions and deductions. The "cost" as used herein may include all items of material and labor, the use of power tools and equipment, and such items of cost as Workmen's Compensation Insurance, Social Security and Old Age Benefit, Performance Bond Adjustment and pro-rata charges for foreman. The following items shall be considered as overhead: insurance other than mentioned above, supervision, superintendents, timekeepers, clerks, watchmen, small tools, incidental job burdens and general office expense, and all other items not included in "cost" as above defined.

4. Price requests for changes in the Work furnished to the Architect shall include individual costs for materials, labor, subcontractor work (if applicable), and profit and overhead unless otherwise noted.

5. Unit Prices listed on Bid Form of Proposal, Sitework Material allowances, and Form of Contract shall include all overhead and profit costs. Overhead and profit shall not be listed as a separate or added cost when unit prices and materials allowances are used or credited.

TIME

The Contractor shall fully complete the Work in accordance with the schedule of COMPLETION DATES which are DATES CERTAIN, with no time extensions granted for any reason other than delays caused by the Owner (see below).

WEATHER

Weather is by its nature not “normal”, and rail fall varies from year to year. Weather delays are to be accommodated within the schedule as specified, however, “natural disasters”, such as caused by severe hurricanes, are excepted. In making his bid, the bidder acknowledges that provisions to accelerate the schedule will be provided as required to meet the scheduled dates, to accommodate abnormal weather conditions, or other delays, except as caused by the Owner.

PROJECT PHASING (note: “Prime” contractor means “sub” contractor under a Single Prime contracting method)

1. The General Contractor is responsible as the project coordinator for all the Prime Contractors. It is the General Contractor’s responsibility to schedule the work of all Contractors, to maintain weekly reports to the Architect and the Owner regarding the status of activities of all Contractors, and to submit plans to the Architect and Owner for recovery of any scheduled activity by any Contractor, to the Owner and Architect, for review and immediate implementation.

2. Each Prime Contractor shall be required to coordinate their schedule of activities with the General Contractor, and, in submitting a bid, agree to execute a construction schedule in conformance with the required completion dates. All parts of this schedule will be binding on each Contractor, and it is agreed by all Contractors that liquidated damages will be withheld for any delays caused by them which affect the completion date directly or indirectly, in the sole opinion of the Architect, as further described and defined under the Contract for Construction.

3. All Contractors agree that maintaining the scheduled completion of individual activities is essential for the overall completion of the project schedule, and understand that many activities by other Contractors are dependent on timely completion of their own activities. As such, it is understood and agreed by all Contractors that liquidated damages will be withheld, at the time of delay, for any delays which impact the completion of activities by other Contractors and cause the schedule to be revised to a later completion date. For example, the Sitework Contractor must complete various aspects of sitework in a timely manner to allow the other Prime Contractors to store and stage materials on stoned parking areas, or that finish grading, seeding, mulching, and fertilizing operations shall be completed in a manner which will allow the other Prime Contractors to complete their exterior finish work on time, to provide the project with a completed, full stand of grass on the completion date and not afterwards. As an additional example, General Contractor shall schedule his work and make all provisions to allow the Mechanical Contractor to complete his work in a timely manner to meet his scheduled completion date, which is prior to the General Contractor’s completion date, in order for the General Contractor to utilize the HVAC system for conditioning of the building. The foregoing illustrative examples are not intended to imply a listing of issues possible but only to serve as examples.

4. It is understood by all bidders that they will cooperate with each other to formulate and agree on a construction schedule detailing all significant activities of the project within 30 days of award.

COMPLETION DATES (ALL DATES CERTAIN)

The Start Date for the project will be the seventh day following receipt of the Architect's Notice to Proceed.

1. 20 days following Start Date: General Contractor shall submit proposed construction schedule to all major subcontractors (site, plumbing, mechanical, electrical, technology, masonry, steel, roofing, windows, elevator) with copy to Architect and Owner.

2. 30 days following Start Date: General Contractor shall submit proposed construction schedule, approved by subcontractors, for acceptance by Owner.

3. Substantial Completion, 420 Days from Start Date. Complete all work required to allow Owner to occupy all areas with provided occupancy permits. Liquidated damages incurred for each calendar day late.

4. Final Completion, 480 Days from Start Date: All construction review items issued by Architect's office shall be completed. Additional Liquidated damages incurred for each calendar day late.

LIQUIDATED DAMAGES

For each day in excess of the number of days allowed to complete construction under 8.1.5, for each scheduled date, the Contractor shall pay to the Owner the sum of $1000.00 as liquidated damages reasonably estimated in advance to cover the costs and/or losses incurred by the Owner by the failure of the Contractor to complete the Work of any Phase indicated in the time specified, such time being in the essence of this Contract and a material consideration thereof. Liquidated damages for days in excess of completion date shall be held as retainage from monthly payments by the Owner, and released from subsequent payments only if delay days are made up and no damages have been incurred by the Owner. The Architect shall be the sole judge as to the division of responsibility between the prime contractors, and shall apportion the amount of liquidated damages to be paid by each of them, according to delay caused by any or all of them. Issuance of a Certificate of Occupancy by any Building Official DOES NOT constitute Substantial Completion or completion of construction under this paragraph. Substantial Completion is defined as suitable for use, in the opinion of the Owner and the Architect.

ADDITIONAL LIQUIDATED DAMAGES

For each day in excess of sixty days beyond the date of Substantial Completion that any corrective or incompleted items remain to be done, for each scheduled date, the Contractor shall pay to the Owner the sum of $1000.00 as liquidated damages reasonably estimated in advance to cover the costs and/or losses incurred by the Owner by the failure of the Contractor to complete such corrective work or incomplete items for any Phase listed, such time being in the essence of this Contract and a material consideration thereof.

OWNER'S RIGHT TO COMPLETE WORK TO MAINTAIN SCHEDULE

The Contractor agrees that if the Architect determines, at his sole discretion, that the Contractor has repeatedly or persistently failed or refused to implement such measures as will bring the progress of the Work into conformity with the Construction Schedule, then the Owner may contract with others or use the Owner's own forces to perform the Work to bring the progress into conformity with the Construction Schedule. The Contractor agrees that the Owner will be entitled to a set off for the cost thereof including, but not limited to , actual costs, legal fees, and additional overhead costs, which will be charged against the Contract Sum due the Contractor.

COST INFORMATION FOR INSURANCE PURPOSES

During the course of the construction, the contractor will be required to provide written cost breakdowns for various parts of the work for insurance purposes.

PAY APPLICATIONS AND RETAINAGE

Contractor shall submit Applications for Payments to the Architect monthly for work completed and materials stored ending the twenty-fifth day of the month. Retainage shall be five percent (5%) of monthly estimates. The Architect may, at any time after fifty percent of the work has been completed, if he finds that satisfactory progress is being made and with written consent of Contractor's Surety, recommend to the Owner that retainage be reduced to two and one-half percent (2.5%) of monthly estimates.

Sales tax expenditures shall be substantiated with a certified statement by the Contractor and each of his Subcontractors individually showing total purchases of material from each separate vendor and total sales taxes paid each vendor. Certified statement must have the invoice number or numbers covered and inclusive dates of such invoices.

Materials used from Contractor's or Subcontractor's warehouse stock shall be shown in certified statement at warehouse stock prices and amount of tax paid.

The Contractor shall not be required to certify the Sub-Contractor's statements.

The Contractor and each of his Sub-Contractors shall also show purchases of materials from each separate vendor and the cost of same for which no sales tax has been paid.

When applicable, file a Form E-589CI, Affidavit Of Capital Improvement.

BUILDERS RISK INSURANCE

Contractor shall provide Builder’s Risk Insurance, payable to the Contractor and Owner as their interest may appear upon the amount of the bid and upon all materials in or adjacent thereto which are to be made apart of the insured structure to 100% of the insurable value thereof covering fire, extended coverage, vandalism and Malicious mischief.

END OF SUPPLEMENTARY CONDITIONS

SUMMARY OF WORK

This project involves the furnishing of all labor, materials, and services necessary to complete the construction of the COMMUNITY CENTER AND GYMNASIUM FOR ALICE KEENE DISTRICRT PARK, Pitt County, North Carolina as shown by the drawings and as specified herein.

CONSTRUCTION SCHEDULE

Each Prime Contractor shall coordinate his work with the others to complete his work, on schedule, within the specified time allowed. Within thirty days of award of Contracts to the successful Bidders, the General Contractor will prepare, with the assistance of each Prime Contractor, a Master Construction Schedule, in both bar chart and critical path method form, which shall be signed by each Contractor and become a requirement and part of the Contract Documents.

The Schedule shall include work by Architect and Owner, as may be required by the contractor (i.e. Critical shop drawing review, color selection, inspections, etc.).

The Master Schedule shall be created in electronic computer form using an industry-recognized “Critical Path Method” software program, and continuously maintained for the benefit and use of all Contractors and the Owner/Architect. The General Contractor shall submit to all parties, at each monthly meeting, printed reports, generated from the computer program file, indicating the current status of all project activities, including those of the other Contractors.

CONTRACTS

Contracts will be executed for each Prime Contractor on AIA Document A101, Standard Form of Agreement Between Owner and Contractor, as amended herein.

PAYMENTS

Payments to the Contractor will be made on the basis of ninety-five percent (95%) of monthly estimates approved by the Architect.

Bids shall include North Carolina sales and Use Tax or local sales and use tax. The Owner shall be entitled to reimbursement of taxes paid by Contractor on basis shown separately on monthly request for payment. At the time of delivery of the periodic monthly estimate and request for progress payments, the Contractor shall attach to such requests a statement which shall show the amount of sales tax paid by the Contractor upon purchases of building materials during the period covered by the progress payment request. A sworn statement by the Contractor shall be attached stating that the property upon which such sales taxes where paid was or will be used in the performance of the contract. Sales tax on purchases or rental of tools and equipment is taxable to the Contractor and shall not be included in the sworn statement. When applicable, file a Form E-589CI, Affidavit Of Capital Improvement. Refer to Section 01011, Supplementary Conditions, subparagraph 9.3.4 for additional requirements.

CONSTRUCTION PROCEDURES

The following Construction Procedures are to be implemented for this project:

1. The General Contractor shall be the Project Coordinator, and as such shall schedule and manage the entire work. Notify the Architect immediately upon any conflict with separate Prime Contractors.

2. The General Contractor shall coordinate with all Prime Contractors to prepare and submit to the Architect within two weeks following the date of the Notice to Proceed his proposed Progress Schedule for completing the Project in the specified time. Include critical shop drawing reviews, inspections, or other work to be scheduled with Architect or Engineer.

3. Approved Schedule shall be distributed to all other Prime Contractors by the General Contractor. Also, post copy in Contractor's field office. General Contractor shall keep other contractors, including his subcontractors, informed of his planned and actual progress, so that the Project Schedule can be maintained.

4. All other prime and sub-contractors shall organize their work to conform to this Schedule and see that all phases of the work progress as smoothly and efficiently as possible.

5. The General Contractor will coordinate the location of tool sheds and storage areas for all contractors within the limits of the site area designated or approved by the Owner.

6. All Contractors shall submit within twenty (20) days from the date of the Notice to Proceed a complete list of all subcontractors and material suppliers (including addresses), that they propose to use on this Project for Architect's and Engineer's approval.

7. All Contractors are requested to furnish the Architect with the name of their project manager, safety manager, and job foreman or superintendent who will be in charge of the work. These men will not be changed during the course of construction without prior notice to the Architect. Furnish Architect and Owner with name and home telephone number of job superintendent and project manager for emergency contact.

8. Architect will hold monthly meetings at the project site on a day and time to be determined. Each Contractor shall have his job superintendent and project manager present. The purpose of these meetings is to evaluate progress, resolve problems, and in general to help expedite construction. Meeting representatives must have authority to act on behalf of the Contractor.

9. See Specifications, Division 1, General Requirements, for information relative to the following:

    a. Schedules and Reports

    b. Samples and Shop Drawings

    c. LEED Requirements (THIS IS NOT A LEED PROJECT)

    d. Temporary Facilities and Controls

    e. Cleaning Up

    f. Project Close Out

10. To expedite handling paperwork, the following procedures shall be used:

    a. Shop drawings and submittals shall be submitted electronically via e-mail, in non-editable format PDFs. Electronic submittals e-mail subject line will contain the project name, specification number, and product name.

    b. Each Contractor shall submit to the Architect a cost breakdown of his contract on standard AIA form, AIA G703 or equivalent replica. Breakdown shall show separate lines for labor and material. Upon approval by Architect and Engineer, this breakdown shall be used for progress payments.

    c. Contractor's payment period shall be from the twenty-fifth day of the month to the twenty-fifth day of the following month. Contractor shall forward to the Architect by the first of the following month his Application and Certificate for Payment in PDF format, standard AIA G702 or equivalent replica, submitted electronically, with ink professional seals. Owner will make payments by the fifteenth of the month. Professional seals shall be ink stamped, not embossed.

d. Sales tax expenditures for each pay period shall be substantiated with an attached certified statement by the Contractor and each of his Subcontractors individually showing total purchases of material from each separate vendor and total sales taxes paid each vendor for the applicable period.

e. Payment for material stored on site will be approved upon verification of material and quantity. Payment will also be approved if material is stored in a bonded warehouse approved by the Architect and Owner and insured for its full value. Include insurance certificates and certificates verifying storage in bonded warehouse with Application for Payment of such materials.

f. Submit copy of Building Permit prior to or with submission of first Pay Application. Payments will be withheld until permit copy is submitted.

11. All materials and submittal data must be approved before Contractor proceeds with installing such items in the Project. All materials requiring color selection shall be submitted together. Contractor shall confirm in writing that color samples provided are current and available to select from. An incomplete color schedule will not be issued. All material samples must be submitted in order to make a complete, coordinated schedule.

12. Materials and compaction testing company shall be selected by the Owner. The Architect will notify the Contractor of the company and of the specific testing to be done. Based on these instructions, the Contractor will be responsible for notifying the testing company of individual tests to be made.

13. Notify Architect, Structural Engineer, and Testing Laboratory twenty-four (24) hours prior to pouring footings. Pours shall always be the maximum that can be properly handled in a day.

14. Inspection Reports from Architect or Engineers pointing up defective or unacceptable work shall be corrected immediately. Failure to do so will be cause to withhold monthly progress payments.

15. Each Separate Prime Contractor shall be responsible for removing his own waste material and job debris from the all construction areas and the site, fully coordinated with requirements of the Construction Waste Management Plan (CWMP). This shall be done continually. Failure to keep job site clean and safe for maximum working efficiency will be cause to withhold monthly progress payments. Failure to comply with the Construction Waste Management Plan (CWMP) will be cause to withhold monthly progress payments.

16. Construction workers will be properly dressed at all times on the site (shirts, shoes, etc.), and the use of foul language, vulgar or lewd gestures, or any other conduct deemed inappropriate by the Owner will be cause for immediate dismissal.

17. Working Schedule: Working hours shall be coordinated among all Prime Contractors. Advise Owner and Architect.

18. Claims: Follow General Conditions, as amended, for any claims for additional money or time. Claim must be made at time of discovery, time limits in accordance with these Conditions.

19. Final Inspection of Projects: It is the Contractor's responsibility to notify the Architect that the project is complete and to submit a list of discrepancies to be corrected. Following such notification, the Architect shall make a preliminary review of the project to verify completion. From the preliminary review, the Architect shall prepare a punch list of discrepancies for the Contractor. Upon notification by the Contractor that the discrepancies have been rectified, the Architect shall schedule a formal final inspection with the Owner.

20. Record Drawings: One (1) complete set of working drawings will be maintained on the job site by the General Contractor. If any changes or deviations from these drawings are made by any Contractor, such Contractor shall indicate the change on the drawings using colored pencils or ink.

21. Safety Regulations: All Contractors shall abide by current OSHA Regulations at all times. Be advised that the Owner is obligated by these Regulations to report any known violations to OSHA.

22. Smoking is prohibited and not allowed on the construction site property.

DRAWINGS AND SPECIFICATIONS

The following principles shall govern the settlement of disputes which may arise over discrepancies in the contract documents.

1. As between written figures given on drawings and the scale measurements, the figures shall govern.

2. As between large-scale drawings, and small scale drawings, the larger scale drawings shall govern. Discrepancies noted shall be reported to the Architect before commencing work.

3. Where more than one item or procedure is specified or indicated, the Contractor shall provide the item of greatest expense or most stringent procedure.

Titles to divisions and paragraphs in the contract documents are introduced merely for convenience and shall not be taken as a correct or complete segregation of the several units of materials and labor. The Contractor shall see that each subcontractor is familiar with the entire work under this contract to the extent that it affects his portion of the work, as no responsibility is assumed by the Architect for omissions or duplications by the Contractor or his subcontractors due to real or alleged error in arrangement of material in these documents.

The plans and specifications are both a part of this contract and shall be considered cooperative. Any work called for by the plans and not hereinafter specified or vice versa, shall be executed by the Contractor as if specifically mentioned in both.

The drawings and specifications are to be used for this building only and are the property of the Architect; they are to be returned to him before the final certificates are given.

After award of Contract, drawings and specifications shall be obtained and /or downloaded by the General Contractor from the Hite Associates website, www.hiteassoc.com. Additional drawings and / or specifications may be purchased by contacting Speedyblue Reprographics at (252) 758-1616, print@speedyblue.com.

INTENT OF DRAWINGS

In making a Proposal, the Contractor acknowledges that the drawings are diagrammatic in nature, and agrees to provide complete and finished construction assemblies to comply with the Architect's intent and pertinent Building Codes, whether all parts or components of such assemblies are shown or not (for example, doors or frames shown on plan drawings but not scheduled or detailed otherwise shall be furnished, consistent with other doors or frames of type and material as would be reasonably inferable, complete with hardware).

For renovations and additions, the plans and specifications are intended to convey the broad scope of work that is to be included in the demolition scope and/or renovations scope of existing areas in the

contract, they do not show every item or detail to be installed or removed. Provide complete and finished construction assemblies.

Bidders and their subcontractors must visit the site prior to bid to verify all existing conditions in areas to be renovated, including equipment platforms, to ascertain items to be removed or relocated to perform the work as shown and specified, and to provide complete assemblies. No allowance will be made for claims for additional cost or time based on conditions that are accessible for inspection.

STANDARD OF QUALITY, CONTRACT DEFINITION

The Standard of quality for all work shall be first class is all respects, in the opinion of the Project Architect and Project Engineer. In submitting a Bid, the Contractor agrees to abide by this Standard, and no other. Any work considered less than first class by the Architect/Engineer shall be corrected or removed and replaced as directed.

PROJECT MANAGER AND SUPERINTENDENTS, APPROVAL OF PERSONNEL

The Contractor shall provide resumes of proposed Project Manager and Superintendents to Owner, through Architect, for review and approval prior to assignment. Contractor shall submit only those candidates with a minimum of five years experience in the respective capacities proposed, with projects of similar size and scope.

FIELD SUPERVISION REQUIREMENTS

The Contractor is required to provide a full time Field Superintendent to supervise the work of their Contract and to be present, in the field, and not in a field office, at all times work is being performed by that Contractor or his Subcontractors, for the express purpose of providing continuous control of the quality and correctness of construction. In addition, the Contractor's Field Superintendent is required to provide general supervision and coordination of the work of all other Prime Contractors. This person is required to be equipped with a mobile telephone at all times. The Contractor shall issue daily electronic update reports, in PDF format, via e-mail, with descriptions of day's work performed, 3 photos minimum, weather conditions, parties on site with manpower counts, and equipment on site.

FIRE RATED CONSTRUCTION ASSEMBLIES

Where U.L., F.M., W.H.I., or other independent testing agency fire rated construction assemblies are referenced on the drawings, it shall be the Contractor's responsibility to meet the specific requirements of the assembly, as defined by State and Local Building Authorities.

MEASUREMENTS AND DIMENSIONS

Before ordering material or doing work which is dependent for proper size or installation upon coordination with building conditions, the Contractor shall verify all dimensions by taking measurements at the building and shall be responsible for the correctness of same. No consideration will be given to any claim based on differences between the actual dimensions and those indicated on the drawings. Any discrepancies between the drawings and/or the specifications and the existing conditions shall be referred to the Architect for adjustment before any work affected thereby is begun.

SAMPLES AND SHOP DRAWINGS

Each Contractor shall submit such samples of materials and examples of workmanship as are requested by the Architect to show quality and kind of material and work he proposes to deliver or perform in executing his contract.

Shop drawings and submittals shall be submitted electronically, in non-editable format PDFs, submitted via e-mail. Electronic submittals e-mail subject line will contain the project name, specification number, and product name.

Coordinate LEED submittals with general submittal requirements. Refer to Section 01405 LEED Requirements.

Contractors shall make all submittals promptly after award of contract. Submittals requiring color selection shall be made no later than 60 days after award of contract. Contractor and manufacturer shall confirm in writing that color samples provided are up-to-date, current and can be provided.

All material requiring color selection shall be submitted for review before any colors are selected. The Contractor shall allow 45 days after all submittals are made and all color samples received for the Owner to make selections, and schedule his submittals accordingly.

OWNER SYSTEM TRAINING SESSIONS

Each Contractor shall have factory trained and certified product representatives provide equipment and system training sessions for the Owner for each product and system. Sufficient training shall be provided to the extent that each Owner attendee is fully versed on the product and/or system and can be a designated “trained” participant, and that each participant can demonstrate the ability to operate each product and system in total variety of operations. Provide multiple training sessions if such is required to be certified as fully trained personnel. An Owner Training Certification is to be provided. Submit an affidavit that each required Owner training session has been performed. Submitted affidavit to include sign-up log of attendees/trainees and description of system or product, cross referenced to the specific contract document.

TEMPORARY FACILITIES

This section covers the furnishing of all appliances, labor, materials, tools, transportation and services required to perform and complete all preliminary work and temporary construction required for the building and site as indicated.

Storage - Each Contractor shall provide such temporary structures as are required for the protection of persons and property. On barricades where necessary, lights shall be maintained at night.

Field Office - General Contractor shall provide and maintain a full time field office construction trailer at the site, equipped with heat, lights, plan desks and telephones. Office shall be sufficient size for use by this Contractor and for on-site meetings with a separate office provided specifically for the Architect's Representatives.

Scaffolds, Tolls, etc. - Each Contractor shall erect and provide all necessary platforms and scaffolds of ample strength required for the handling of materials and equipment such as ladders, horses, poles, planks, ropes, wedges, centers, etc.

Staging: The location of trailers and material storage areas shall be approved by the Architect. Each Prime Contractor will be responsible for repair and testing of the paving base if damaged by his staging activities.

Working Hours: Single or separate prime contractors may set their own working hours, provided, however, that the Project is under supervision by the General Contractor at all times work is being performed.

Sanitation: The General Contractor shall provide and maintain temporary toilets as necessary for use of all workmen. Locate toilets where directed, keep in sanitary condition, and comply with the requirements of the local public health authority.

OSHA

It shall be the responsibility of all contractors to conform to the latest edition of Safety Standards for construction by "OSHA".

CUTTING AND PATCHING / REPLACE

All cutting and patching throughout Project shall be done by the trade requiring the cut. Patching of work or areas affected by cutting, digging and fitting shall be done by mechanics skilled in the applicable trades and shall match surrounding or adjoining similar work. If the quality of the cutting and patching work is not first class and, in the opinion of the Architect, not acceptable, the Contractor will be required to have this work done by the General Contractor, who will be reimbursed for the cost thereof.

Where documents indicate the terms “replace or replacing” of any item or system, the items or system called out to be replaced shall be removed in their entirety complete, by the trade performing the replacement.

CLEANING UP

Each Prime Contractor shall be responsible for keeping the project clean and free of hazardous working conditions. Remove scrap or surplus materials and keep stored materials in a neat and orderly fashion, minimum once weekly.

The General Contractor shall advise all subcontractors and separate prime contractors of their responsibility to keep their part of the project clear and free of accumulated debris.

After completion of Utility Platforms and Main Boiler and Electrical Room construction by all contractors, the General Contractor shall provide a complete vacuuming and wipe down of all mechanical and electrical equipment, including ductwork. The General Contractor shall then provide two coats of clear polyurethane floor sealer as specified to these spaces, after approval of the condition of each space by the Architect.

At the completion of work, the entire project shall be left clean and ready for occupancy. All finished surfaces shall be cleaned, polished, waxed and left in first class condition.

CONSTRUCTION WASTE MANAGEMENT: WASTE AND RECYCYLING

The General Contractor shall be responsible for developing and implementing a Construction Waste Management Plan (CWMP) that identifies the materials to be diverted from disposal and their quantities by weight in order to divert a minimum of 75% of all construction and demolition debris. The GC shall submit monthly progress reports indicating quantities disposed and quantities diverted along with each Payment Application. The GC shall also be responsible for providing separate recycling collection containers for disposal and recycling of non hazardous construction and demolition waste. All containers must be clearly labeled with a list of acceptable and unacceptable materials that meet the requirements of the recovery facility or recycling processor, to which the materials shall be hauled. The General Contractor shall provide on site instruction of appropriate separation, handling, and recycling, and return methods to be used by all contractors. These containers shall be maintained on a regular schedule by either the GC or a GC contracted service. If the contracted service provides off-site sorting services, then waste may be commingled on site per the contracted services specifications. If commingling on site is not permitted, then containers are to be provided for the following materials:

1. Concrete waste
2. Brick and CMU (shall be recycled)
3. Wood and Wood Products
4. Cardboard (shall be recycled)
5. Steel and Metals (shall be recycled)

PROJECT CLOSEOUT

Prior to issuance of a Certificate of Final Payment, unless otherwise noted, each Prime Contractor will be required to deliver to the Architect the following items, in encrypted electronic PDF format, indexed with a hyperlinked Table of Contents. All professional seals shall be stamps, not embossed. Files to be submitted on an electronic storage device. All warranties requiring signatures for execution, shall be submitted in paper format.

1. Certificate Of Occupancy issued by the jurisdiction having authority.

2. Fully executed final Change Order, reconciling all project allowances.

3. Submit Final Application for Payment, AIA Documents and Final Sales Tax Report collated and bundled together.

4. AIA Document G 706/Contractors Affidavit of Payment of Debts and Claims, and AIA Document G 706 A/Contractors Affidavit of Release of Liens, properly executed, notarized, with no exceptions.

5. Consent of Surety to Final Payment.

6. Certificate of Compliance. Each Prime Contractor shall furnish the Architect a certificate, duly notarized, stating that he has constructed his part of the work of the project in complete compliance with the Drawings and Specifications.

7. Each Prime Contractor shall furnish to the Owner through the Architect a certificate, duly notarized, stating that "no hazardous materials, including lead, asbestos, or PCBs, have been used in the work of the Contract".

8. Each Prime Contractor shall furnish to the Owner through the Architect, duly notarized, an unconditional Warranty to guarantee his work free from defects in materials and workmanship for a period of one year following Substantial Completion.

9. Operations and Maintenance Manuals indexed, shall be submitted in electronic format with items and sections hyperlinked to the O&M's Table of Contents. Provide paper copies of product warranties.

10. As-Built drawings. Each prime contractor shall deliver to Architect one complete set of as-built drawings. Changes in the work shall be marked in red on a new set of drawings.

11. Transmittal of keys to Principal, acknowledgement signed by Principal, and Finish Hardware Bitting List.

12. Final Color Finishes Schedule.

13. Owner Training Certification: Submit affidavit that each required Owner training session has been performed. Submitted affidavit to include sign-up log of attendees and description of system or product cross referenced to the specific contract document.

14. Process and deliver to the Architect all product guarantees and warranties, materials and testing certificates, etc., as required by various sections within these specifications and by various agencies having jurisdiction over the Work, indexed.

Do not make separate submittals of the above. Incomplete submittals will be returned to the Contractor.

END OF SECTION

GO TO NEXT PAGE

CONTRACTOR'S SALES TAX REPORT OF NC STATE AND LOCAL TAXES PAID DATE: _____

CONTRACTOR: _____ OWNER: _____
ADDRESS: _____ PROJECT: _____
_____ PERIOD FROM: _____
TO:

* County is the county of delivery or county in which the contractor directly picked up the merchandise. 4.75%

VENDOR	ADDRESS	SUMMARY OF ITEMS PURCHASED	INVOICE NUMBER	INVOICE DATE	INVOICE AMOUNT	NC TAXES	COUNTY TAXES	TOTAL TAXES	*NAME OF COUNTY
TOTAL					-	-	-		

NOTE: ATTACH COPIES OF INVOICES AS DESCRIBED ABOVE

I,_____, certify that the foregoing statement of applicable sales taxes paid in connection with the referenced contract is true to the best of my knowledge and belief.

By: _____ Title: _____

I, _____, Notary Public for _____ County, State of _____, do hereby certify that _____ personally appeared before me this day and acknowledged the due execution of the foregoing instrument.

Witness my hand and official seal, this the _____ day of _____, 20___.

_____
Notary Public (Official Seal)

Printed Name _____
My commission expires _____, 20___

1. **CONFLICT OF GRADE**: It is intended that the water mains be installed with a minimum of 36"inch cover, but the contractor is notified that he will be required to install the water mains with more than 36-inch cover as required in order to avoid conflicts.

2. **THRUST RESTRAINT**: Concrete blocking shall be installed as required at all tees, bends, etc., for all pipes unless otherwise directed. No separate payment shall be made for thrust restraint.

3. **CONNECTION TO AHJ (Authority Having Jurisdiction) OWNED FACILITIES**: No connection to or alteration (including operation of valves, hydrants, etc.) of the AHJ (Authority Having Jurisdiction) facilities shall be performed without the AHJ specific approval. All pipe, valves, taps, fittings, etc. which could possibly contaminate the AHJ's facilities shall be thoroughly disinfected prior to their use. Excavations for such connections shall be kept completely dewatered and the utmost care exercised to avoid contamination of AHJ owned facilities.

4. **SALVAGE OF AHJ OWNED FACILITIES**: When project work results in removal of AHJ owned facilities and equipment, the Contractor shall be required to deliver those facilities or equipment undamaged to the AHJ's Operation Center, if requested to do so by AHJ.

5. **NOTIFYING UTILITIES COMPANIES**:

5.1 In accordance with the Underground Damage Prevention Act, the Contractor shall, within a time frame of not less than 2 or no more than 10 working days prior to the start of any excavation within any public right of way or private easement areas owned by a utility company, notify each utility owner having underground utilities in the area to be excavated of the following information:

1. Name, address, and telephone number of the person serving the notice.
2. Name, address, and telephone number of the company that will be performing the excavation.
3. Anticipated starting date of the excavation and duration.
4. Type of excavation to be conducted.
5. Location of excavation.
6. Whether or not explosives will be used.

7. Contractor shall notify NC One Call, Greensboro, N.C. at least 48 hours prior to commencing construction in order that existing utilities in the area may be flagged or staked. The toll-free number is 1-800-632-4949. This service will in no way relieve Contractor of his responsibility to protect and maintain all existing utilities in an operational manner. Utilities location by NC One Call is not valid after the expiration of a 10-day period beginning on the date of such location.

5.2 **Responsibilities during Construction**: In addition to serving notice of intent to perform excavation, the Contractor shall:

1. Plan the excavation to avoid damage and to minimize interference with underground utilities in and near the construction area to the best of his abilities;

2.Maintain a clearance between an underground utility and the cutting edge or point of any mechanized equipment, taking into account the known limit of control of that cutting edge or point, as is reasonably required to avoid damage; and

3. Provide support for the underground utilities in or near the construction area, including backfill, as may be reasonably required by the utility owner for the protection of the underground utilities.

4. When excavation by the Contractor results in known damage to an underground utility, the Owner of the utility shall be notified immediately and the utility given a reasonable time in which to repair the damage before the Contractor proceeds with excavation in the immediate area of the damage.

5.3 **Responsibility of Utility**: Once notified, each utility must, prior to the day designated by the

Contractor as the anticipated start date, provide the Contractor with the following information:

1. The location of the utility;
2. The location and description of all utility markers;
3. Any other information that would assist in locating the utility, including temporary markers when necessary.

5.4 **Failure to Respond**: If the utility fails to respond to the Contractor's notice or fails to properly locate its underground utilities, the Contractor is free to proceed with excavation. Neither the Contractor nor Owner is liable for damage to utilities if the Contractor exercises due care.

6. **CONSTRUCTION STAKE-OUT**:
The construction staking shall be performed by a Registered Land Surveyor at least twenty-four (24) hours and three hundred feet (300') in advance of construction and shall identify the party responsible for payment for same.

The staking will include waterline, valves and fire hydrant stakeout; sanitary sewer stakeout; water and sewer services; rough grade staking; curb and gutter staking; storm drainage structure staking.

7. **TRAFFIC CONTROL**: The Contractor shall be responsible for maintaining an approved traffic control plan during the course of this work. The traffic control plan implemented for this project shall be devised through a joint effort of the NCDOT and the Contractor immediately prior to construction. In all instances, however, the Contractor shall be required to furnish, place, and maintain all signs, barricades, cones, and other traffic handling devices necessary to implement the traffic control plan.

8. **PROJECT SCHEDULE**: The Contractor shall be required to furnish an anticipated schedule of work at the time of the pre-construction conference. In addition, the Contractor shall be required to furnish bi- weekly updates of the schedule of work.

9. **FINAL CLEAN-UP**: The Contractor shall clear all streets, curbs, gutters, driveways and other contract items of all dirt and debris before final inspection will be made. The Owner will not inspect the improved area until they are cleaned.

10. **USE OF A PORTION OF THE WORK**: Whenever, in the opinion of the Engineer, any portion of the work is completed, or is in an acceptable condition for use, it shall be used for the purpose intended. Such use shall not be held in any way as an acceptance of that portion of the work used, or as a waiver of any of the provisions of these specifications. Necessary repairs or renewals in any section of the work due to defective materials, defective workmanship, or natural causes, under the instructions of the Engineer shall be performed by the Contractor at no additional cost to the Owner.

11. **SPECIAL AREAS**: Special access to construction other than existing easements or rights-of-ways shall be the responsibility of the Contractor and he shall be liable for all special agreements.

12. **MOBILIZATION**: Shall be accomplished in accordance with Section 800 of the N.C. State Highway Specifications for Roads and Structures except that there will be no compensation for mobilization as a line item.

13. **TEMPORARY TOILETS**: Provide temporary toilet facilities for use of all workmen. Insure temporary toilet facilities comply with local and State sanitation laws and regulations. Use of existing facilities by Contractor is not permitted.

14. **DRAWINGS SHOWING CHANGES DURING CONSTRUCTION**: The Contractor shall maintain a set of plans and specifications marked "Construction Record Drawings". The Contractor shall keep a complete and up-to-date record in red pencil of any and all changes made during

construction. This set of Contract Documents shall be submitted to the Engineer and approved by him prior to the Engineer recommending final payment.

15. **PRECONSTRUCTION CONFERENCE**: Conference shall be held in the AHJ at a designated place, after acceptance of proposals. Engineer will notify Contractor of time and date of meeting.

Prior to commencing any water or sewer extension construction work, the Department Engineer shall be contacted to schedule a preconstruction conference. No construction shall occur until after the preconstruction conference is held.

16. **WORK IN NORTH CAROLINA RIGHT-OF-WAY**: A bond shall be posted with the State of North Carolina for ten percent (10%) of the cost of construction within the right-of-way. This bond shall be posted prior to commencement of work.

17. **NORMAL WORK HOURS**: Unless special written consent is issued by the AHJ, all construction shall be performed during the regular office hours of the AHJ, i.e. 8:00 a.m. to 5:00 p.m. After hours, holiday, or weekend work should include only such tasks that do not require observation by the AHJ's Representative. Under certain conditions, the AHJ may agree to provide construction observation after hours or on weekends and holidays. The Contractor shall bear the costs of provision of such construction observation.

18. **OPERATION OF EXISTING FACILITIES**:

1. The Contractor performing water or sewer extension work shall contact the Department Engineer whenever operation of the AHJ's valves or hydrants is necessary to request scheduling of such operation. The AHJ shall require the Contractor to estimate the length of time service will be interrupted and the number of customers to be affected.

2. Facilities and equipment belonging to the AHJ may not be operated or adjusted without the express permission of the AHJ's Representative. In the case of any emergency, the Contractor shall be allowed to take such steps with valves and hydrants as necessary for the protection of life and property.

3. Valves which control networks not yet accepted but which are connected to the existing system shall be considered system valves. Valves within a network not yet accepted and which do not control the flow of water between new and existing systems are not considered system valves and do not require permission to operate.

4. Notification to the AHJ must be made by the Contractor upon breakage of any AHJ maintained water or sewer line or appurtenance thereof. Repair of the AHJ's facilities shall be made by the Contractor upon approval of the Department Engineer. Any repairs made with AHJ forces will be billed to the contractor at cost.

5. Where interruption of service is required, the AHJ shall be notified to request approval and subsequent scheduling of such interruption. The AHJ shall notify the affected customers should the interruption be approved.

19. **Project Close-out**:

A.. Pre-final Inspection: upon the completion of construction, the Contractor or Developer shall contact the AHJ to schedule a pre-final inspection. A pre-final inspection will not be scheduled until the following requirements are met:

a. The work shall be in accordance with the requirements of the AHJ.
b. A copy of the final estimate has been submitted and approved by the AHJ.
c. The easements and dedicated property required for the work by this Manual have been obtained and are recorded at the Register of Deeds.

d. The As- built drawings for the work have received the approval of the Department Engineer.
e. All fees applicable to the project have been received by the AHJ.
f. When a project includes sewer system extension(s), the AHJ has received certification by a Professional Engineer stating that the sewer system installation conforms with the requirements of the approved Contract Documents as required by Section .0219 of the DEHNR regulations (G.S. 143-215.1).
g. When a project includes water system extension(s), the AHJ has received certification by a Professional Engineer stating that the water system installation conforms with the requirements of the approved Contract Documents as required by Section .0903 of the NCDHS regulations (G.S. 130A-315; 130A-317).

At the scheduled pre-final inspection, the Department Engineer shall perform a visual inspection in the presence of the representatives of the Contractor and the Engineer. The Engineer or his representative shall prepare a detailed punch list of any deficiencies discovered and provide copies to the Developer, Contractor, and the AHJ. Any defective items noted shall be corrected prior to acceptance.

B. Final Inspection: upon completion of the items on the punch list, the Contractor or Developer shall contact the AHJ to schedule the final inspection. Any remaining defective items shall be noted and corrected prior to acceptance. No service shall be provided prior to project acceptance.

*****END OF SECTION*****

GENERAL

The Base Bid constitutes the primary choice of the Owner with respect to the pertinent specifications for construction, materials, equipment and supplies. The Owner reserves the right to accept or reject any or all Alternates, in any combination with the Base Bid, in accordance with the general provisions of the Contract for Construction.

See Form of Proposal for complete description of Alternates.

END OF SECTION

GENERAL

CASH ALLOWANCES:

The Contractor shall include a CASH ALLOWANCE in his bid of $350,000 to include labor, tax, and freight. The Owner reserves the right to bid the work or select subcontractors, and to credit the balance of the allowance at the completion of the Contract.

The work and items covered in the CASH ALLOWANCE are indicated in the plans and specifications, and include:

- Testing and Special Inspections
- EMS BDA Radio testing and equipment as required
- Project sign and permanent signage interior and exterior
- Video TV/monitors or projectors
- Special gym floor graphics (jump circle)
- Building Equipment approved by the Owner
- Other items or work directed by the Owner

Equipment or items which are specified and not noted to be a part of an ALLOWANCE are to be priced and included in bid separately.

(Listed products shall include installation, unless otherwise noted)

*(** Does not include labor or installation, to be provided by GC, unless otherwise noted)*

General Contract:

Testing and Special Inspections 01062:	$50,000
**Project Sign 01065:	$2,000
** Interior and Exterior Signage 10440:	$15,000
Video TV/monitors and brackets or projectors 11780:	$13,000
Gym Floor graphics (jump circle):	$5,000
EMS BDA Radio Repeaters:	$40,000
Utility Companies Tap Fees:	$25,000
General Allowance (For Owner directed work):	$200,000
TOTAL	**$350,000**

BUILDING PERMITS and all other permit costs shall be determined by Bidders and provided for in Bids.

MATERIAL ALLOWANCES:

1. Mass undercut for roads, drives, parking areas: General Contractor shall provide in his bid 800 cubic yards of mass undercut, disposal off site, and off-site select backfill, compacted in place, as directed by the Engineer. Specified stripping of site as indicated in geotechnical report and fill as indicated by finished construction grades is NOT a part of this allowance.

2. Structural geogrid subgrade stabilization for parking and drive areas: General Contractor shall provide in his bid 500 square yards of geogrid, installed as directed by the Engineer.

NOTE: THESE MATERIAL ALLOWANCES WILL BE MEASURED AND MONITORED BY THE OWNER'S TESTING AGENCY. AMOUNTS NOT USED WILL BE CREDITED BACK TO THE OWNER AT THE UNIT PRICE INDICATED ON FORM OF PROPOSAL. AMOUNTS USED IN EXCESS OF THESE ALLOWANCES WILL BE CHARGED TO THE OWNER AT THE SAME UNIT PRICES.

END OF SECTION

The recommendations of the Geotechnical Subsurface Report shall be and are the requirements of the Work, AS MODIFIED HEREIN.

All bidders are advised to carefully review the soil conditions of the project site and the site itself, and shall take into account in their bid, conditions that will require weatherproofing of the building pad or areas outside the building pad, with stone or other materials to allow construction to continue in wet weather, and to provide off site select backfill for trenches where natural soils may not reach specified compaction.

Alice F. Keene District Park – New Gymnasium

Geotechnical Engineering Report

December 27, 2022 | Terracon Project No. 72225128

Prepared for:

Hite Associates, P.C.
2600 Meridian Drive
Greenville, NC 27834-5563

Terracon
Explore with us

Nationwide
Terracon.com

- Facilities
- Environmental
- Geotechnical
- Materials

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Winterville, NC 28590
P (252) 353-1600
North Carolina Registered F-0869
Terracon.com

December 27, 2022

Hite Associates, P.C.
2600 Meridian Drive
Greenville, NC 27834-5563

Attn: James (Jimmy) G. Hite, AIA
P: (252) 757-0333
E: jgh@hiteassoc.com

Re: Geotechnical Engineering Report
Alice F. Keene District Park – New Gymnasium
4561 County Home Road
Greenville, NC
Terracon Project No. 72225128

Dear Mr. Hite:

We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Proposal No. P72225128 dated November 4, 2022. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon

Mike Delaney, E.I.
Staff Professional

Andrew J. Gliniak. P.E.
Project Engineer
Registered, NC 042183

Table of Contents

Figures

Attachments

Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Report Summary

Topic [1]	Overview Statement [2]
Project Description	Proposed additions to the Alice F. Keene District Park facilities include a gymnasium, approximately 25,000 square feet, with associated paved parking and drives.
Geotechnical Characterization	The exploration encountered very loose to medium dense clayey sand and very soft to stiff lean clay. A layer of dense sand was encountered between depths of 20 and 35 feet beneath the existing ground surface (bgs). Existing fill soils were encountered at location B-1 extending to approximately 3 feet bgs. Groundwater is anticipated at a depth of 5 feet bgs.
Geotechnical Overview	Inherent risks associated with construction upon or above existing fill soils, such as those encountered at location B-1, are discussed in this report.
Earthwork	The near-surface clayey sands and lean clays could become unstable with typical earthwork and construction traffic. Earthwork operations should be performed during the warmer and drier times of the year to avoid potential issues associated with a wet subgrade. Low pressure/tracked equipment should be anticipated for site preparation.
Shallow Foundations	Shallow foundations are recommended for building support Allowable bearing pressure = 1,000 psf Expected settlements: < 1-inch total, < 0.5-inches differential
Pavements	With subgrade prepared as noted in **Earthwork**. Concrete: ■ 5 inches Portland Cement Concrete (PCC) over 4 inches granular base (GB) in Light and Medium Duty areas ■ 7 inches PCC over 4 inches GB in Heavy Duty areas Asphalt: ■ 3 inches Asphaltic Concrete (AC) over 6 inches GB in Light Duty areas ■ 4 inches AC over 8 inches GB in Medium Duty areas
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed gymnasium to be located next to the Pitt County Schools and Recreation Building in Alice F. Keene District Park at 4561 County Home Road in Greenville, NC. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Seismic site classification per IBC
- Site preparation and earthwork
- Demolition considerations
- Dewatering considerations
- Foundation design and construction
- Floor slab design and construction
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of nine (9) CPT soundings, laboratory testing, engineering analysis, and the preparation of this report.

Drawings showing the site and exploration locations are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the exploration logs and as separate graphs in the **Exploration Results** section.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Email communication with site plans and prescribed test locations provided on October 24, 2022.

Item	Description
Project Description	Proposed additions to the Alice F. Keene District Park facilities include a gymnasium, approximately 25,000 square feet, with associated paved parking and drives. The new gymnasium will be connected by a causeway to the existing building.
Building Construction	Assumed to be metal framed supported on conventional shallow foundations with slab-on-grade construction.
Finished Floor Elevation	Finished floor elevation for the gymnasium is anticipated to be 69.67 feet based on the plans provided.
Maximum Loads	Anticipated structural loads were not provided. In the absence of information provided by the design team, we will use the following loads in estimating settlement based on our experience with similar projects. ▪ Columns: 150 kips ▪ Walls: up to 6 kips per linear foot (klf) ▪ Slabs: 100 pounds per square foot (psf)
Grading/Slopes	Less than 2 feet of cut and fill is anticipated to develop final grade, excluding remedial grading requirements.
Pavements	Paved driveway and parking will be constructed on approximately 0.8 acres of the property. We assumed that both rigid (concrete) and flexible (asphalt) pavement surfaces should be considered. A proposed pavement section of 3 inches S9.5A asphalt over 6 inches ABC stone was noted on the provided plans. Anticipated traffic loading conditions are as follows: ▪ Auto/light trucks: 100 vehicles per day ▪ Light delivery and trash collection vehicles: 2 vehicles per week ▪ Tractor-trailer trucks: Less than 1 vehicle per week The pavement design period is 20 years.
Building Code	2018 North Carolina State Building Code (based on 2015 International Building Code)

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 4561 County Home Road in Greenville, NC. The parcel spans roughly 99 Acres. Latitude: 35.5486°N, Longitude: 77.3490°W (approximate) Pitt County Parcel Identification Number (PIN): 4695181394 See **Site Location**
Existing Improvements	Existing buildings and recreational facilities, asphalt paved walking paths, landscaping.
Current Ground Cover	Grass, asphalt
Existing Topography	Relatively level in elevation ranging from 68 feet to 69 feet MSL based on publicly available topography maps published by the USGS and Google Earth Pro™.

We also collected photographs at the time of our field exploration program. Representative photos are provided in our **Photography Log**.

Geotechnical Characterization

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** and the GeoModel can be found in the **Figures** attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each test location, refer to the GeoModel. CPT model layers include topsoil.

Model Layer	Layer Name	General Description
1	Existing Fill	Sand with varying amounts of clay and debris consisting of rock fragments
2	Sand	Sand with varying amounts of silt and clay, very loose to medium dense
3	Clay and Sand	Very soft to stiff clay with interbedded layers of very loose to loose sand

CPT model layers include topsoil. The existing fill soils encountered in the upper 3 feet at location B-1 were likely placed during grading operations for the original construction of Alice F. Keene District Park. Based on CPT tip resistances in excess of 100 tsf at these depths, the fill appears to have been placed in a controlled manner; however, we have no records indicating the degree of control. Construction upon or above existing fill is discussed in **Existing Fill**.

Groundwater Conditions

Based on measured water levels 5 feet to 6 feet below existing grades at the test locations, CPT data, and the moisture condition of the soil samples, groundwater is anticipated a depth of approximately 5 feet beneath existing site grades. Groundwater conditions may be different at the time of construction. Groundwater conditions may change because of seasonal variations in rainfall, runoff, and other conditions not apparent at the time of drilling. Long-term groundwater monitoring was outside the scope of services for this project.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties observed at the site and as described on the exploration logs and results, our professional opinion is for that a **Seismic Site Classification of E** be considered for the project. Subsurface explorations at this site were extended to a maximum depth of 50 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth. Geophysical testing results will likely result in a seismic site classification of D.

Geotechnical Overview

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test soundings, provided that the recommendations provided in this report are implemented in the design and construction phases of this project.

The exploration encountered poor subgrade conditions consisting of moisture sensitive soil and softer/looser conditions. Low ground pressure and tracked equipment will likely be required for site preparation. We recommend earthwork during warmer periods of the year and vibratory rolling of the subgrade. Existing fill was also encountered at the site which appears suitable for building and pavement support.

The near surface, very loose to medium dense clayey sand and very soft to stiff lean clay could become unstable with typical earthwork and construction traffic, especially after precipitation events. The effective drainage should be completed early in the construction sequence and maintained after construction to avoid potential issues. If possible, the grading should be performed during the warmer and drier times of the year. If grading is performed during the winter months, an increased risk for possible undercutting and replacement of unstable subgrade will persist. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section.

Support of foundations, floor slabs, and pavements on or above existing fill materials is discussed in this report. However, even with the recommended construction procedures, an inherent risk remains for the owner that compressible fill or unsuitable material, within or buried by the fill, will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report. To take advantage of the cost benefit of not removing the entire amount of undocumented fill, the owner must be willing to accept the risk of increased differential performance which can result in increased cracking and abrupt differential settlement. Should this risk be acceptable, floor slabs and pavements can be supported above the fill.

Following the recommended **Earthwork**, the building can be supported on shallow foundations bearing on approved existing soils or structural fill compacted as recommended and sized for a maximum net allowable soil bearing pressure of 1,000 psf. The **Shallow Foundations** section addresses support of the building bearing on densified existing fill soils or structural fill. The **Floor Slabs** section addresses slab-on-grade support of the building.

A rigid or flexible pavement system is suitable for this site. The **Pavements** section addresses the design of pavement systems supported on the densified existing soils or structural fill.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include demolition, clearing and grubbing, excavations, and engineered fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Demolition

The proposed building will be constructed within the footprint of some existing pavements which will need to be demolished, as well as exterior sidewalks and utilities. We recommend existing foundations, slabs, and utilities be removed from within the proposed building footprint and at least 5 feet beyond the outer edge of foundations.

For areas outside the proposed building footprint and foundation bearing zones, existing utilities should be removed where they conflict with proposed utilities, retaining walls, and pavements. In such cases, existing foundations, floor slabs, and utilities should be removed to a depth of at least 2 feet below the affected utility or design pavement subgrade elevation.

Site Preparation

Prior to placing fill, existing vegetation, topsoil, and root mats should be removed. Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas.

Although no evidence of underground facilities (such as septic tanks, cesspools, basements, and utilities) was observed during the exploration and site reconnaissance, such features could be encountered during construction. If unexpected underground facilities are encountered, such features should be removed, and the excavation thoroughly cleaned prior to backfill placement and/or construction.

Subgrade Preparation

After stripping and removing topsoil and once any areas of cut have been excavated to proposed subgrade elevation, the exposed subgrade soils in the building and pavement footprints should be densified in place using a medium weight vibratory roller. Low ground pressure and tracked equipment will likely be required due to poor subgrade conditions. The purpose of the vibratory rolling is to densify the exposed subgrade soils for floor slab and pavement support and to potentially improve the foundation bearing soils. The roller should make at least six passes across the site, with the second set of three passes perpendicular to the first set of three passes with intermittent vibration activated. If water is brought to the surface by the vibratory rolling, the operation should be discontinued until the water subsides. Vibratory rolling should be completed during dry weather. Static rolling and additional repairs should be anticipated for areas too wet for vibratory rolling.

After the vibratory rolling, pore pressures should be allowed to dissipate for a minimum of 16 hours. After the waiting period, proofrolling should be performed on the exposed subgrade soils in areas to receive fill or at the subgrade elevation with a loaded, tandem-axle dump truck (15 to 20 ton total vehicle weight) or similar rubber-tired construction equipment. Proofrolling is recommended as a means of detecting areas of soft or unstable subgrade soils. The proofrolling should be performed during a period of dry weather to avoid degrading an otherwise suitable subgrade. The proofrolling operations should be observed by a representative of the geotechnical engineer. Subgrade soils that exhibit excessive rutting or deflection during proofrolling should be repaired as directed by the field representative. Typical repairs include overexcavation followed by replacement with either properly compacted fill or by a subgrade stabilization fabric in conjunction with a sand fill or crushed stone.

If subgrade soils are unsuitable, they will require removal and replacement; however, if they are unstable due to excessive moisture, the most economical solution for remediation may be to scarify, dry and recompact the material. This remediation is most effective during the typically hotter months of the year (May to October). If construction is performed during the cooler period of the year, the timeline for scarifying, drying, and recompacting typically increases considerably and may lead to alternative remediation solutions. These solutions can include overexcavation of some or all of the unstable material to be backfilled with either approved structural fill or geotextile and ABC Stone. Potential undercutting can be reduced if the site preparation work is performed during a period of dry weather and if construction traffic is kept to a minimum on prepared subgrades. We recommend that the contractor submit a unit rate cost for undercutting as part of the bidding process.

Utility Abandonment

Special precautions should be made to remove all underground utilities and their associated backfill as the proposed structure's foundations may overlay these materials. Terracon considers removing the utilities and underground structures and backfilling the resulting trenches to be the preferred method of abandonment. In-place abandonment by filling piping with grout should only be considered in the building footprint after checking the location of the piping in both plan and elevation space for potential conflict with the proposed foundations, construction, and new utilities. Care should be given to locating and addressing these items during the site preparation phase of the project. If overlooked, they could be detrimental to the long-term performance of the structure.

Existing Fill

As noted in **Geotechnical Characterization**, test location B-1 encountered previously placed fill to a depth of from about 3 feet. We have no records to indicate the degree of control, and consequently, the fill is considered unreliable for support of foundation loads. Support of floor slabs and pavements on or above existing fill soils is discussed in this report. However, even with the recommended construction procedures, inherent risk exists for the owner that compressible fill or unsuitable material, within or buried by the fill will, not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report.

If the owner elects to construct the footings, floor slabs, or pavements on the existing fill, the following protocol should be followed. Once areas of cut are excavated to proposed subgrade elevation and after vibratory densification, the entire area should be proof-rolled with heavy, rubber tire construction equipment, to aid in delineating areas of soft, or otherwise unsuitable soil. The bottom of footings should be checked with hand augers and Dynamic Cone Penetrometer (DCP) testing that extend through the existing fill material. Once any areas of unsuitable materials have been remediated, and the subgrade has passed the proof-roll/DCP testing, the existing soils that were removed can be evaluated for reuse as structural fill.

Excavation

We anticipate that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 5 feet of structures and pavements. General fill is material used to achieve grade outside of these areas.

Soil Type[1]	USCS Classification	Acceptable Location for Placement
Imported Soil	SC, SM, SP, SP-SM, SC-SM	All locations and elevations
On-Site Soils	SM, SC (LL<50 or PI<30)	All locations and elevations

1. Structural fill should consist of approved materials free of organic matter and debris. Frozen materials should not be used, and fill should not be placed on frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.

Fine-grained soils such as clay and silts should not be reused as structural fill due to their moisture sensitivity when compared to the sandier soils available.

Fill Placement and Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used	Same as structural fill
Minimum Compaction Requirements [1,2,3]	95% of maximum 98% of maximum within 1 foot of pavement subgrade	92% of max.
Water Content Range [1, 3]	95% of maximum 98% of maximum within 1 foot of pavement subgrade	As required to achieve min. compaction requirements

Item	Structural Fill	General Fill

1. Fill should be tested for moisture content and compaction during placement. If in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the tests should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. It is not necessary to achieve 95% compaction on the existing ground prior to placing fill or beginning construction. However, the subgrade should be evaluated by the Geotechnical Engineer prior to placing fill or beginning construction.
3. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).
4. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254). Materials not amenable to density testing should be placed and compacted to a stable condition observed by the Geotechnical Engineer or representative.

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with public works specifications for the utility be supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from existing foundations without engineering review of shoring requirements and geotechnical observation during construction.

On-site materials are considered suitable for backfill of utility and pipe trenches from 1 foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs or footings, the backfill should satisfy the gradation and expansion index requirements of engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab

and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 5 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 5 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Performing earthwork operations during warmer periods of the year (May through October) will reduce the potential for problems associated with wet, unstable subgrades.

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

The groundwater table could affect overexcavation efforts, especially for overexcavation and replacement of lower strength soils. A temporary dewatering system consisting of well points or sumps with pumps may be necessary to achieve the recommended depth of overexcavation depending on groundwater conditions at the time of construction. The excavation should remain dewatered until backfilled with compacted fill.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming

responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. Where not specified by local ordinance, one density and water content test should be performed for every 50 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1, 2]	1,000 psf
Required Bearing Stratum [3]	Approved existing soils or structural fill
Minimum Foundation Dimensions	Columns: 24 inches Continuous: 16 inches Thickened: 12 inches
Sliding Resistance [4]	0.35 coefficient of friction -
Minimum Embedment below Finished Grade [5]	Exterior footings in unheated areas: 18 inches Exterior footings in heated areas: 18 inches Interior footings in heated areas: 12 inches
Estimated Total Settlement from Structural Loads [2]	Less than about 1 inch
Estimated Differential Settlement [2, 6]	About 0.5 inches

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume that exterior grades are no steeper than **20% within 10** feet of structure.
2. Values provided are for maximum loads noted in **Project Description**. Additional geotechnical consultation will be necessary if higher loads are anticipated.
3. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in **Earthwork**.
4. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Frictional resistance for granular materials is dependent on the bearing pressure which may vary due to load combinations. For fine-grained materials, lateral resistance using cohesion should not exceed ½ the dead load.
5. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
6. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

Design Parameters – Overturning and Uplift Loads

Shallow foundations subjected to overturning loads should be proportioned such that the resultant eccentricity is maintained in the center-third of the foundation (e.g., $e < b/6$, where b is the foundation width). This requirement is intended to keep the entire foundation area in compression during the extreme lateral/overturning load event. Foundation oversizing may be required to satisfy this condition.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils with consideration to the IBC basic load combinations.

Item	Description
Soil Moist Unit Weight	110 pcf
Soil Effective Unit Weight[1]	47 pcf
Soil weight included in uplift resistance	Soil included within the prism extending up from the top perimeter of the footing at an angle of 20 degrees from vertical to ground surface

1. Effective (or buoyant) unit weight should be used for soil above the foundation level and below a water level. The high groundwater level should be used in uplift design as applicable.

Construction Adjacent to Existing Building

New footings for the causeway should bear at or near the bearing elevation of immediately adjacent existing foundations. Depending upon their locations and current loads on the existing footings, footings for the new addition could cause settlement of adjacent walls. To reduce this concern and risk, clear distances at least equal to the new footing widths should be maintained between the addition's footings and footings supporting the existing building.

Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. This is an essential part of the construction process. The Geotechnical Engineer should use a combination of hand auger borings and dynamic cone penetrometer (DCP) testing to determine the suitability of the bearing materials for the design bearing pressure. DCP testing should be performed to a depth of 3 to 5 feet below the bottom of foundation excavation and through any existing fill soils. Excessively soft, loose, or wet bearing soils should be over excavated to a depth recommended by the geotechnical engineer. The excavated soils should be replaced with structural fill or washed, crushed stone (NCDOT No. 57) wrapped in a geotextile fabric (Mirafi 140 N or equivalent). The need for the geotextile fabric with the crushed stone should be determined by the Geotechnical Engineer during construction based on sloughing/caving soils and excavation observations. However, footings could bear directly on the soils after over excavation if approved by the Geotechnical Engineer.

Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Existing fill materials were observed at location B-1 extending to a depth of 3 feet below existing grades. As discussed in **Existing Fill**, any existing fill materials present beneath floor slabs should be completely removed OR further evaluated by the Geotechnical Engineer.

Depending upon the finished floor elevation, unsuitable, weak, and/or soft to medium stiff soils may be observed at the floor slab subgrade level. These soils should be replaced with structural fill so the floor slab is supported on at least 2 feet of compacted suitable natural soils or structural fill.

Due to the potential for significant moisture fluctuations of subgrade material beneath floor slabs supported at-grade, the Geotechnical Engineer should evaluate the material within 12 inches of the bottom of the LVC zone immediately prior to placement of additional fill or floor slabs. Soils below the specified water contents within this zone should be moisture conditioned or replaced with structural fill as stated in our **Earthwork** section.

Floor Slab Design Parameters

Item	Description
Floor Slab Support[1]	Suitable existing soils or new structural fill compacted in accordance with **Earthwork** section of this report.
Estimated Modulus of Subgrade Reaction [2]	100 pounds per square inch per inch (psi/in) for point loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support

equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted but could be larger than normal and result in some cracking. Mitigation measures, as noted in **Existing Fill** within **Earthwork**, are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams, and/or post-tensioned elements.

Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of base stone and concrete and corrective action will be required to repair the damaged areas.

Finished subgrade, within and for at least 5 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Pavements

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Pavement Design Parameters

A California Bearing Ratio (CBR) of 3 was used for the subgrade for the asphaltic concrete (AC) pavement designs. A modulus of subgrade reaction of 100 pci was used for the portland cement concrete (PCC) pavement designs. The value was empirically derived based upon our experience with the clayey subgrade soils and our expectation of the quality of the subgrade as prescribed by the **Site Preparation** conditions as outlined in **Earthwork**. A modulus of rupture of 550 psi was used in design for the concrete (based on correlations with a minimum 28-day compressive strength of 4,000 psi). A minimum thickness for future maintenance was also incorporated into the pavement section design.

Pavement Section Thicknesses

The following table provides our opinion of minimum thickness for AC sections:

Asphaltic Concrete Design

Layer	Thickness (inches)		
	NCDOT Grading [1]	Automobile Areas (Light Duty)	Main Drives and Truck Access Areas (Medium Duty)
AC Surface	S-9.5B	3 [2]	1.5
AC Intermediate	I-19.0C	--	2.5
Aggregate Base	ABC	6	8

1. All materials should meet the current North Carolina Department of Transportation Standard Specifications
2. Placed in two equal lifts.
3. See **Project Description** for more specifics regarding traffic assumptions.

The following table provides our estimated minimum thickness of PCC pavements.

Portland Cement Concrete Design

Layer	Specification [1]	Thickness (inches)		
		Automobile Areas (Light Duty)	Main Drives and Truck Access Areas (Medium Duty)	Heavy Duty [2]
PCC	4,000 psi	5		7
Aggregate Base	ABC	4 [3]		4

1. All materials should meet the current North Carolina Department of Transportation (NCDOT) Standard Specifications.
2. In areas of anticipated heavy traffic, fire trucks, delivery trucks, or concentrated loads (e.g. dumpster pads), and areas with repeated turning or maneuvering of heavy vehicles.
3. Crushed Aggregate Base Course is recommended for construction purposes. Concrete could be placed directly on an approved subgrade. However, stormwater can quickly degrade exposed subgrades without the crushed aggregate base course leading to additional subgrade repair.
4. See **Project Description** for more specifics regarding traffic assumptions.

For subgrade instability that could develop due to the weather, we recommend that contingencies be placed in the budget for stabilization of the subgrade in planned pavement areas using a geosynthetic fabric and additional ABC stone. The geosynthetic could be left off corridors/easements for deeper utility lines for ease of construction.

Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles.

Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and doweled where necessary for load transfer. PCC pavement details for joint spacing, joint reinforcement, and joint sealing should be prepared in accordance with ACI 330 and ACI 325.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. Islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils are particular areas of concern. The civil design for the pavements with these conditions should include features to restrict or collect and discharge excess water from the islands. Examples of features are edge drains connected to the stormwater collection system, longitudinal subdrains, or other suitable outlets and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

The placement of a partial pavement thickness for use during construction is not suggested without a detailed pavement analysis incorporating construction traffic. If the actual traffic varies from the assumptions outlined in **Project Description** we should be contacted to update our recommendations as necessary.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Based on the possibility of shallow and/or perched groundwater, we recommend installing a pavement subdrain system to control groundwater, improve stability, and improve long-term pavement performance.

Due to frost-susceptible soils and the possibility of perched groundwater, consideration should be given to installing a pavement subdrain system to control subgrade moisture, improve stability, and improve long-term pavement performance.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic upkeep should be anticipated. Preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Pavement care consists of both localized (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Additional engineering consultation is recommended to determine the type and extent of a cost-

effective program. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in

accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

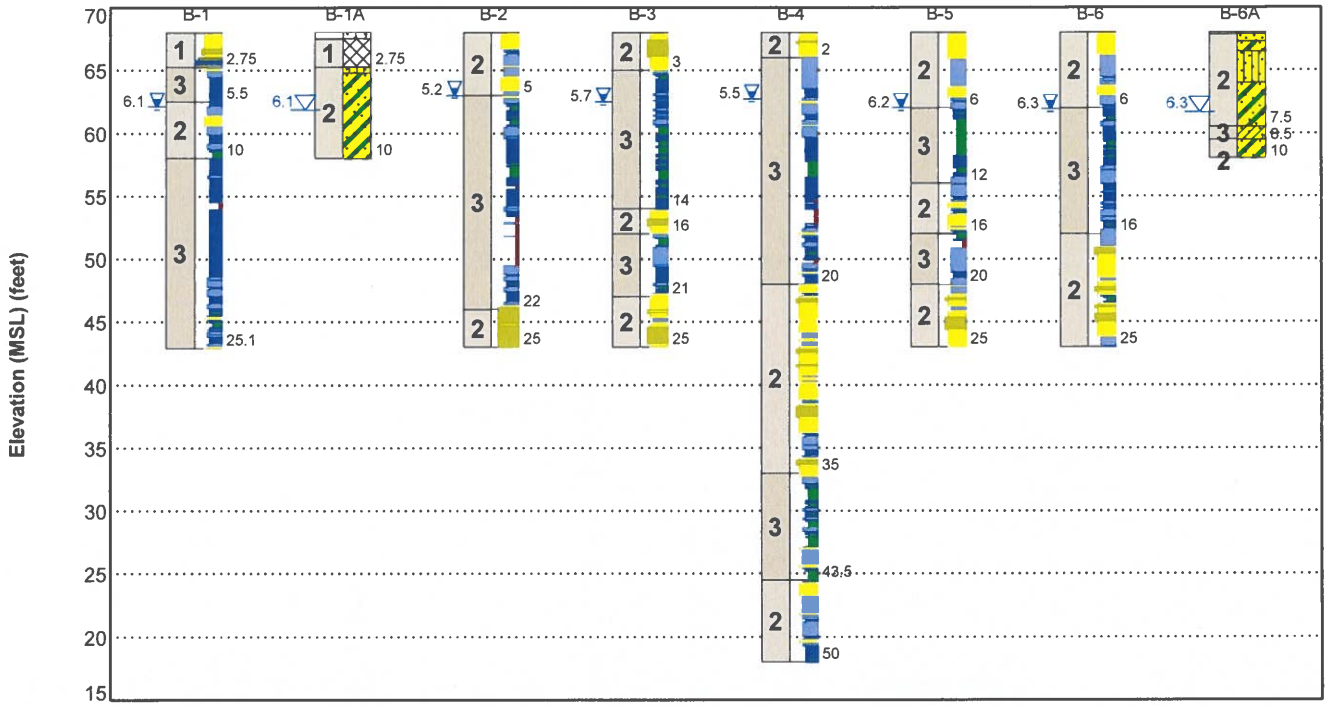
Figures

Contents:

Alice F. Keene District Park - Proposed Gymnasium
4561 County Home Road | Greenville, NC
Terracon Project No. 72225128

Terracon
314 Beacon Dr
Winterville, NC

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Existing Fill	Sand with varying amounts of clay and debris consisting of rock fragments
2	Sand	Sand with varying amounts of silt and clay, very loose to medium dense
3	Clay and Sand	Very soft to stiff clay with interbedded layers of very loose to loose sand

LEGEND

- Topsoil
- Fill
- Silty Sand
- Clayey Sand
- Poorly-graded Sand
- Sandy Lean Clay

▽ First Water Observation

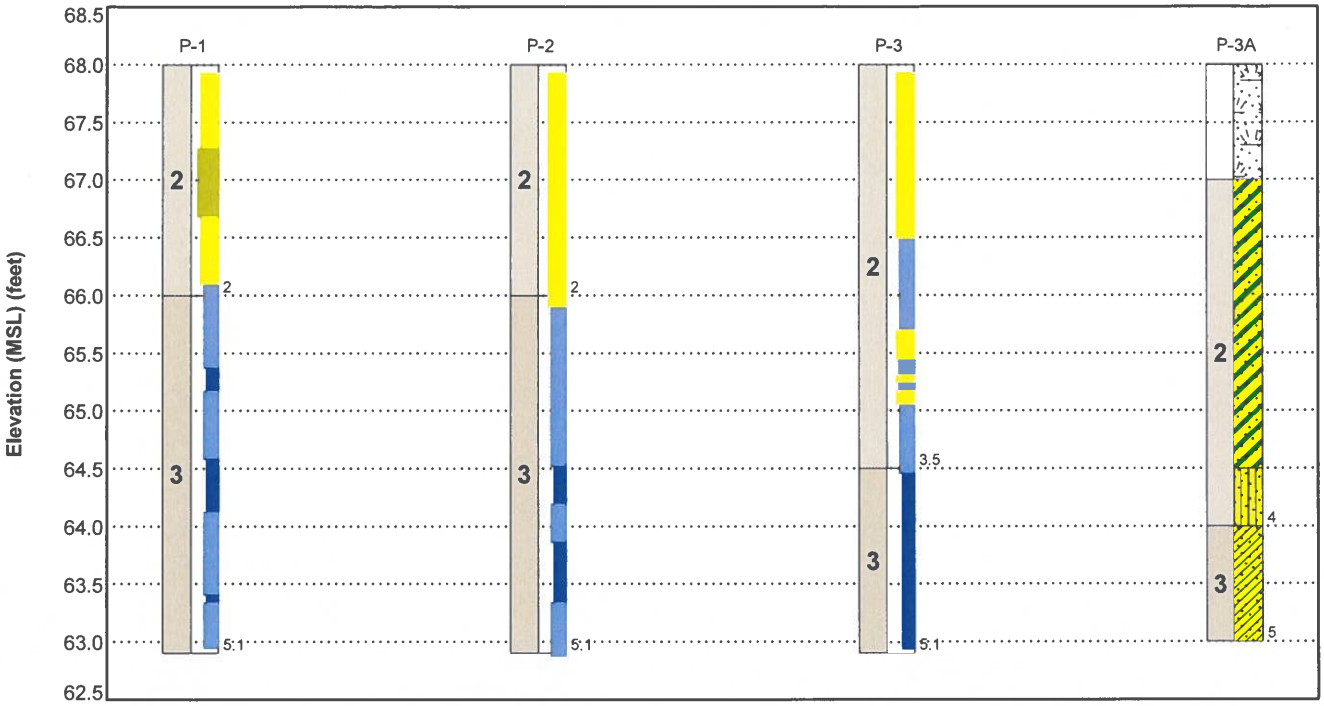
The groundwater levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

Alice F. Keene District Park - Proposed Gymnasium
4561 County Home Road | Greenville, NC
Terracon Project No. 72225128

Terracon
314 Beacon Dr
Winterville, NC

GeoModel



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Model Layer	Layer Name	General Description
1	Existing Fill	Sand with varying amounts of clay and debris consisting of rock fragments
2	Sand	Sand with varying amounts of silt and clay, very loose to medium dense
3	Clay and Sand	Very soft to stiff clay with interbedded layers of very loose to loose sand

LEGEND

- Topsoil
- Sandy Lean Clay
- Clayey Sand
- Silty Sand

▽ First Water Observation

The groundwater levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

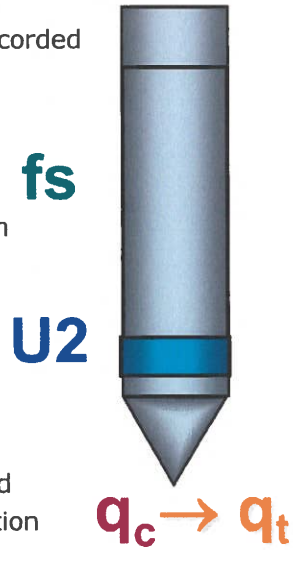
Field Exploration

Number of Soundings	Approximate Sounding Depth (feet)	Location
6	25 to 50	Proposed building
3	5	Proposed pavement

Exploration Layout and Elevations: Terracon personnel provided the exploration layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. Approximate ground surface elevations were estimated using Google Earth Pro. If elevations and a more precise exploration layout are desired, we recommend the test locations be surveyed.

Subsurface Exploration Procedures: The subsurface exploration was performed by a track mounted power drilling rig utilizing direct push, cone penetration testing (CPT) to advance into the subsurface. Additionally, select macrocore samples were obtained adjacent to select CPT sounding locations to depths of 5 to 10 feet below existing grades to obtain laboratory samples and visually classify near-surface soils. Samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification.

Cone Penetration Testing (CPT): The CPT hydraulically pushes an instrumented cone through the soil while nearly continuous readings are recorded to a portable computer. The cone is equipped with electronic load cells to measure tip resistance and sleeve resistance and a pressure transducer to measure the generated ambient pore pressure. The face of the cone has an apex angle of 60° and an area of 10 cm^2. Digital data representing the tip resistance, friction resistance, pore water pressure, and probe inclination angle are recorded about every 2 centimeters while advancing through the ground at a rate between 1½ and 2½ centimeters per second. These measurements are correlated to various soil properties used for geotechnical design. No soil samples are gathered through this subsurface investigation technique.



CPT testing is conducted in general accordance with ASTM D5778 "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils." Upon completion, the data collected was downloaded and processed by the project engineer.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Gradation Analysis (No. 200 Wash)
- Atterberg Limits

The laboratory testing program often included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Photography Log

Photos taken during site visit on December 6, 2022

Photo 1: Location P-1, facing southwest

Photo 2: Location P-3, facing north

Site Location and Exploration Plans

Contents:

Note: All attachments are one page unless noted above.

Site Location

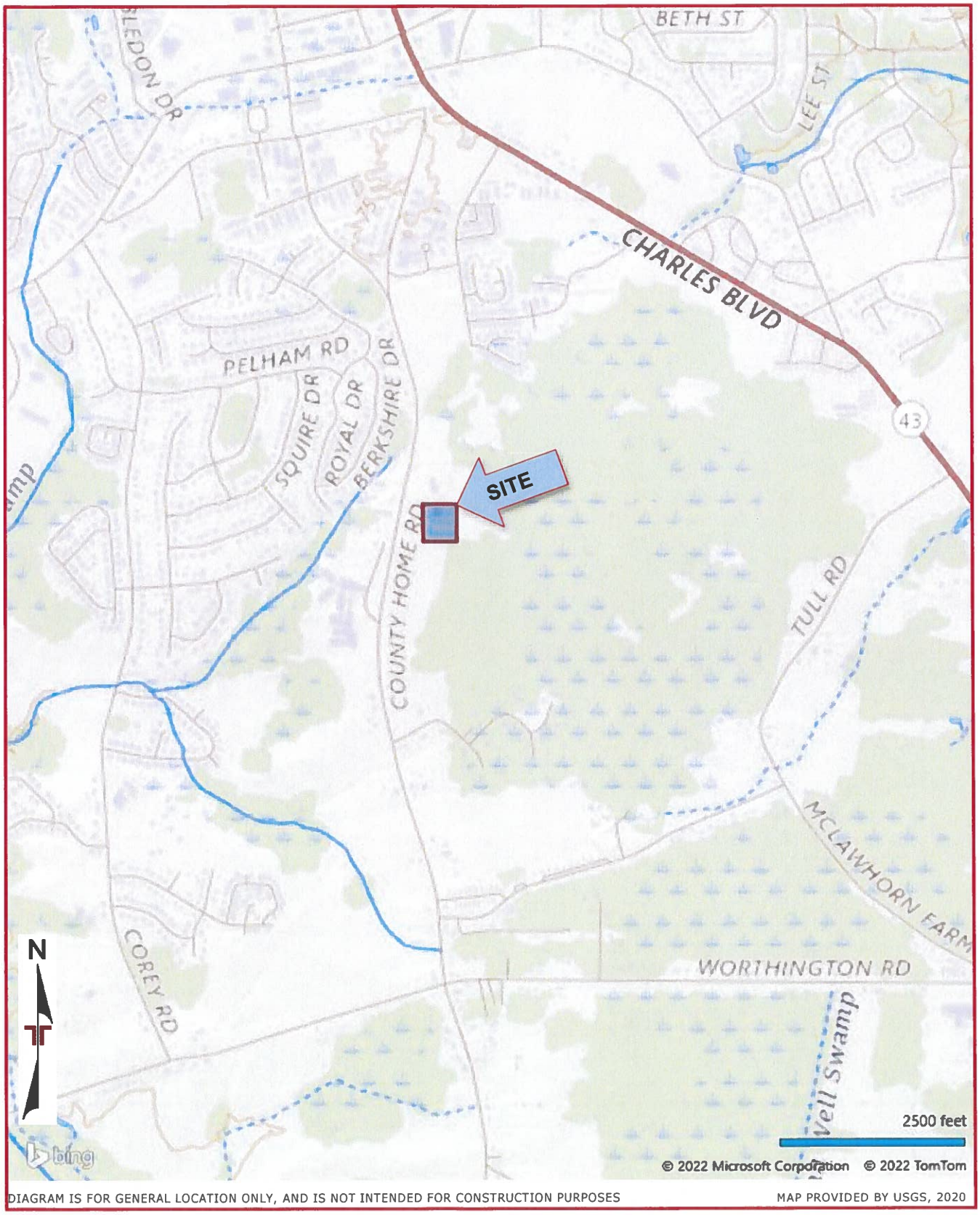


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY USGS, 2020

Exploration Plan

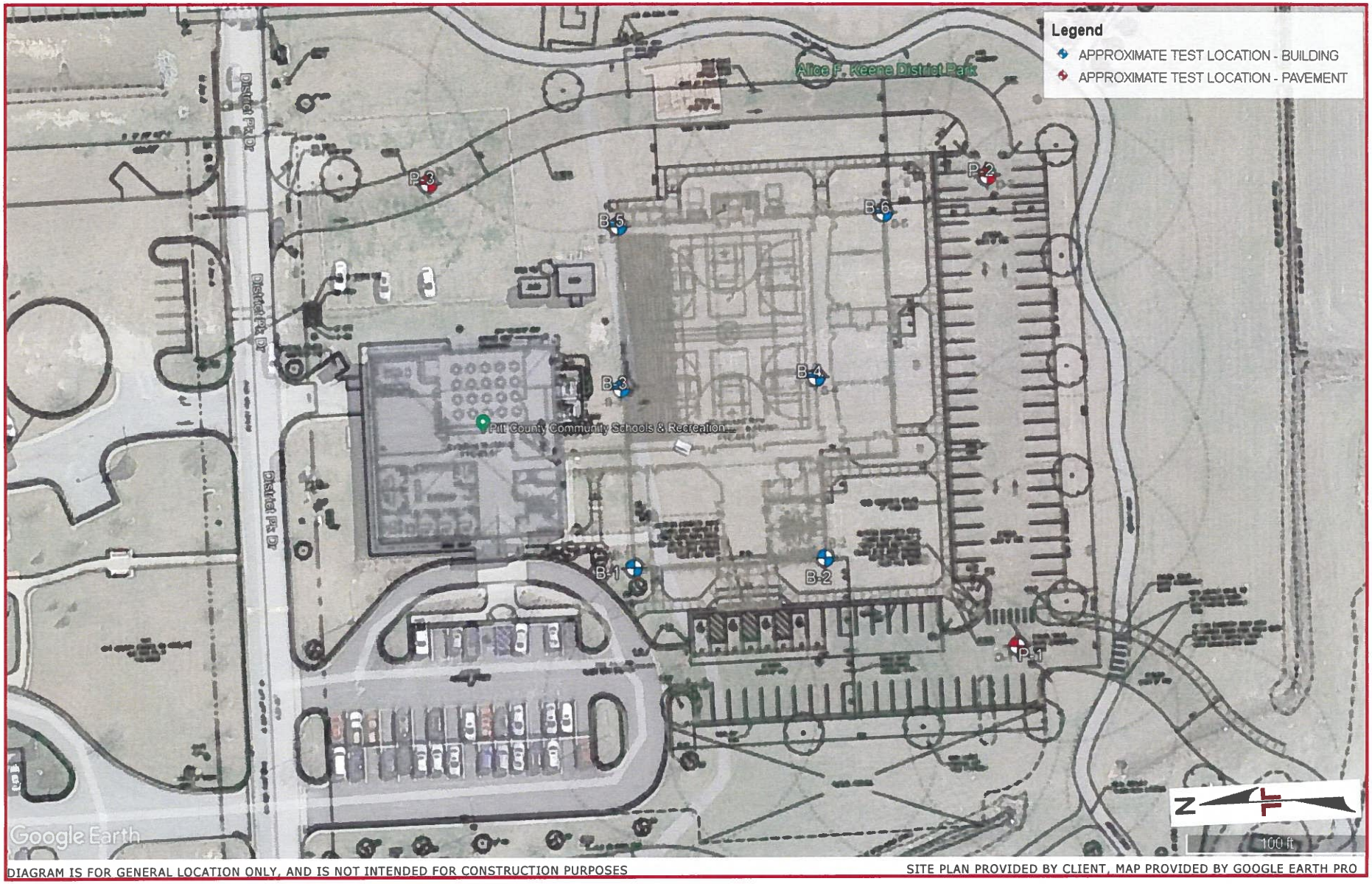


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

SITE PLAN PROVIDED BY CLIENT, MAP PROVIDED BY GOOGLE EARTH PRO

Exploration and Laboratory Results

Contents:

Note: All attachments are one page unless noted above.

CPT LOG NO. B-1

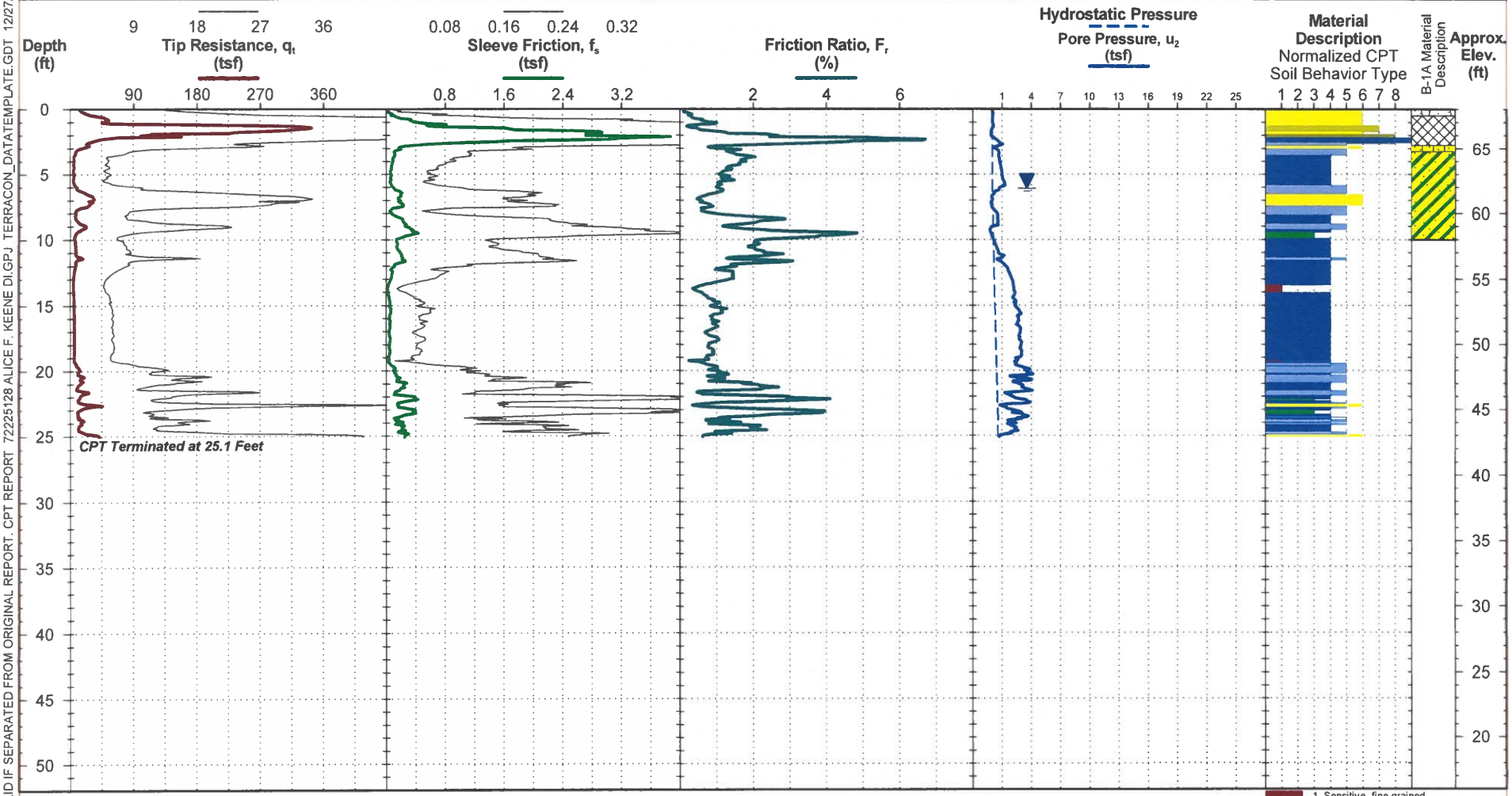
PROJECT: Alice F. Keene District Park - Proposed Gymnasium

CLIENT: Hite Associates, P.C.
Greenville, NC

SITE: 4561 County Home Road
Greenville, NC

TEST LOCATION: See Exploration Plan

Approx. Surface Elev: 68 ft +/- Adjacent Test: B-1A
Latitude: 35.54894692°
Longitude: -77.34933745°



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Approximate elevations obtained from Google Earth Pro

See B-1A for the adjacent test's full details.

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 6.1 ft measured water depth
(used in normalizations and correlations; See Supporting Information)

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 12/9/2022
CPT Completed: 12/9/2022
Rig: CPT
Operator: R. Rascot
Project No.: 72225128

Alice F. Keene District Park - Proposed Gymnasium
4561 County Home Road | Greenville, NC
Terracon Project No. 72225128

Terracon
314 Beacon Dr
Winterville, NC

Boring Log No. B-1A

Location: See Exploration Plan

Latitude: 35.5489° Longitude: -77.3493°

Model Layer	Graphic Log	Depth (Ft.)	Elevation: 68 (Ft.) +/-	Depth (Ft.)	Water Level Observations	Sample Type	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.5	**TOPSOIL**, 6-inches 67.5						
1		2.8	**FILL - CLAYEY SAND**, brown, red, and white -Noted rock fragments from 1.75 feet to 2.75 feet 65.25				10.0		
2		3.3	**SILTY SAND (SM)**, black 64.75 **CLAYEY SAND (SC)**, dark gray, gray, and brown	5	▽		15.9 16.4	23-11-12	43
		10.0	-Noted clay lense at 8.5 feet 58	10			21.6		
			Boring Terminated at 10 Feet						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ At completion of drilling

Drill Rig
CPT

Driller
R. Rascot

Logged by

Boring Started
12-09-2022

Boring Completed
12-09-2022

Notes
Elevation Reference: Approximate elevations obtained from Google Earth Pro

Advancement Method
Direct Push

Abandonment Method

CPT LOG NO. B-2

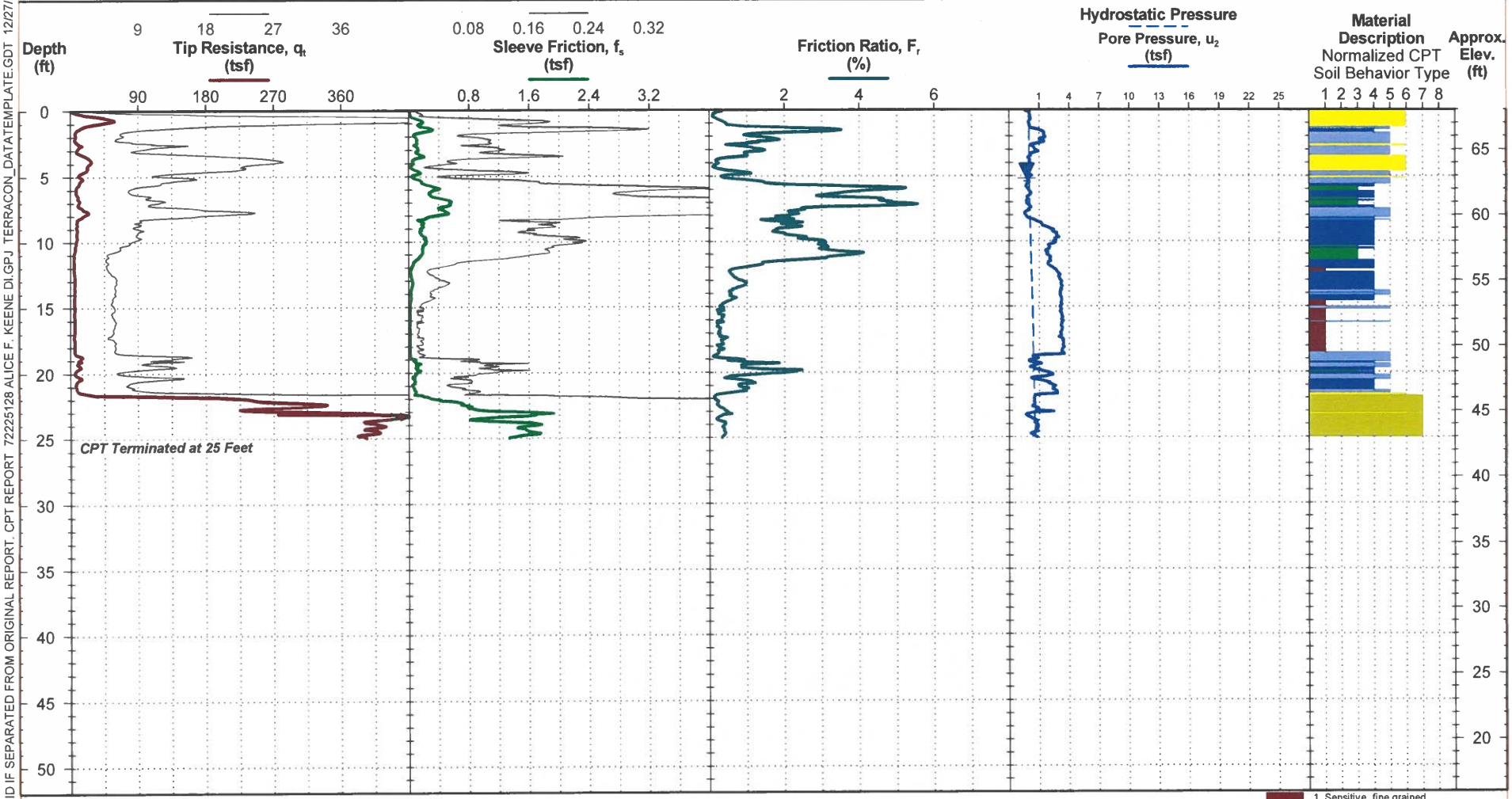
PROJECT: Alice F. Keene District Park - Proposed Gymnasium

CLIENT: Hite Associates, P.C.
Greenville, NC

SITE: 4561 County Home Road
Greenville, NC

TEST LOCATION: See Exploration Plan

Approx. Surface Elev: 68 ft +/-
Latitude: 35.54865958°
Longitude: -77.34933802°



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
Approximate elevations obtained from Google Earth Pro

Auger anchors used as reaction force.
CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

5.2 ft measured water depth
(used in normalizations and correlations; See Supporting Information)

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 12/9/2022
CPT Completed: 12/9/2022
Rig: CPT
Operator: R. Rascot
Project No.: 72225128

CPT LOG NO. B-3

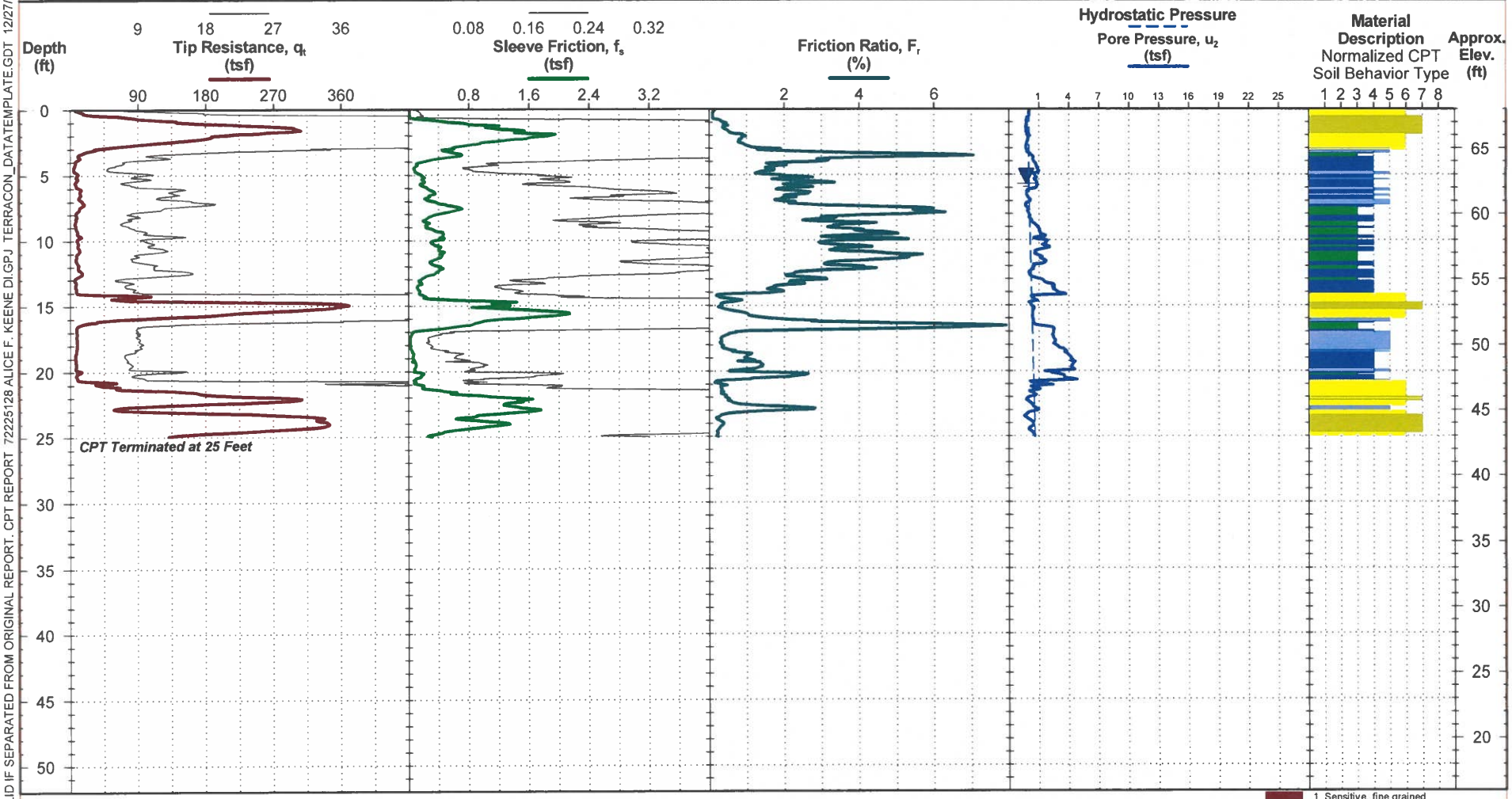
PROJECT: Alice F. Keene District Park - Proposed Gymnasium

CLIENT: Hite Associates, P.C.
Greenville, NC

SITE: 4561 County Home Road
Greenville, NC

TEST LOCATION: See Exploration Plan

Approx. Surface Elev: 68 ft +/-
Latitude: 35.54894936°
Longitude: -77.34901454°



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Approximate elevations obtained from Google Earth Pro

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 5.7 ft measured water depth
(used in normalizations and correlations; See Supporting Information)

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 12/9/2022
CPT Completed: 12/9/2022
Rig: CPT
Operator: R. Rascot
Project No.: 72225128

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72225128 ALICE F. KEENE DI.GPJ TERRACON_DATATEMPLATE.GDT 12/27/22

CPT LOG NO. B-4

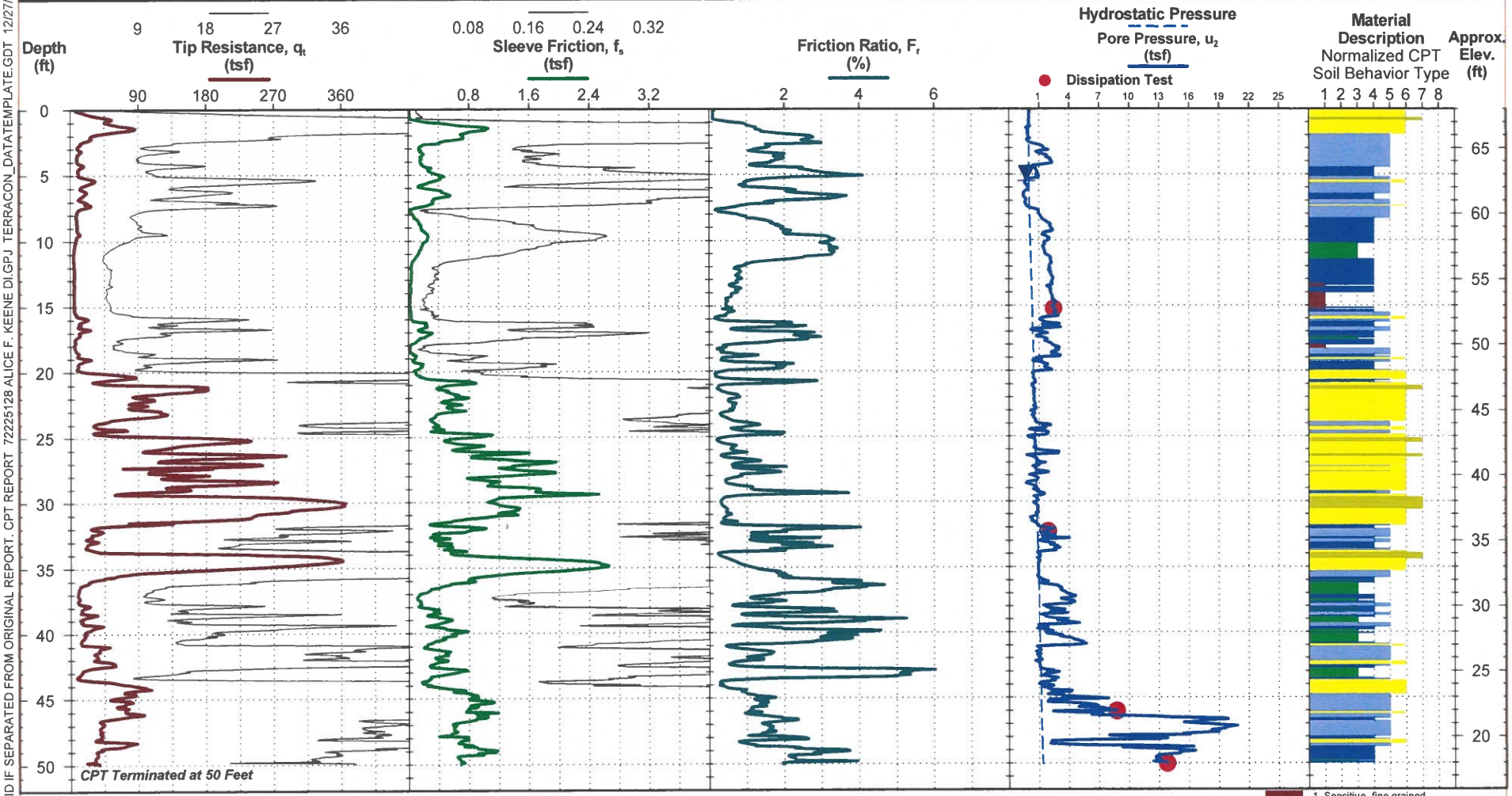
PROJECT: Alice F. Keene District Park - Proposed Gymnasium

CLIENT: Hite Associates, P.C.
Greenville, NC

SITE: 4561 County Home Road
Greenville, NC

TEST LOCATION: See Exploration Plan

Approx. Surface Elev: 68 ft +/-
Latitude: 35.54866047°
Longitude: -77.34901454°



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Approximate elevations obtained from Google Earth Pro

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

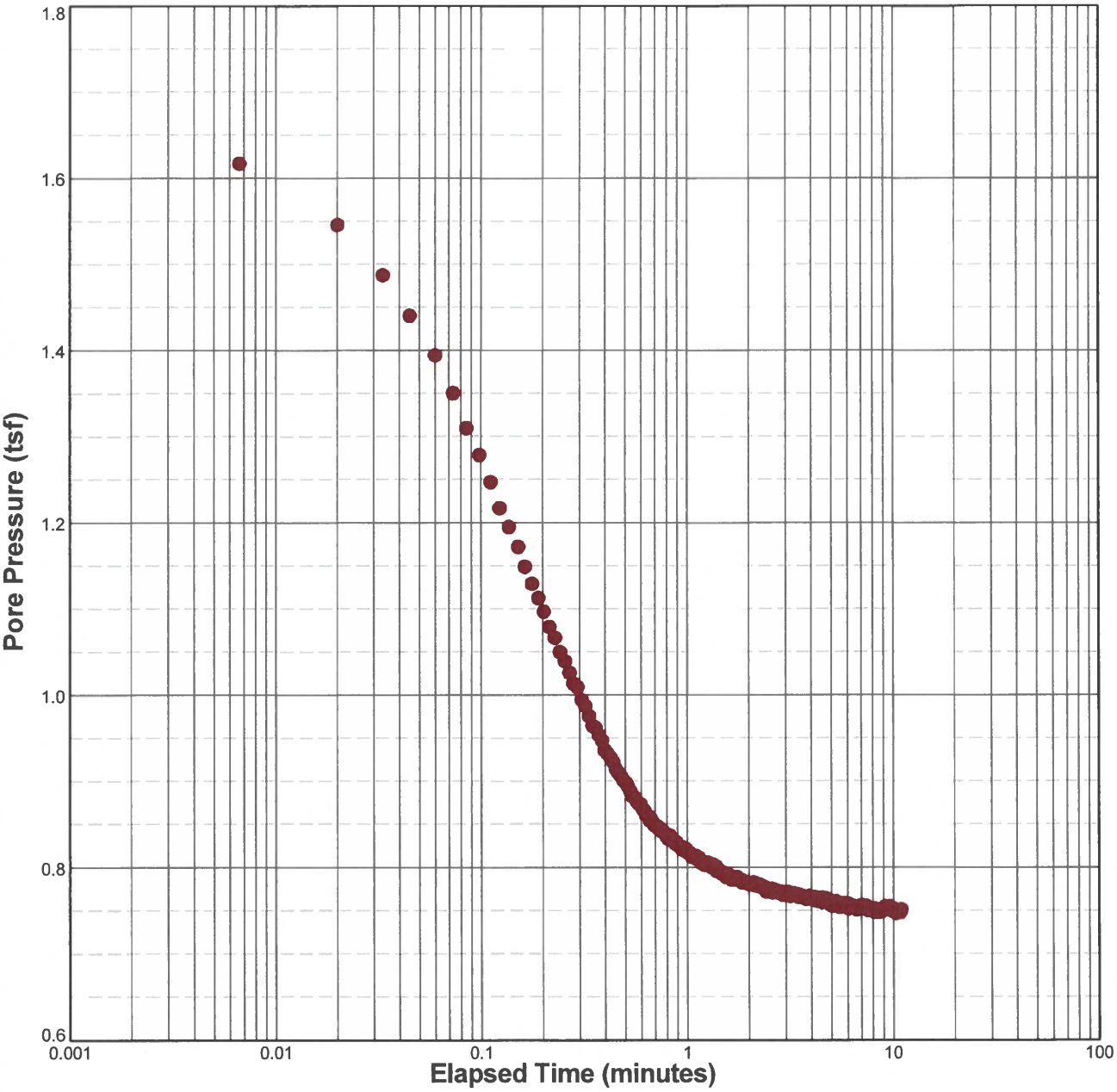
▼ 5.5 ft measured water depth
(used in normalizations and correlations; See Supporting Information)

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 12/9/2022
CPT Completed: 12/9/2022
Rig: CPT
Operator: R. Rascot
Project No.: 72225128

PORE PRESSURE DISSIPATION TEST RESULTS



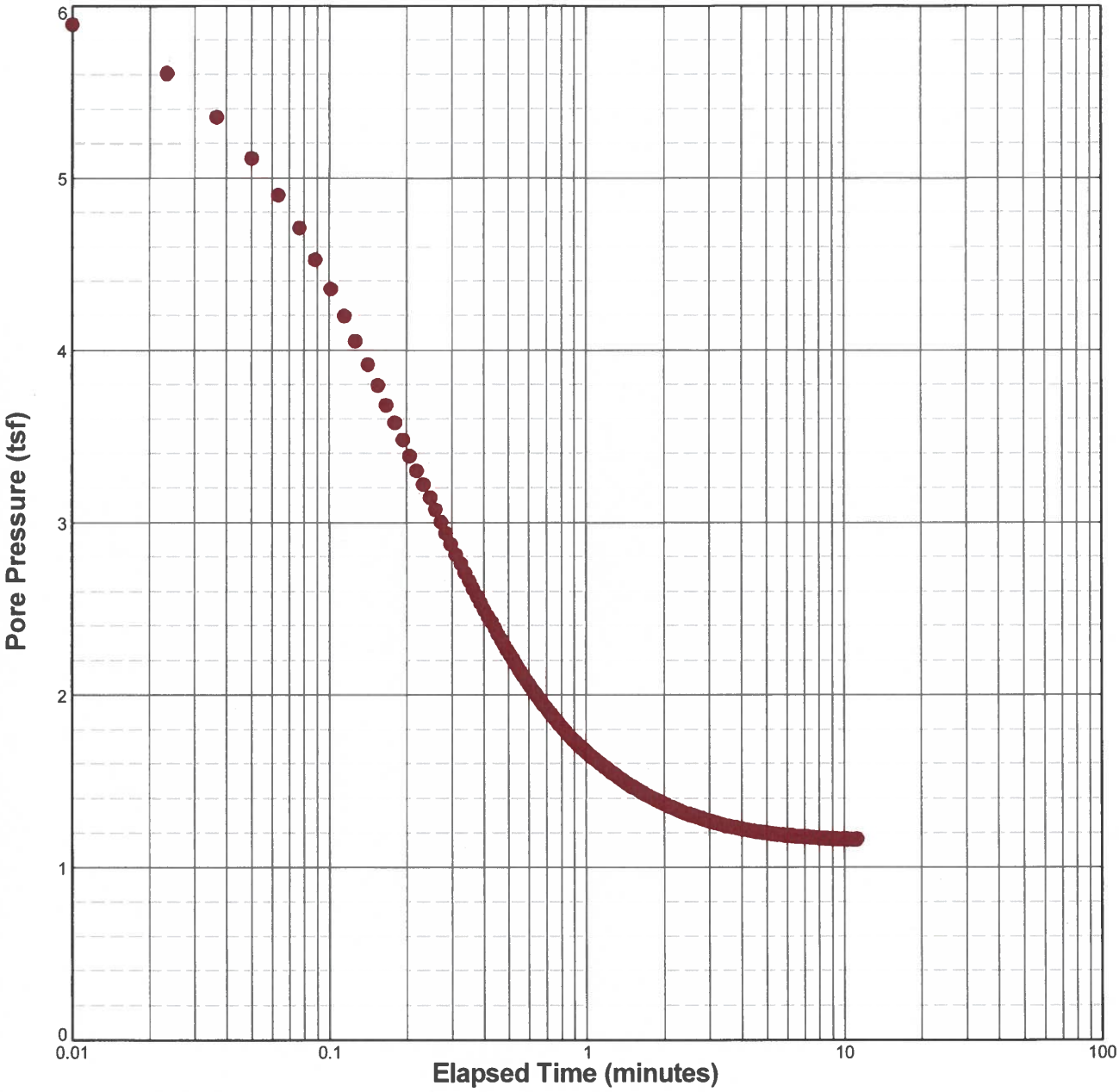
TEST: B-4

TEST DEPTH: 32.3 ft

TEST DURATION: 10.9 min

PROJECT: Alice F. Keene District Park - Proposed Gymnasium	Terracon 314 Beacon Dr Winterville, NC	PROJECT NUMBER: 72225128
SITE: 4561 County Home Road Greenville, NC		CLIENT: Hite Associates, P.C. Greenville, NC
		EXHIBIT: A-2

PORE PRESSURE DISSIPATION TEST RESULTS



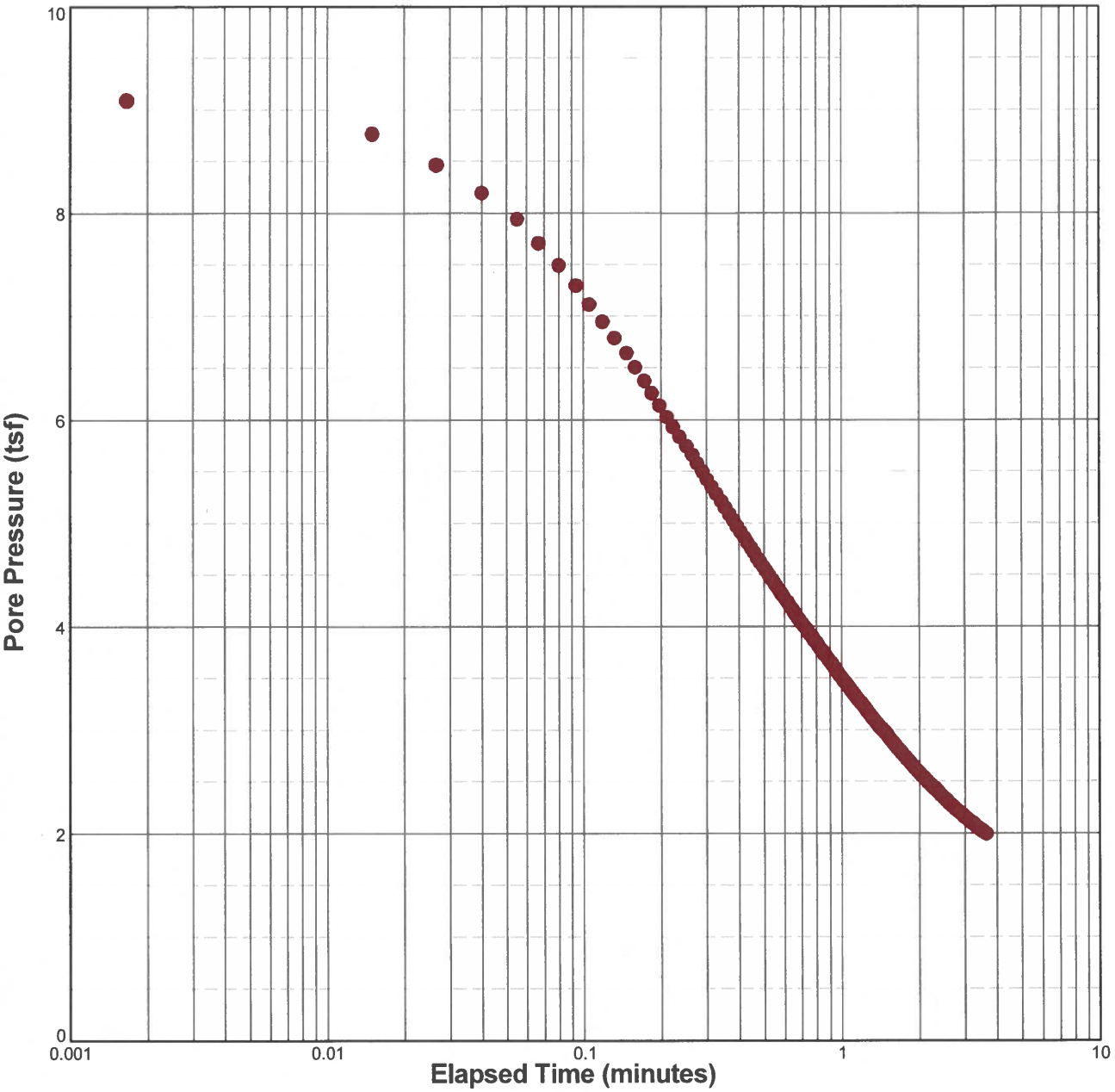
TEST: B-4

TEST DEPTH: 46.03 ft

TEST DURATION: 11.2 min

PROJECT: Alice F. Keene District Park - Proposed Gymnasium	Terracon 314 Beacon Dr Winterville, NC	PROJECT NUMBER: 72225128
SITE: 4561 County Home Road Greenville, NC		CLIENT: Hite Associates, P.C. Greenville, NC
		EXHIBIT: A-3

PORE PRESSURE DISSIPATION TEST RESULTS



TEST: B-4

TEST DEPTH: 50.033 ft

TEST DURATION: 3.6 min

PROJECT: Alice F. Keene District Park - Proposed Gymnasium	Terracon 314 Beacon Dr Winterville, NC	PROJECT NUMBER: 72225128
SITE: 4561 County Home Road Greenville, NC		CLIENT: Hite Associates, P.C. Greenville, NC
		EXHIBIT: A-4

CPT LOG NO. B-5

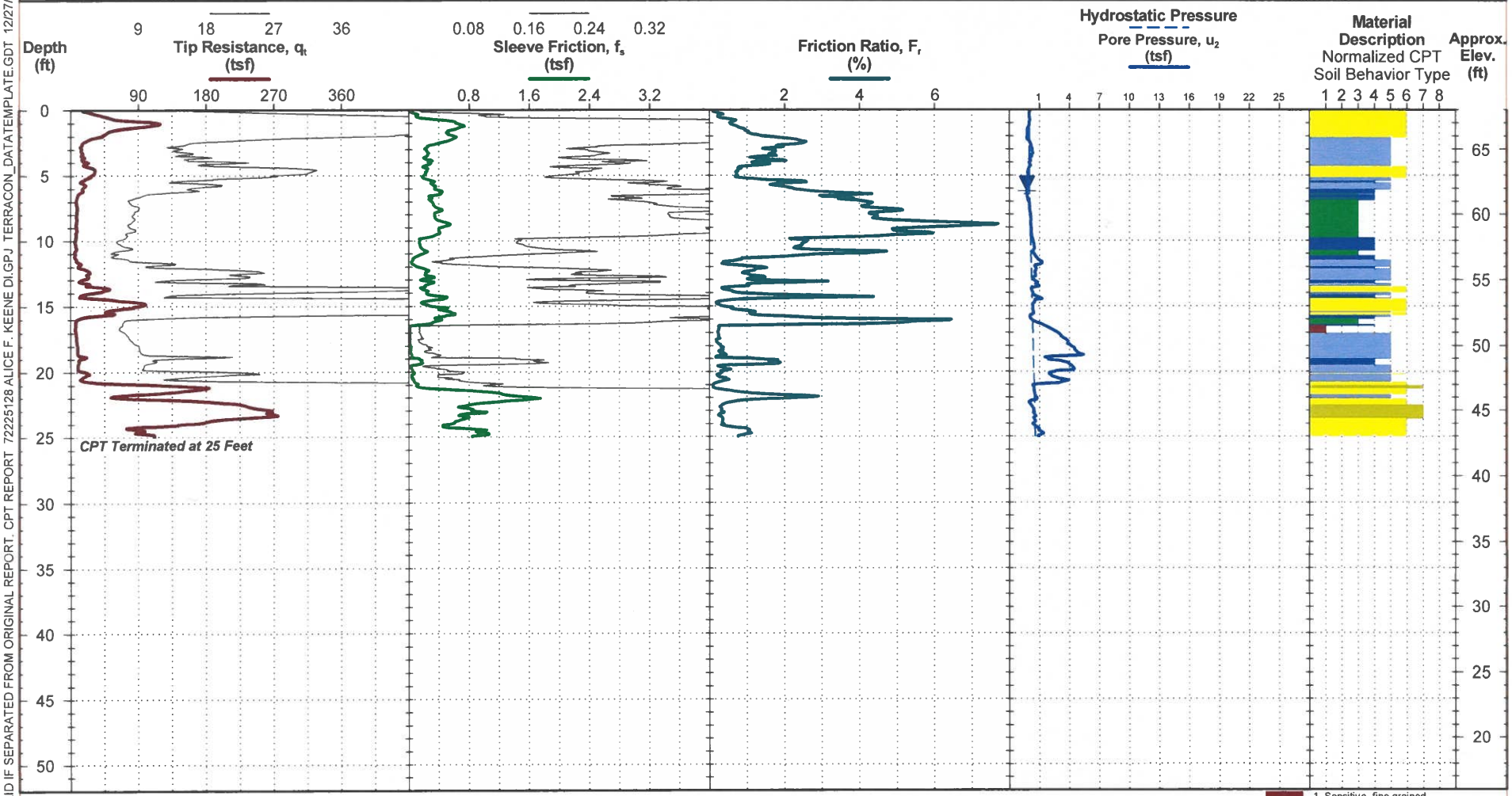
PROJECT: Alice F. Keene District Park - Proposed Gymnasium

CLIENT: Hite Associates, P.C.
Greenville, NC

SITE: 4561 County Home Road
Greenville, NC

TEST LOCATION: See Exploration Plan

Approx. Surface Elev: 68 ft +/-
Latitude: 35.54894759°
Longitude: -77.34872373°



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Approximate elevations obtained from Google Earth Pro

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 6.2 ft measured water depth
(used in normalizations and correlations; See Supporting Information)

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 12/9/2022 | CPT Completed: 12/9/2022

Rig: CPT | Operator: R. Rascot

Project No.: 72225128

CPT LOG NO. B-6

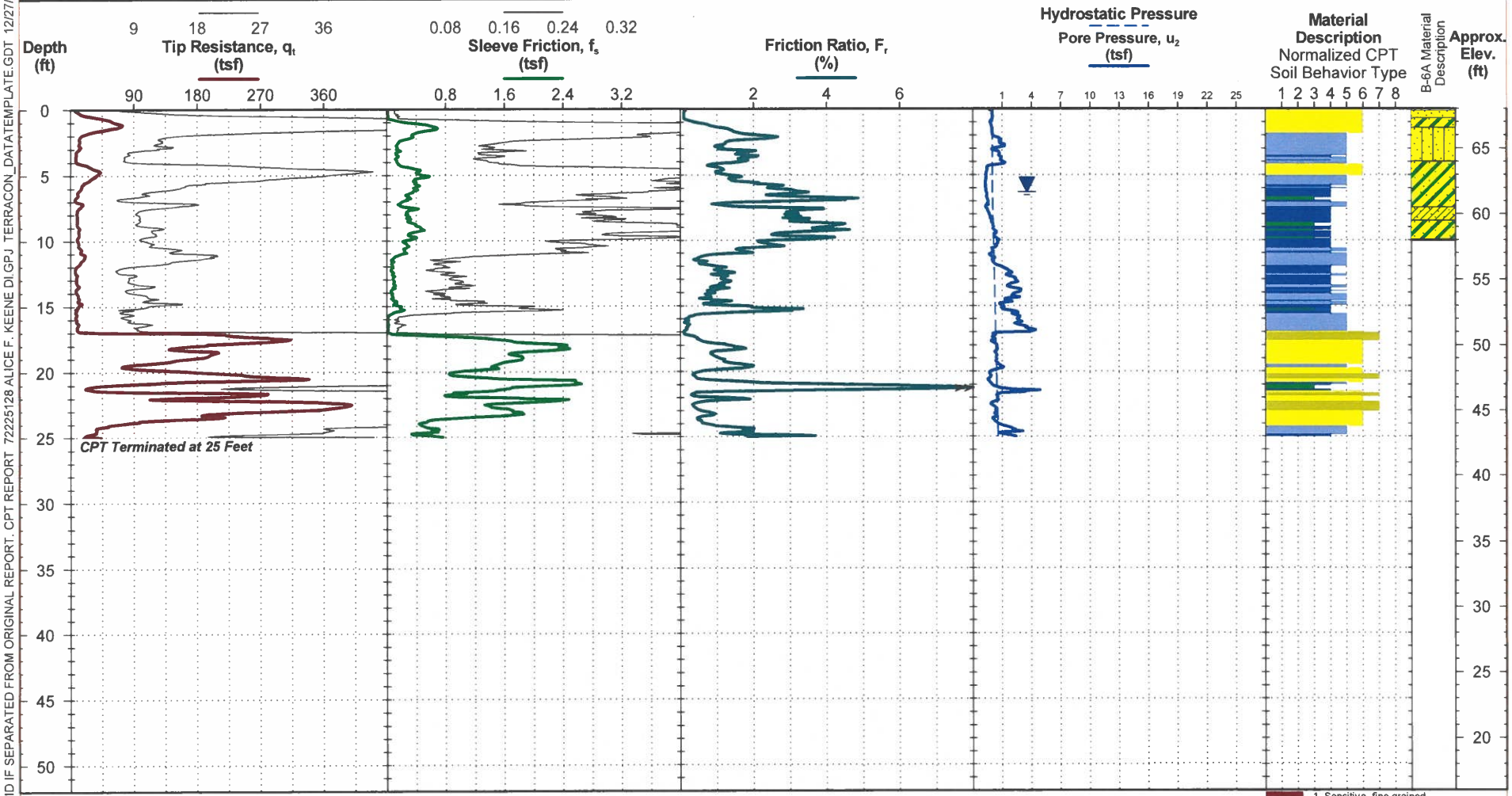
PROJECT: Alice F. Keene District Park - Proposed Gymnasium

CLIENT: Hite Associates, P.C.
Greenville, NC

SITE: 4561 County Home Road
Greenville, NC

TEST LOCATION: See Exploration Plan

Approx. Surface Elev: 68 ft +/- Adjacent Test: B-6A
Latitude: 35.54854704°
Longitude: -77.34872449°



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Approximate elevations obtained from Google Earth Pro

See B-6A for the adjacent test's full details.

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 6.3 ft measured water depth
(used in normalizations and correlations; See Supporting Information)

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 12/9/2022 CPT Completed: 12/9/2022
Rig: CPT Operator: R. Rascot
Project No.: 72225128

Alice F. Keene District Park - Proposed Gymnasium
4561 County Home Road | Greenville, NC
Terracon Project No. 72225128

Terracon
314 Beacon Dr
Winterville, NC

Boring Log No. B-6A

Location: See Exploration Plan

Latitude: 35.5485° Longitude: -77.3487°

Model Layer	Depth (Ft.)	Elevation: 68 (Ft.) +/-	Sample Type	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
	0.2	**TOPSOIL**, 2-inches — 67.83				
	0.8	**POORLY GRADED SAND (SP)**, brown — 67.25				
	1.5	**CLAYEY SAND (SC)**, dark brown — 66.5				
2	4.0	**SILTY SAND (SM)**, dark brown — 64		12.6		
				11.3	NP	29
	7.5	**CLAYEY SAND (SC)**, gray and brown — 60.5		19.4		
3	8.5	**SANDY LEAN CLAY (CL)**, gray, orange, and brown — 59.5		24.5		
2	10.0	**CLAYEY SAND (SC)**, gray and orange — 58				
		Boring Terminated at 10 Feet				

Depth (Ft.): 5, 10

Water Level Observations: ▽ At completion of drilling

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes
Elevation Reference: Approximate elevations obtained from Google Earth Pro

Advancement Method
Direct Push

Abandonment Method

Drill Rig
CPT

Driller
R. Rascot

Logged by

Boring Started
12-09-2022

Boring Completed
12-09-2022

CPT LOG NO. P-1

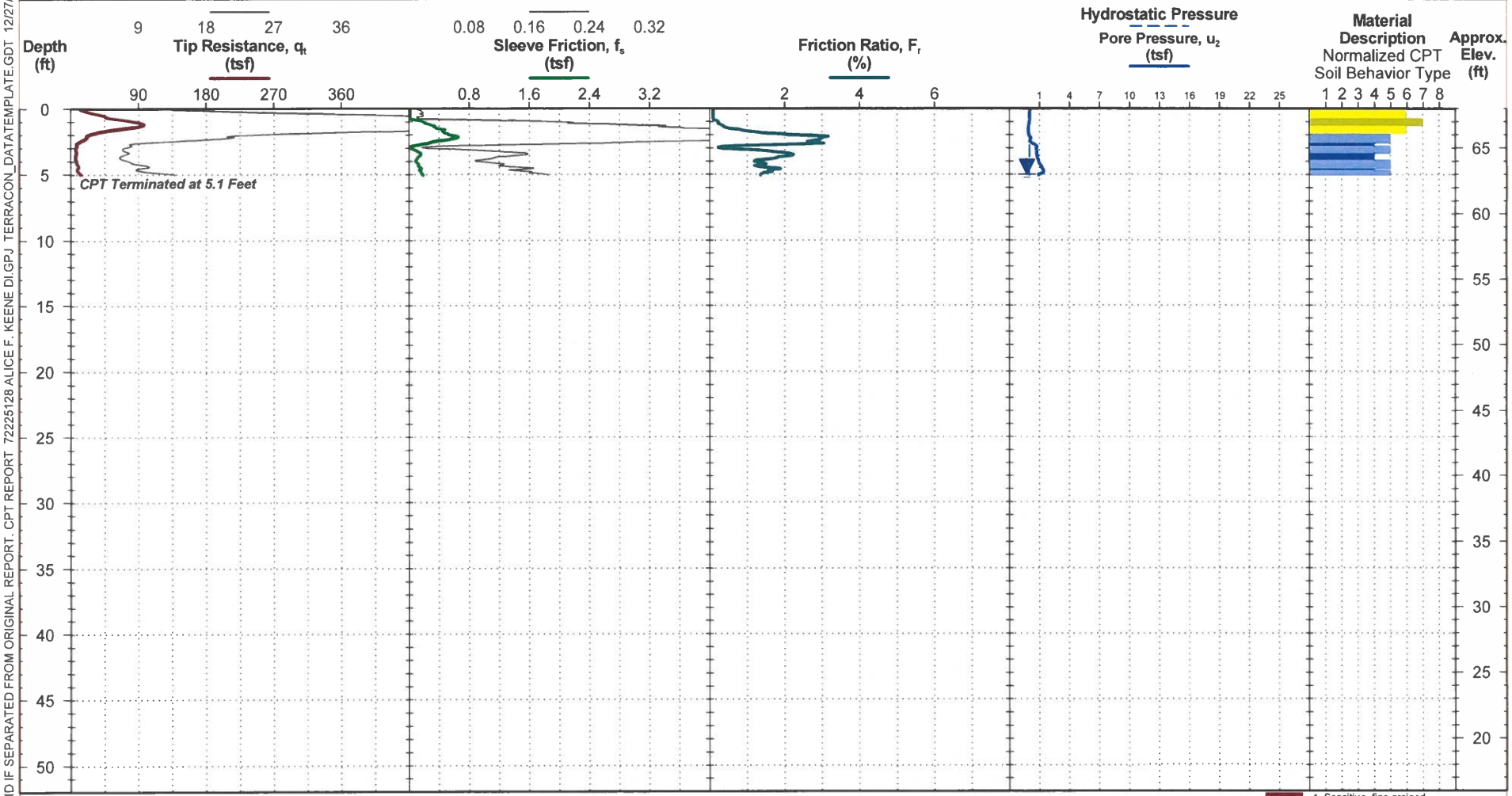
PROJECT: Alice F. Keene District Park - Proposed Gymnasium

CLIENT: Hite Associates, P.C.
Greenville, NC

SITE: 4561 County Home Road
Greenville, NC

TEST LOCATION: See Exploration Plan

Approx. Surface Elev: 68 ft +/-
Latitude: 35.54837463°
Longitude: -77.349517°



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Approximate elevations obtained from Google Earth Pro

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
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6 Sands - clean sand to silty sand
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8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 5 ft estimated water depth
(used in normalizations and correlations; See Supporting Information)

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 12/9/2022	CPT Completed: 12/9/2022
Rig: CPT	Operator: R. Rascot
Project No.: 72225128	

CPT LOG NO. P-2

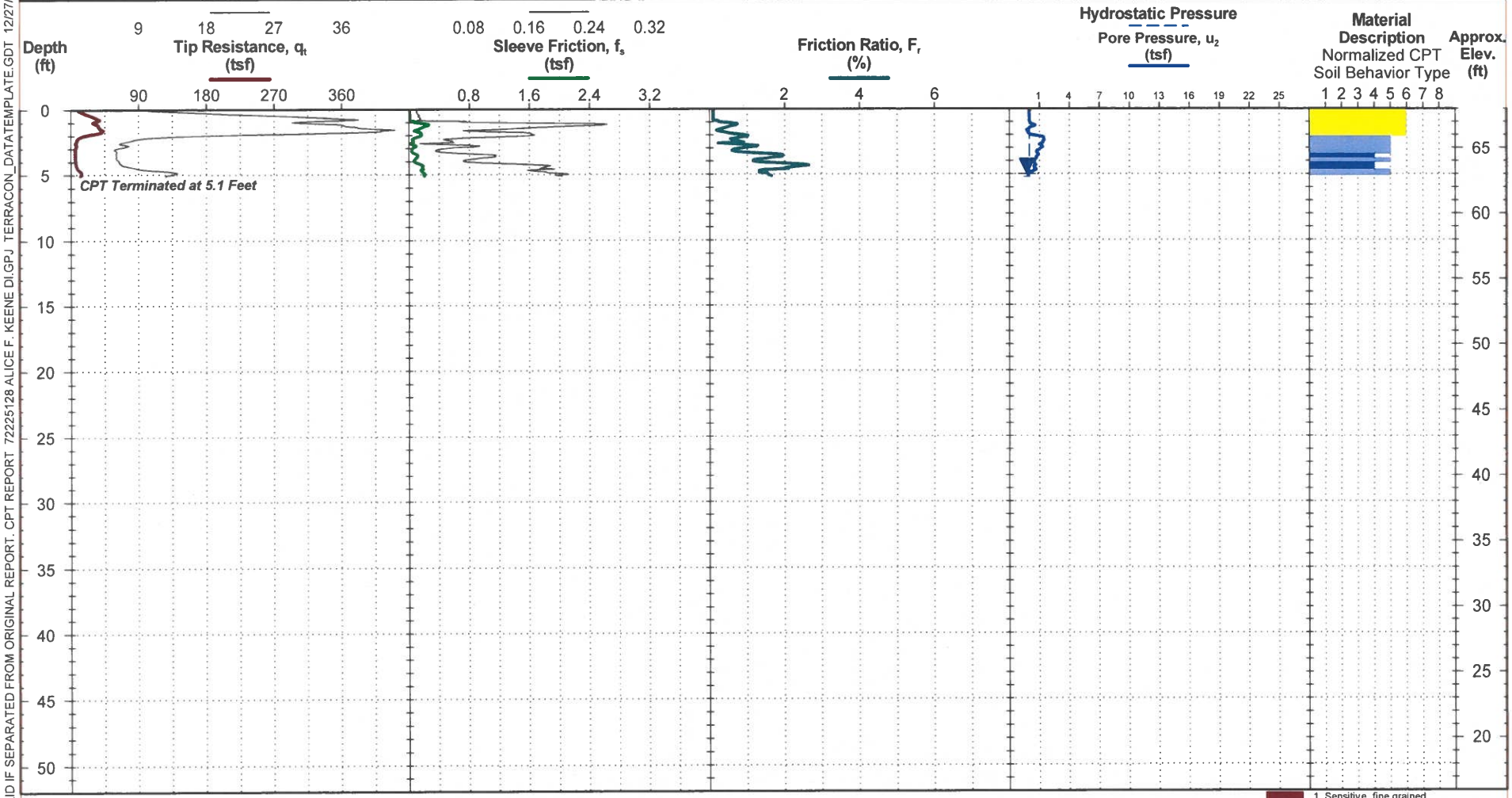
PROJECT: Alice F. Keene District Park - Proposed Gymnasium

CLIENT: Hite Associates, P.C.
Greenville, NC

SITE: 4561 County Home Road
Greenville, NC

TEST LOCATION: See Exploration Plan

Approx. Surface Elev: 68 ft +/-
Latitude: 35.54838601°
Longitude: -77.34866824°



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

Approximate elevations obtained from Google Earth Pro

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
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6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 5 ft estimated water depth
(used in normalizations and correlations; See Supporting Information)

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 12/9/2022
CPT Completed: 12/9/2022
Rig: CPT
Operator: R. Rascot
Project No.: 72225128

CPT LOG NO. P-3

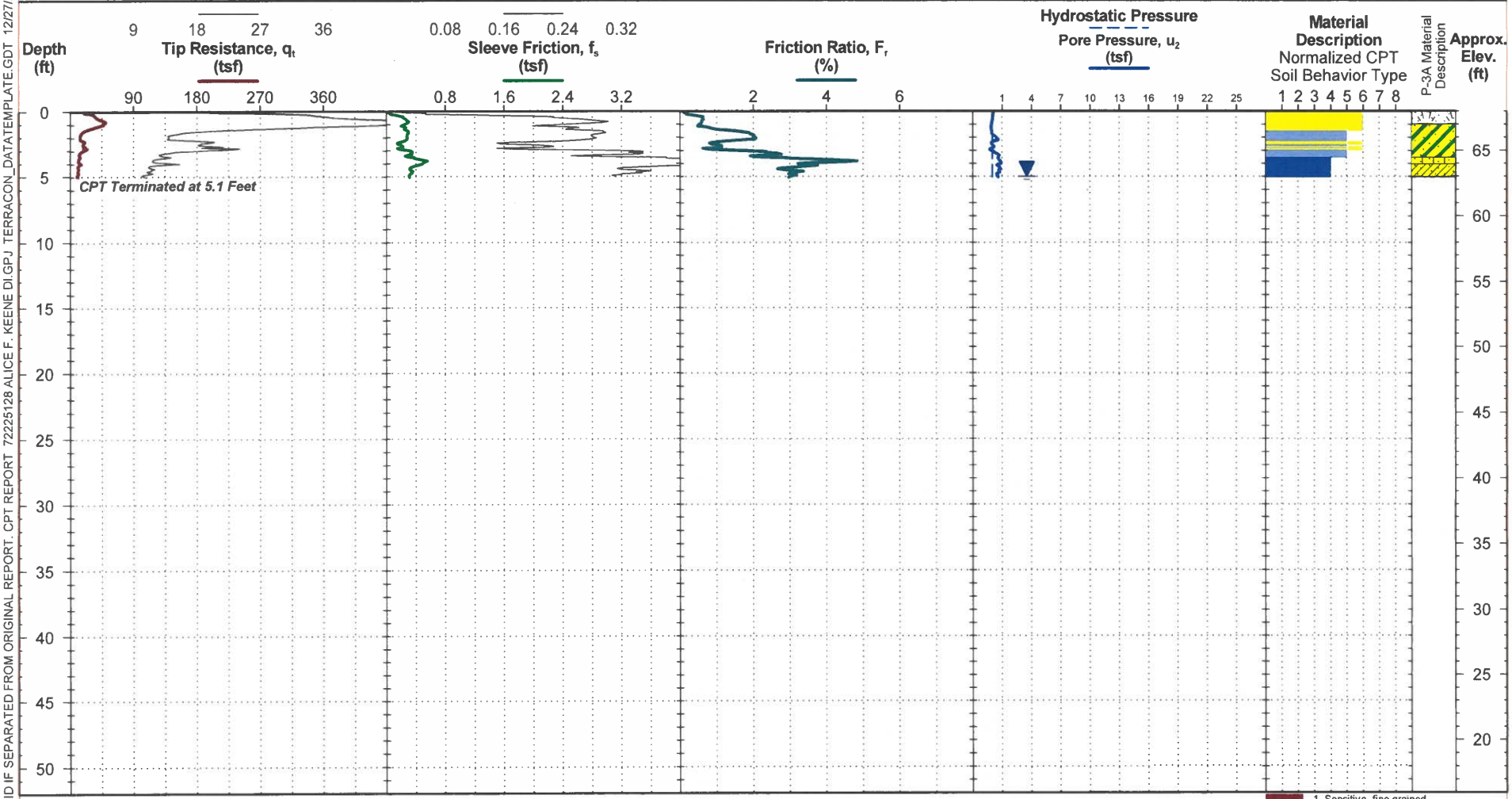
PROJECT: Alice F. Keene District Park - Proposed Gymnasium

CLIENT: Hite Associates, P.C.
Greenville, NC

SITE: 4561 County Home Road
Greenville, NC

TEST LOCATION: See Exploration Plan

Approx. Surface Elev: 68 ft +/- Adjacent Test: P-3A
Latitude: 35.54922975°
Longitude: -77.34862951°



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
Approximate elevations obtained from Google Earth Pro

See P-3A for the adjacent test's full details.
Auger anchors used as reaction force.
CPT sensor calibration reports available upon request.

1 Sensitive, fine grained
2 Organic soils - clay
3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay
5 Sand mixtures - silty sand to sandy silt
6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand
8 Very stiff sand to clayey sand
9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 5 ft estimated water depth
(used in normalizations and correlations; See Supporting Information)

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 12/9/2022 CPT Completed: 12/9/2022
Rig: CPT Operator: R. Rascot
Project No.: 72225128

Alice F. Keene District Park - Proposed Gymnasium
4561 County Home Road | Greenville, NC
Terracon Project No. 72225128

Terracon
314 Beacon Dr
Winterville, NC

Boring Log No. P-3A

Location: See Exploration Plan

Latitude: 35.5492° Longitude: -77.3486°

Model Layer	Graphic Log	Depth (Ft.)	Elevation: 68 (Ft.) +/-	Depth (Ft.)	Water Level Observations	Sample Type	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.0	**TOPSOIL**, 12-inches						
		1.0	67						
2			**CLAYEY SAND (SC)**, tannish gray and orange				14.5		35
		3.5	64.5						
		4.0	**SILTY SAND (SM)**, gray 64						
3			**SANDY LEAN CLAY (CL)**, gray				23.1		
		5.0	63	5					
			Boring Terminated at 5 Feet						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not encountered

Drill Rig
CPT

Driller
R. Rascot

Logged by

Boring Started
12-09-2022

Boring Completed
12-09-2022

Notes
Elevation Reference: Approximate elevations obtained from Google Earth Pro

Advancement Method
Direct Push

Abandonment Method

Summary of Laboratory Results

BORING ID	Depth (Ft.)	Soil Classification USCS	Water Content (%)	% Fines	Liquid Limit	Plastic Limit	Plasticity Index
B-1A	1-1.5		10.0				
B-1A	3.5-4	CLAYEY SAND(SC)	15.9	42.8	23	11	12
B-1A	5-5.5		16.4				
B-1A	9-9.5		21.6				
B-6A	1-1.5		12.6				
B-6A	2-2.5	SILTY SAND(SM)	11.3	28.7	NP	NP	NP
B-6A	5-5.5		19.4				
B-6A	8-8.5		24.5				
P-3A	1.5-2		14.5	35.4			
P-3A	4.5-5		23.1				

PROJECT: Alice F. Keene District Park - Proposed Gymnasium

PROJECT NUMBER: 72225128

SITE: 4561 County Home Road Greenville, NC

Terracon
314 Beacon Dr
Winterville, NC

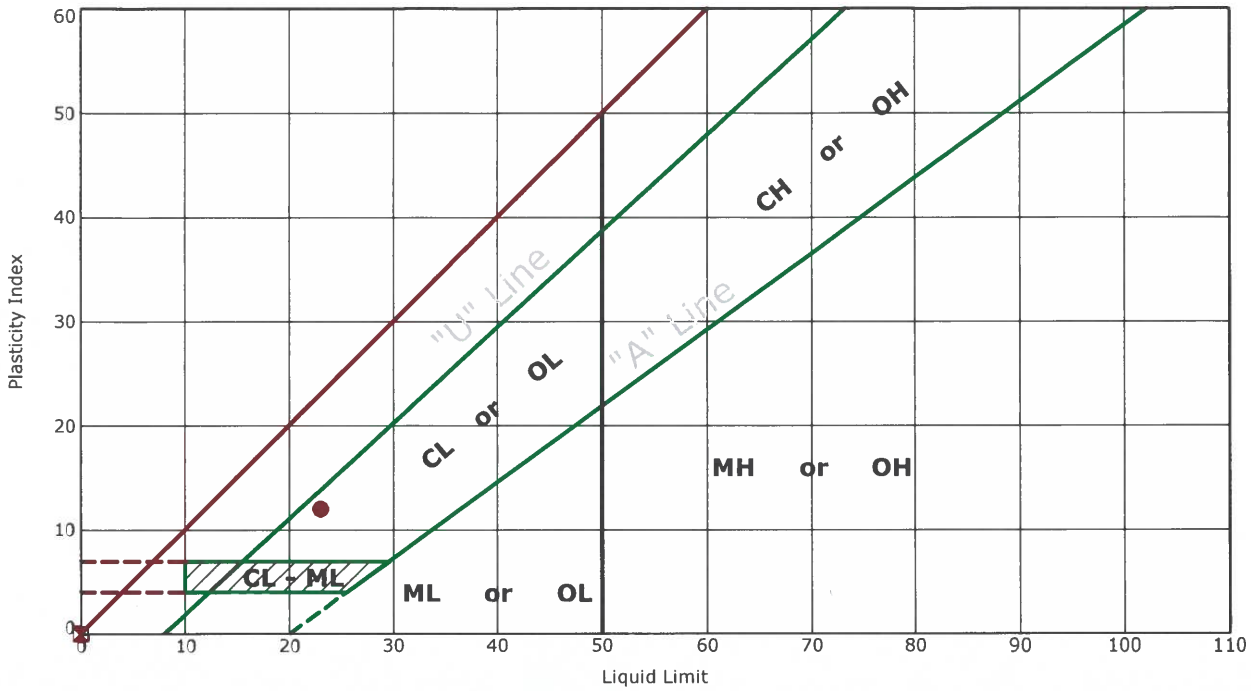
CLIENT: Hite Associates, P.C. Greenville, NC

Alice F. Keene District Park - Proposed Gymnasium
4561 County Home Road | Greenville, NC
Terracon Project No. 72225128

Terracon
314 Beacon Dr
Winterville, NC

Atterberg Limit Results

ASTM D4318



	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	B-1A	3.5 - 4	23	11	12	42.8	SC	CLAYEY SAND
⋈	B-6A	2 - 2.5	NP	NP	NP	28.7	SM	SILTY SAND

Supporting Information

Contents:

Note: All attachments are one page unless noted above.

Terracon
314 Beacon Dr
Winterville, NC

General Notes

Sampling

Water Level


Water Initially Encountered


Water Level After a Specified Period of Time


Water Level After a Specified Period of Time


Cave In Encountered

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

Field Tests

N	Standard Penetration Test Resistance (Blows/Ft.)
(HP)	Hand Penetrometer
(T)	Torvane
(DCP)	Dynamic Cone Penetrometer
UC	Unconfined Compressive Strength
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils
(More than 50% retained on No. 200 sieve.)
Density determined by Standard Penetration Resistance

Relative Density	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 50
Very Dense	> 50

Consistency of Fine-Grained Soils
(50% or more passing the No. 200 sieve.)
Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance

Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Soft	less than 0.25	0 - 1
Soft	0.25 to 0.50	2 - 4
Medium Stiff	0.50 to 1.00	4 - 8
Stiff	1.00 to 2.00	8 - 15
Very Stiff	2.00 to 4.00	15 - 30
Hard	> 4.00	> 30

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

CPT GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Terracon GeoReport

DESCRIPTION OF MEASUREMENTS AND CALIBRATIONS

To be reported per ASTM D5778:

Uncorrected Tip Resistance, q_c
Measured force acting on the cone divided by the cone's projected area

Corrected Tip Resistance, q_t
Cone resistance corrected for porewater and net area ratio effects
$q_t = q_c + u_2(1 - a)$
Where a is the net area ratio, a lab calibration of the cone typically between 0.70 and 0.85

Pore Pressure, u
Pore pressure measured during penetration
u_1 - sensor on the face of the cone
u_2 - sensor on the shoulder (more common)

Sleeve Friction, f_s
Frictional force acting on the sleeve divided by its surface area

Normalized Friction Ratio, F_r
The ratio as a percentage of f_s to q_t, accounting for overburden pressure

To be reported per ASTM D7400, if collected:

Shear Wave Velocity, V_s
Measured in a Seismic CPT and provides direct measure of soil stiffness

DESCRIPTION OF GEOTECHNICAL CORRELATIONS

Normalized Tip Resistance, Q_{tn}
$Q_{tn} = ((q_t - \sigma_{v0})/P_a)(P_a/\sigma'_{v0})^n$
$n = 0.381(I_c) + 0.05(\sigma'_{v0}/P_a) - 0.15$

Over Consolidation Ratio, OCR
$OCR\ (1) = 0.25(Q_{tn})^{1.25}$
$OCR\ (2) = 0.33(Q_{tn})$

Undrained Shear Strength, S_u
$S_u = Q_{tn} \times \sigma'_{v0}/N_{kt}$
N_{kt} is a soil-specific factor (shown on S_u plot)

Sensitivity, S_t
$S_t = (q_t - \sigma_{v0}/N_{kt}) \times (1/f_s)$

Effective Friction Angle, ϕ'
$\phi'\ (1) = \tan^{-1}(0.373[\log(q_t/\sigma'_{v0}) + 0.29])$
$\phi'\ (2) = 17.6 + 11[\log(Q_{tn})]$

Unit Weight, γ
$\gamma = (0.27[\log(F_r)]+0.36[\log(q_t/atm)]+1.236) \times \gamma_{water}$
σ_{v0} is taken as the incremental sum of the unit weights

Small Strain Shear Modulus, G_0
$G_0\ (1) = \rho V_s^2$
$G_0\ (2) = 0.015 \times 10^{(0.55Ic + 1.68)}(q_t - \sigma_{v0})$

Soil Behavior Type Index, I_c
$I_c = [(3.47 - \log(Q_{tn}))^2 + (\log(F_r) + 1.22)^2]^{0.5}$

SPT N_{60}
$N_{60} = (q_t/atm) / 10^{(1.1268 - 0.2817Ic)}$

Elastic Modulus, E_s (assumes $q/q_{ultimate} \sim 0.3$, i.e. FS = 3)
$E_s\ (1) = 2.6\Psi G_0$ where $\Psi = 0.56 - 0.33\log Q_{tn,clean\ sand}$
$E_s\ (2) = G_0$
$E_s\ (3) = 0.015 \times 10^{(0.55Ic + 1.68)}(q_t - \sigma_{v0})$
$E_s\ (4) = 2.5q_t$

Constrained Modulus, M
$M = \alpha_M(q_t - \sigma_{v0})$
For $I_c > 2.2$ (fine-grained soils)
$\alpha_M = Q_{tn}$ with maximum of 14
For $I_c < 2.2$ (coarse-grained soils)
$\alpha_M = 0.0188 \times 10^{(0.55Ic + 1.68)}$

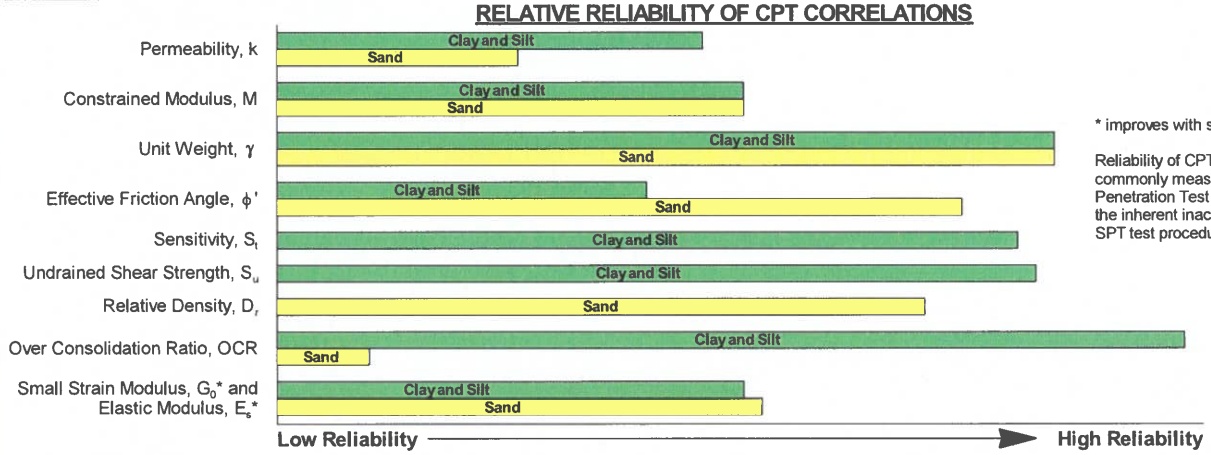
Hydraulic Conductivity, k
For $1.0 < I_c < 3.27$ $k = 10^{(0.952 - 3.04Ic)}$
For $3.27 < I_c < 4.0$ $k = 10^{(-4.52 - 1.37Ic)}$

Relative Density, D_r
$D_r = (Q_{tn} / 350)^{0.5} \times 100$

REPORTED PARAMETERS

CPT logs as provided, at a minimum, report the data as required by ASTM D5778 and ASTM D7400 (if applicable). This minimum data include q_t, f_s, and u. Other correlated parameters may also be provided. These other correlated parameters are interpretations of the measured data based upon published and reliable references, but they do not necessarily represent the actual values that would be derived from direct testing to determine the various parameters. To this end, more than one correlation to a given parameter may be provided. The following chart illustrates estimates of reliability associated with correlated parameters based upon the literature referenced below.

RELATIVE RELIABILITY OF CPT CORRELATIONS



* improves with seismic V_s measurements

Reliability of CPT-predicted N_{60} values as commonly measured by the Standard Penetration Test (SPT) is not provided due to the inherent inaccuracy associated with the SPT test procedure.

WATER LEVEL

The groundwater level at the CPT location is used to normalize the measurements for vertical overburden pressures and as a result influences the normalized soil behavior type classification and correlated soil parameters. The water level may either be "measured" or "estimated:"

Measured - Depth to water directly measured in the field

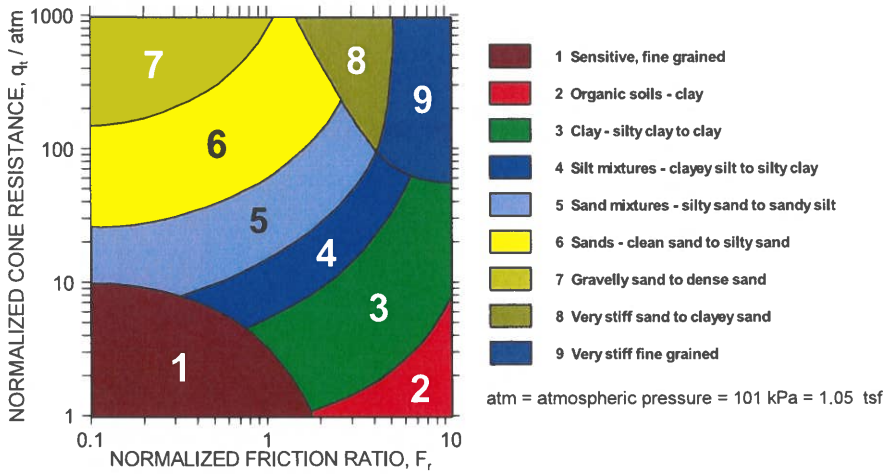
Estimated - Depth to water interpolated by the practitioner using pore pressure measurements in coarse grained soils and known site conditions

While groundwater levels displayed as "measured" more accurately represent site conditions at the time of testing than those "estimated," in either case the groundwater should be further defined prior to construction as groundwater level variations will occur over time.

CONE PENETRATION SOIL BEHAVIOR TYPE

The estimated stratigraphic profiles included in the CPT logs are based on relationships between corrected tip resistance (q_t), friction resistance (f_s), and porewater pressure (u_2). The normalized friction ratio (F_r) is used to classify the soil behavior type.

Typically, silts and clays have high F_r values and generate large excess penetration porewater pressures; sands have lower F_r's and do not generate excess penetration porewater pressures. The adjacent graph (Robertson *et al.*) presents the soil behavior type correlation used for the logs. This normalized SBT chart, generally considered the most reliable, does not use pore pressure to determine SBT due to its lack of repeatability in onshore CPTs.



atm = atmospheric pressure = 101 kPa = 1.05 tsf

REFERENCES

Kulhawy, F.H., Mayne, P.W., (1997). "Manual on Estimating Soil Properties for Foundation Design," Electric Power Research Institute, Palo Alto, CA.

Mayne, P.W., (2013). "Geotechnical Site Exploration in the Year 2013," Georgia Institue of Technology, Atlanta, GA.

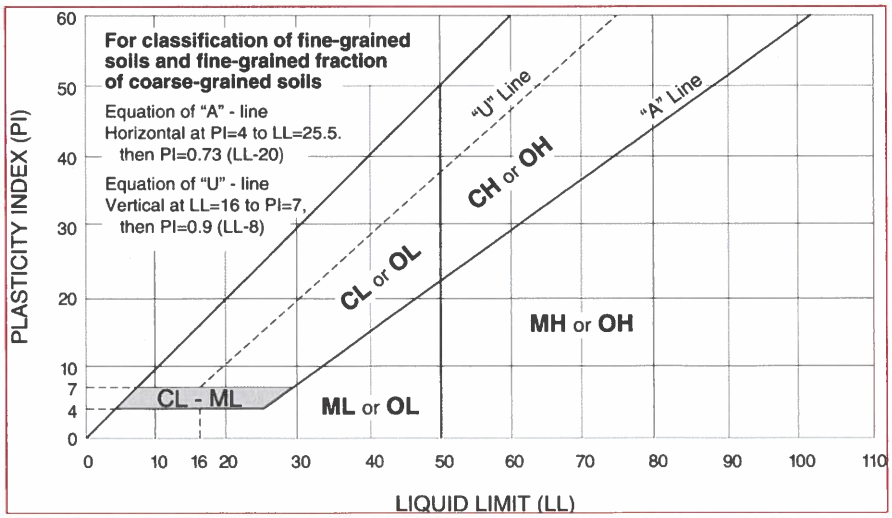
Robertson, P.K., Cabal, K.L. (2012). "Guide to Cone Penetration Testing for Geotechnical Engineering," Signal Hill, CA.

Schmertmann, J.H., (1970). "Static Cone to Compute Static Settlement over Sand," *Journal of the Soil Mechanics and Foundations Division*, 96(SM3), 1011-1043.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 4 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N] / Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P] / Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



PART 1: GENERAL

Testing laboratory services will be paid for under the cash allowance as indicated in Section 01056 Allowances, to be provided in the General Contractor's bid, as amended below.

DESCRIPTION:

Work Included: From time to time during progress of the work, the Architect may require that testing be performed to determine that materials provided for the work meet the specified requirements; such testing includes, but not necessarily limited to:

- Proofrolling, Cutting & Filling Earthwork Operations
- Soil Compaction
- Cast-In-Place Concrete & Reinforcing
- Structural Steel & Decking Connections
- Masonry Reinforcing
- Exterior Wall Light Gauge Framing
- Spray-On Foam Insulation
- Fireproofing

Related work described elsewhere: Requirements for testing may be described in various sections of these specifications and Drawings; where no testing requirements are described but the Architect decides that testing is required, the Architect may require testing to be performed under current pertinent standards for testing.

Work not included: Selection of testing laboratory: The Architect will select a pre-qualified independent testing laboratory and / or consultant.

QUALITY ASSURANCE:

Qualifications of testing laboratory: The testing laboratory will be qualified to the Architect's approval in accordance with ASTM E-329-70 "Recommended Practice for Inspection and Testing Agencies for Concrete and Steel Used in Construction".

Codes and Standards: Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

PRODUCT HANDLING:

Promptly process and distribute all required copies of test reports and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the work.

PART 2: PRODUCTS

PAYMENT FOR TESTING SERVICES:

Initial Services: All testing services shall be paid for by the General Contractor through an allowance per Section 01056 Allowances.

Retesting: When initial tests indicate non-compliance with the contract documents, all subsequent retesting occasioned by the non-compliance shall be performed by the same testing laboratory and the costs thereof will be paid for by the Contractor and not charged to the Owner for Testing.

PART 3: EXECUTION

COOPERATION WITH TESTING LABORATORY:

Representatives of the testing laboratory shall have access to the work at all times; provide facilities for such access in order that the laboratory may properly perform its function.

SCHEDULES FOR TESTING:

Establishing Schedule: By advance discussion with the testing laboratory selected by the Architect, determine the time required for the laboratory to perform its tests and to issue each of its finding.

Provide all required testing time within the construction schedule.

Revising Schedule: When changes of construction schedule are necessary during construction coordinate all such changes of schedule with the testing laboratory as required.

Adherence to Schedule: When the testing laboratory is ready to test according to the determined schedule but is prevented from testing or taking specimens due to incompleteness of work, all extra costs for testing attributable to the delay may be back-charged to the Contractor and shall not be charged to the Owner.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

GENERAL

DESCRIPTION OF WORK:

Work of this Section shall be to provide a Project Sign for each site to be purchased by the Contractor with the project cash allowance specified in 01056, constructed and painted as indicated, and erected on the site in a location selected by the Architect. The project sign shall be maintained by the Contractor until completion of the Project, and repaired and/or relocated as required during the construction period. No other signs will be allowed on the site - the General Contractor will be responsible for enforcing this provision.

END OF SECTION

ABBREVIATIONS AND NAMES: The following acronyms or abbreviations as referenced in contract documents are defined to mean the associated names. Both names and addresses are subject to change, and are believed to be, but are not assured to be, accurate and up-to-date as of date of contract documents:

AA	Aluminum Association 818 Connecticut Ave. NW; Washington DC 20006; 202/862-5100
AAMA	Architectural Aluminum Manufacturers Association 35 E. Southern Bldg.; Washington DC 20005; 202/737-4060
AAN	American Association of Nurserymen 230 Southern Bldg.; Washington, DC 20005; 202/737-4060
AASHTO	American Association of State Highway and Transportation Officials 444 North Capital St.; Washington DC 20001; 202/624-5800
AATCC	American Association of Textile Chemists and Colorists P. O. Box 12215; Research Triangle Park, NC 27709; 919/549-8141
ACI	American Concrete Institute P. O. Box 19150; Detroit, MI 48219; 313/532-2600
ACIL	American Council of Independent Laboratories 1725 K St., NW; Washington DC 20006 202/659-3766
ADC	Air Diffusion Council 230 N. Michigan Aven.; Chicago, IL 60601; 312/372-9800
AGA	American Gas Association 1515 Wilson Blvd., Arlington, VA 22209; 703/841-8400
AHAM	Association of Home Appliance Manufacturers 20 N. Wacker Dr.; Chicago, IL 60606 312/984-5800
AI	Asphalt Institute Asphalt Inst. Bldg.; College Park, MD 20740 301/277-4258
AIA	American Institute of Architects 1735 New York Ave., NW; Washington, DC 20006; 202/626-7474
A.I.A.	American Insurance Association 85 John St.; New York, NY 10038;

212/699-0400

AISC American Institute of Steel Construction
400 N. Michigan Ave.; Chicago, IL 60611;
312/670-2400

AISI American Iron and Steel Institute
1000 16th St., NW; Washington, DC 20036;
202/452-7100

AITC American Institute of Timber Construction
333 W. Hampden Ave.; Englewood, CO 80110;
303/761-3212

AMCA Air Movement and Control Association
30 W. University Dr.; Arlington Heights, IL 60004;
312/394-0150

ANSI American National Standards Institute
1430 Broadway; New York, NY 10018;
212/354-3300

APA American Plywood Association
P. O. Box 11700; Tacoma, WA 98411;
206/565-6600

ARI Air Conditioning and Refrigeration Institute
1815 N. Fort Myer Dr.; Arlington, VA 22209;
703/524-8800

ASC Adhesive and Sealant Council
1600 Wilson Blvd.; Arlington, VA 22209;
703/841-1112

ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers
1791 Tullie Circle, NE; Atlanta, Ga 30329
404/636-8400

ASME American Society of Mechanical Engineers
345 East 47th St.; New York, NY 10017;
212/705-7722

ASPE American Society of Plumbing Engineers
15233 Ventura Blvd.; Sherman Oaks, Ca. 91403
213/783-4845

ASSE American Society of Sanitary Engineering
P. O. Box 9712; Bay Village, OH 44140
216/835-3040

ASTM American Society for Testing and Materials
1916 Race St..; Philadelphia, CA 19103
215/299-5400

AWI	Architectural Woodwork Institute 2310 S. Walter Reed Dr.; Arlington, VA 22206 703/671-9100
AWPA	American Wood-Preserver's Association 7735 Old Georgetown Rd.; Bethesda, MD 20814 301/652-3109
AWPB	American Wood Preservers Bureau P. O. Box 6085; Arlington, VA 22206 703/931-8180
AWS	American Welding Society P. O. Box 351040; Miami, FL 33135 305/642-7090
AWWA	American Water Works Association 6666 W. Quincy Ave., Denver, CO 80235 303/794-7711
BHMA	Builders' Hardware Manufacturers Association (c/o TGAM) 60 East 42nd St.; New York, NY 10017 212/682-8142
BIA	Brick Institute of America 1750 Old Meadow Rd.; McLean, VA. 22102 703/893-4010
CDA	Copper Development Association 405 Lexington Ave.; New York, NY 10174 212/953-7300
CE	Corps of Engineers (U.S. Dept. of the Army) Washington, DC 20314
CFR	Code of Federal Regulations Available from Government Printing Office; Washington, DC 20402 (usually first published in Federal Register)
CISPI	Cast Iron Soil Pipe Institute 1499 Chain Bridge Rd., McLean, VA. 22101 703/827-9177
CRIGLP	CRI Green Label Plus 730 College Drive Dalton, GA 30720 706-278-3176
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Rd., Schamburg, IL 60195 312/372-5059
CS	Commercial Standard of NBS (U.S. Dept. of Commerce)

	Government Printing Office; Washington, DC 20402
DHI	Door and Hardware Institute 7711 Old Springhouse Rd., McLean, VA. 22102 703/556-3990
EIA	Electronic Industries Association 2001 Eye St., NW; Washington, DC 20006 202/457-4900
FAA	Federal Aviation Administration (U. S. Dept. of Transportation) 800 Independence Ave., SW; Washington, DC 20590
FCC	Federal Communications Commission 1919 M St., NW; Washington, D C 20554 202/632-7000
FCI	Fluid Controls Institute U.S. Highway One, Plaza 222; Tequesta, FL 33458; 305/746-6466
FGMA	Flat Glass Marketing Association 33l0 Harrison; Topeka, KS 666ll; 9l3/266-7013
FHA	Federal Housing Administration (U. S. Dept. of HUD) 451 - 7th St., SW; Washington, D C 20201
FM	Factory Mutual Engineering Corp. 1151 Boston-Providence Turnpike; Norwood, MA 02062 6l7/762-4300
FS	Federal Specification (General Services Admin.) Obtain from your Regional GSA Office, or purchase from GSA Specifications Unit (WFSIS); 7th and D Streets, SW; Washington, DC 20406; 202/472-2205 or 2140
FTI	Facing Tile Institute c/o Box 8880; Canton, OH 44711; 216/488-1211
GA	Gypsum Association 1603 Orrington Aven.; Evanston, IL 60201 312/491-1744
HPMA	Hardwood Plywood Manufacturers Association P. O. Box 2789, Reston, VA. 22090 703/435-2900
IEEE	Institute of Electrical and Electronic Engineers, Inc. 345 E. 47th St.; New York, NY 10017; 212/705-790
IESNA	Illuminating Engineering Society of North America

345 E. 47th St.; New York, NY 10017
212/705-7926

ILI — Indiana Limestone Institute of America
Stone City Bank Bldg.; Bedford, IN 47421;
812/275-4425

IRI — Industrial Risk Insurers
85 Woodland St.; Hartford, CT 06102;
203/525-260l

ISA — Instrument Society of America
P. O. Box 12277; Research Triangle Park, NC 27709;
919/549-8411

LEED — Leadership in Energy and Environmental Design
U. S. Green Building Council
1800 Massachusetts Avenue NW, Suite 300
Washington , DC 20036
(800) 795-1747

MCAA — Mechanical Contractors Association of America
5530 Wisconsin Aven.; Chevy Chase, MD 20815
202/654-7960

MIA — Marble Institute of America
33505 State St.; Farmington, MI 48024
313/476-5558

MIL — Military Standardization Documents (U.S. Dept. of Defense)
Naval Publications and Forms Center
5801 Tabor Ave.; Philadelphia, PA 19120

ML/SFA — Metal Lath/Steel Framing Association
221 N. LaSalle St.; Chicago, IL 60601
312/346-1600

MSS — Manufacturers Standardization Society of the Valve and Fittings Industry
5203 Leesburg Pike; Falls Church, VA 22041;
703/998-7996

NAAMM — National Association of Architectural Metal Manufacturers
221 N. Lasalle St.; Chicago, IL 60601
312/346-1600

NAPF — National Association of Plastic Fabricators
1701 N. St., NW; Washington, DC 20036;
202/233-2504

NBGQA — National Building Granite Quarries Association
c/o H. E. Fletcher Co.; West Chelmsford, MA 01863

NBS — National Bureau of Standards (U.S. Dept. of Commerce)
Gaithersburg, MD 20234

301/921-1000

NCMA National Concrete Masonry Association
P. O. Box 781; Herndon, VA 22070
703/435-4900

NEC National Electrical Code (by NFPA)

NEII National Elevator Industry, Inc.
600 Third Aven.; New York, NY 10016
212/986-1545

NECA National Electrical Contractors Association
7315 Wisconsin Aven.; Bethesda, MD 20814
301/657-3110

NEII National Elevator Industry, Inc.
600 Third Avenue; New York, NY 10016
212/986-1545

NEMA National Electrical Manufacturers Association
2101 L St., NW; Washington, DC 20037
202/457-8400

NFPA National Fire Protection Association
Batterymarch Park; Quincy, MA 02269
617/328-9290

NFPA National Forest Products Association
1619 Massachusetts Aven.; NW; Washington, DC 20036
202/797-5800

NHLA National Hardwood Lumber Association
P. O. box 34518; Memphis, TN 38104;
901/377-1818

NPA National Particleboard Association
2306 Perkins Pl.; Silver Spring, MD 20910;
30l/587-2204

NRCA National Roofing Contractors Association
8600 Bryn Marr Aven.; Chicago, Il. 60631
312/693-0700

NSF National Sanitation Foundation
P. O. Box 1468; Ann Arbor, MI 48106
313/769-8010

NSSEA National School Supply and Equipment Association
1500 Wilson Blvd.; Arlington, VA. 22209
703/524-8819

NTMA National Terrazzo and Mosaic Association
3166 Des Plains Ave.; Des Plains, IL 60018

312/635-7744

NWMA National Wood Manufacturers Association
205 West Touhy Avenue; Park Ridge, IL 60068;
312/823-6747

OSHA Occupational Safety Health Administration (U.S.Dept. of Labor)
Government Printing Office; Washington, DC 20402

PCI Prestressed Concrete Institute
20 N. Wacker Dr., Chicago, IL 60606
312/346-4071

PDI Plumbing and Drainage Istitute
5342 Blvd., Pl.; Indianapolis, IN 46208
317/251-5298

PEI Porcelain Enamel Institute
1911 N. Fort Myer; Arlington, VA 22209
703/527-5257

PS Product Standard of NBS (U.S. Dept. of Commerce)
Government Printing Office; Washington, DC 20402

RFCI Resilient Floor Covering Institute
1030 15th St.; NW; Washington, DC 20005
202/833-2635

RIS Redwood Inspection Service (Grading Rules)
627 Montgomery; San Francisco, CA 94111

SAMA Scientific Apparatus Makers Association
110l 16th St., NW; Washington, DC 20036
202/223-1360

SCAQMD South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765
(909) 396-2000

SDI Steel Deck Institute
P. O. Box 3812; St. Louis, MO 63122
314/965-1741

SDI Steel Door Institute
712 Lakewood Cnt. N.; Cleveland, OH 44107
216/226-7700

SHLMA Southern Hardwood Lumber Manufacturers Association
805 Sterick Bld.; Memphis, TN. 38103
901/525-8221

SIGMA Sealed Insulating Glass Manufacturers Association

	111 E. Wacker Dr.; Chicago, IL. 60601 312/644-6610
SJI	Steel Joist Institute 1703 Parham Rd.; Richmond, VA 23229 804/288-3071
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association P. O. Box 70; Merrifield, VA 22116
SPIB	Southern Pine Inspection Bureau (Grading Rules) 4709 Scenic Hwy.; Pensacola, FL 32504; 904/434-2611
SSPC	Steel Structures Painting Council 4400 5th Avenue; Pittsburgh, PA 15213; 412/578-3327
TCA	Tile Council of America P. O. Box 326, Princeton, NJ 08540; 609/921-7050
TIMA	Thermal Insulation Manufacturers Association 7 Kirby Plaza; Mt. Kisco, NY 10549; 914/241-2284
TPI	Truss Plate Institute 100 W. Church St., Frederick, MD 21701; 301/694-6100
UL	Underwriters Laboratories 333 Pfingsten Rd.; Northbrook, IL 60062; 312/272-8800
WCLIB	West Coast Lumber Inspection Bureau (Grading Rules) P. O. Box 2315; Portland, OR 97223; 503/639-0651
WIC	Woodwork Institute of California 1833 Broadway; Fresno, CA 93773; 209/233-9035
WRI	Wire Reinforcement Institute 7900 Westpark drive; McLean, VA. 22102; 703/790-9790
WSFI	Wood and Synthetic Flooring Institute 2400 E. Devon; Des Plaines, Il 60018; 312/635-7700
WWPA	Western Wood Products Association (Grading Rules) 1500 Yeon Bldg.; Portland, OR 97204; 503/224-3930

WWPA Woven Wire Products Association
108 W. Lake St.; Chicago, IL 6060l;
312/332-6502

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of demolition is shown on the Drawings. Refer to all Drawings and project phasing requirements.

Demolition may require the removal and subsequent off-site disposal of the following, but is not limited to:

Removal of asphalt or concrete paving, with curb and guttering.

Removal of building structures and structural elements, complete with foundations – including concrete floors/walks and exterior canopies.

Removal of building exterior wall and roof components.

Removal of interior walls and components.

Removal of partitions, doors and door frames.

Removal of windows and window walls.

Removal of ceiling systems, floor finishes and wall finishes.

Removal of underground elements and components; piping and accessories.

Removal of plumbing, electrical and mechanical equipment.

Cutting concrete floors, masonry walls and ceilings for piping, ducts, and conduit is included with the work of the respective mechanical and electrical Divisions 15 and 16 Specification Sections.

Locating and identification of existing underground utilities.

SUBMITTALS:

Demolition Schedule: Submit schedule indicating proposed methods and sequence of operations for selective demolition work to Owner's Representative for review prior to commencement of work. Include coordination for shut-off, capping, and continuation of utility services as required, together with details for dust and noise control protection.

Incorporate all selective demolition and abatement operations and phases into the Project CPM Schedule.

Coordinate with Owner’s continuing occupation of portions of existing building.

JOB CONDITIONS:

Occupancy: Owner will be continuously occupying the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in a manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities which will severely impact Owner's normal operations.

Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.

Protections: Provide temporary barricades and other forms of protection as required to protect personnel and general public from injury due to demolition work.

Provide interior and exterior shoring, bracing or support to prevent movement, settlement, or collapse of structure or element to be demolished, and adjacent facilities or work to remain.

Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

Protect all floors, new or existing, with suitable coverings when necessary. Example: protect flooring finishes from damage from overhead welding or torch work.

Construct temporary insulated solid dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks if required.

Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces, and installation of new construction to insure that no water leakage or damage occurs to structure or interior areas of existing building.

Remove protections at completion of work.

Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.

Traffic: Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

Do not close, block or otherwise obstruct streets, walks or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

Explosives: Use of explosives will not be permitted.

Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

Environmental Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

HAZARDOUS MATERIALS

If necessary, asbestos abatement will be performed by the Owner's separate prime contractor, with which the General Contractor shall coordinate with. Master project construction schedule shall incorporate abatement operations. Refer to and coordinate with the approved project construction schedule and the Supplementary General Conditions.

LEAD PAINT

If the building is constructed before 1978, all contractors are to assume that all painted surfaces inside the existing building may contain lead paint. The contractors are required to comply with OSHA Lead Construction Standard 29 CFR 1926.62.

All demolition debris can be disposed of at C&D landfill as long as the painted surfaces matrix has not been disturbed. For patching against the painted surfaces and painting, sanding, cutting etc. should be done by company who has received RRP certification for disturbing lead paint in a closed environment where children 6 years of age and under can enter the space during or after the work is completed. Information for RRP certification can be obtained from N. C. Health Hazard Control Unit, Raleigh, NC. Phone No. (919) 707-5950 / Don Chaney at (919) 707-5974.

Lead-Based Paint Renovation, Repair, and Painting: Firms and renovators who perform renovations in housing or child occupied facilities built before 1978 must be certified by the Health Hazards Control Unit (HHCU).

All work shall comply with requirements as published by the EPA Lead-Based Paint Renovation, Repair and Painting Rule in the Code of Federal Regulations.

Samples: For determining whether components are free of lead-based paint, certified renovators may collect paint chip samples and submit samples to a laboratory recognized by NLLAP for analysis. Required paint chip samples documentation shall be prepared and maintained by the certified renovator for three years.

At interior and exterior areas suspected to be or are tested positive for lead based paints, provide vertical containment consisting of a minimum of plastic sheeting or other impermeable material on a rigid frame, or an equivalent system of containing the work area. Vertical containment shall comply with requirements as published by the EPA Lead-Based Paint Renovation, Repair and Painting Rule in the Code of Federal Regulations.

HEPA vacuum cleaners must be designed so that all the air drawn into the machine is expelled through a HEPA filter with no air leaking past or around the filter.

Machines used to remove paint or other surface coatings through high speed operation such as sanding, grinding, power planning, abrasive blasting, or sandblasting, is prohibited on painted surfaces unless such machines have shrouds or containment systems and are equipped with a HEPA vacuum attachment to collect dust and debris at the point of generation. Machines must be operated so that no visible dust or release of air occurs outside the shroud or containment system.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

INSPECTION:

Prior to commencement of demolition work, inspect areas in which work will be performed. Photograph existing conditions of structure, surfaces, equipment or of surrounding properties which could be

misconstrued as damage resulting from selective demolition work; file with Owner's Representative prior to starting work.

LOCATING EXISTING UNDERGROUND UTILITIES:

Prior to commencement of groundbreaking work, contractor shall provide for and retain a private utilities locating firm. All underground utilities within the construction limits shall be located, marked and identified by the private utility location service, prior to any ground breaking. All information shall be documented in a contractor's As-Built drawings format.

PREPARATION:

Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

Cease operations and notify the Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

Cover and protect furniture, equipment and fixtures to remain from soiling or damage when demolition work is performed in rooms or areas from which such items have not been removed.

Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.

Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 4" studs, 5/8" drywall (joints taped) on occupied side, ½" fire-retardant plywood on demolition side, and fill partition cavity with sound-deadening insulation.

Provide weatherproof closures for exterior openings resulting from demolition work.

Locate, identify, stub off and disconnect utility services that are not indicated to remain.

DEMOLITION:

Perform demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.

Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors or framing.

Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative re-arrange selective demolition schedule as necessary to continue overall job progress without delay.

DISPOSAL OF DEMOLISHED MATERIALS:

The Owner reserves salvage rights to equipment and material, items to be determined at pre-construction conference. At request of the Owner, Contractor shall coordinate the scheduled removal of designated material to be salvaged and place said material outside of building, on site, for removal by Owner.

Remove all debris, rubbish and other materials resulting from demolition operations and not salvaged by the Owner from building site. Transport and legally dispose of materials off-site.

Hazardous materials disposal during demolition operations, shall comply with all applicable regulations, laws, and ordinances, concerning removal, handling and protection against exposure or environmental pollution.

Burning of removed materials is not permitted on project sites.

CLEAN-UP AND REPAIR:

Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.

Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior commencement of demolition work. Repair adjacent construction or surfaces soiled or damaged by demolition work to like new condition.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Extend of site clearing is shown on drawings.

Site clearing work includes, but is not limited to:

- Removal of trees and other vegetation.
- Topsoil stripping and stockpiling.
- Clearing and grubbing.

JOB CONDITIONS:

Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

Protection of Existing Improvements: Provide protection necessary to prevent damage to existing improvements indicated to remain in place.

Protect improvements on adjoining properties and on Owner's property.

Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

PART 2: PRODUCTS

Not applicable to work of this section.

PART 3: EXECUTION

SITE CLEARING:

General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated. Removal includes digging out stumps and roots, and backfill with suitable compacted fill material.

Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2" in diameter, and without weeds, roots, and other objectionable material.

Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.

Remove heavy growths of grass from areas before stripping.

Stockpile a quantity of topsoil to allow a full 3" topsoil layer to be redistributed throughout all finish grade areas.

Stockpile topsoil in storage piles in areas shown, or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind-blown dust. Provide erosion control measures around perimeters of storage piles.

Dispose of unsuitable or excess topsoil same as waste material, herein specified.

Clearing and Grubbing: Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.

Removal of Improvements: Remove existing above-grade and below-grade improvements necessary to permit construction, and other work as indicated.

DISPOSAL OF WASTE MATERIALS:

Burning on Owner's Property: Burning is allowed on the Owner's property, with proper permits.

Removal from Owner's Property: Remove waste materials and unsuitable and excess topsoil from Owner's property and dispose of off-site in legal manner.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Extent of earthwork is indicated on drawings.

Earthwork includes all excavation (removal of material) necessary to reach subgrade elevations indicated. This includes subsequent disposal of material. Preparation of subgrade for building pads, parking areas, access roads and storm drainage installation are included as part of this work.

QUALITY ASSURANCE

TESTING AND INSPECTION SERVICE:

All sub-grade and stone base shall be proof-rolled in accordance with NCDOT Standards and as directed by Engineer. Project Engineer shall be present at proof rolling.

CODES AND STANDARDS:

All work conducted as part of this are to be in compliance with NCDOT specifications for Roadway Construction.

SUBMITTALS:

Test Reports-Excavating: Submit following reports directly to Engineer from the testing services, with copy to Contractor:

Field density test reports on all trench backfill located beneath existing or proposed roadways.

JOB CONDITIONS:

Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner and Project Engineer immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.

Provide minimum of 48-hour notice to Engineer, Owner, and Local Government and receive written notice to proceed before interrupting any utility.

Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

Operate warning lights as recommended by authorities having jurisdiction.

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

PART 2: PRODUCTS

SOIL MATERIALS

DEFINITIONS:

Satisfactory soil materials are defined as those complying with ASTM D 2487 soil classification groups GW, GP, GM, SM, SW and SP.

Drainage Fill: Washed, evenly graded mixture of crushed No. 57 - Stone.

Select Backfill: Job excavated or borrow material of coarse sands, fine sands or sandy clay mixture.

Backfill Materials: Satisfactory Class I through Class VII soil materials free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen material, vegetable and other deleterious matter.

Excavation: Removal of material encountered to subgrade elevations and the reuse or disposal of materials removed. Refer to the following section for additional definitions and classified excavations.

Unauthorized Excavation: Removing materials beyond indicated invert/subgrade elevations or dimensions without direction by the design authority, or Owner. Unauthorized excavations, as well as associated remedial work directed by design authority or Owner, shall be at contractor's expense. Backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by design authority.

Subgrade: The uppermost surface of an excavation (after stripping is fully complete) or the top surface of a new fill or backfill immediately below base course, drainage course, walks, drainage fill, slab base materials, or topsoil materials.

Borrow: Suitable soil materials obtained from off-site when sufficient approved soil material is not available from on-site excavations.

Surface Course: The top layer of the pavement structure placed on aggregate base course, asphalt base course, or subgrade, as required.

Aggregate Base Course: Aggregate material layer placed between the subgrade elevation and asphalt paving course, meeting the requirements of Section 910-1, Paragraph (a) of "Standard Specifications for Roads and Structures" by NCDOT.

Bedding Course: Layer placed over excavated subgrade in trench bottoms before laying pipe.

Structures: Buildings, footings, foundations, retaining walls, slabs-on-grade, curbs, tanks, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

UNIT PRICES

Rock Measurement: Volume of rock actually removed, measured in original position (as observed and recorded by the Geotechnical Engineer), but not exceeding the following:

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. 6 inches beneath bottom of concrete slabs-on-grade.
5. 6 inches beneath bottom of footings.
6. 6 inches beneath invert elevation of pipe and/or related structures in trenches, and the greater of 24 inches wider than outside pipe diameter, or 42 inches wide (regardless of trench box sizes). 24 inches wider than related structures in trenches.

Unsuitable Soil Measurement: Volume of unsuitable soil actually removed below subgrade elevations (as recommended and classified by Owner's Geotechnical Testing Firm) measured in-place, but not exceeding the following:

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. 12 inches beneath invert elevation of pipe and/or related structures in trenches, and the greater of 24 inches wider than outside pipe diameter, or 42 inches wide (regardless of trench box sizes). 24 inches wider than related structures in trenches.
5. Minimum dimensions as recommended by Owner's Geotechnical Testing Firm in any other areas.

Unit prices for unsuitable soil and rock removal shall include all work and materials as defined in Division 1 Sections, including any required replacement with suitable fill soils or other materials, as required.

Structural Geo-Grids: Integrally Formed Biaxial Geogrid for base reinforcement and subgrade improvement formed with polypropylene polymer in roll form providing positive mechanical interlock. Provide Tensar BX1100 Geogrid.

PART 3: EXECUTION

EXCAVATION CLASSIFICATIONS:

Excavation Classifications: All excavation is classified as General Excavation except for Mass Rock, Trench Rock and Unsuitable Soil Materials as defined in this section.

General Excavation: Excavation, removal and/or disposal of pavements and other obstructions visible on surface, underground structures, utilities, and other items indicated to be demolished and/or removed; together with soil, boulders, and other materials encountered that are not classified as Mass Rock, Trench Rock, Unsuitable Soil, or unauthorized excavation.

a. Intermittent drilling, ripping or blasting to increase production and not necessary to permit excavation of materials encountered will be considered general excavation.

b. Soil (irregardless of nature) or other debris encountered above plan subgrade elevations shall be considered general excavation unless determined by the Owner's Geotechnical Testing Firm to meet the definition of Mass Rock.

Unsuitable Soil Excavation: Removal and disposal of soil materials or other debris encountered at or below plan subgrade elevations, which are deemed unsuitable to remain in place by the owner's Geotechnical Testing Firm or design authority.

a. Soil and/or other debris encountered above plan subgrade shall be considered general excavation.

b. Soil material which, in the opinion of the Owner's Geotechnical Testing Firm, can be repaired by scarifying, drying or moistening, and recompacting, or material which is made unsuitable by delay of work, lack of protection, inclement weather, or other actions of the Contractor or their Sub-Contractors shall not be considered as unsuitable soil and shall be repaired or replaced by the contractor at no additional cost to the Owner.

c. Any material moved or removed without the prior classification, measurement and approval by the Owner's Geotechnical Testing Firm or design authority will be considered as general excavation.

Mass Rock Excavation: Removal of a rock formation within an open excavation that (1) is a boulder larger than 1.5 cubic yards in one piece, or (2) cannot be excavated without systematic drilling and blasting. In the event Mass Rock (as defined above) is encountered, the Contractor shall demonstrate (at no additional cost to the owner) to the Owner's Geotechnical Testing Firm that the rock cannot be ripped with equipment equivalent to the following size and performance ratings, without systematic drilling and blasting.

a. Mass Rock Excavation Equipment: Late-model, track-type tractor rated at not les than 270 hp flywheel power with a draw bar pull of 65,000 lbs at 1 mph in the lowest available gear, and the highest normal operating rpm pulling a sharp, single-toothed shank ripper. The equipment operator should be adequately qualified and experienced with ripping rock with this type equipment.

Trench Rock Excavation: Removal of a rock formation within a trench excavation that (1) is a boulder larger than 1.0 cubic yards in one piece, or (2) cannot be excavated by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling and blasting.

a. Trench Rock Excavation Equipment: Late-model, track mounted hydraulic excavator equipped with a 42-inch wide (or smaller), short tip-radius bucket with rock teeth; rated at not less than 120-hp flywheel power with a pull of not les than 36,500-lb at a rate of 10 cubic yards per hour. The equipment operator should be adequately qualified and experienced with excavating rock with this type equipment.

Classified Excavation Requirements:

a. Excavations more than 10 feet in width and pits more than 30 feet in either length or width are defined as open excavations.

b. Contractor shall expose and clean the surface and any exposed areas of the rock material for classification and measurement (in-place) by the Owner's Geotechnical Testing Firm.

c. Do not excavate rock or unsuitable soil until it has been classified and measured by the Owner's Geotechnical Testing Firm. Any material moved or removed without the prior classification and measurement by the Owner's Geotechnical Testing Firm will be considered as unclassified excavation.

d. The Owner or the Owner's Geotechnical Testing Firm shall be the final judge on what is classified as Mass Rock, Trench Rock, or Unsuitable Soils.

e. The contractor may be required to provide equipment specification data verifying that the above minimum-rated equipment will be used for demonstration purposes. The equipment shall be in good repair and proper working condition. The contractor may be required to provide verification of the equipment operator's qualifications and experience operating the noted equipment for rock removal purposes.

f. Rippable rock, weathered rock, partially weathered rock, soft rock, or hard overburden soil, which is not classified as Mass Rock or Trench Rock according to the above definitions, shall be considered unclassified excavation.

EXCAVATION AND BACKFILL:

Roadway Excavation: Excavation for the roadways, drives, and parking areas shall conform to the lines, grades, cross sections, and dimensions indicated on the drawings and shall include the excavation of all unsuitable materials from the subgrade. Subgrade shall conform to proposed line, grade and cross-section. This operation shall include any reshaping and wetting or drying required to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material.

Proof Rolling and Undercut Excavation: When excavation has reached required subgrade elevations, provide a proof rolling of the prepared pavement subgrade with a loaded tandem axle dump truck (+25 tons) in the presence of the Owner's Geotechnical Testing Firm. The proof rolling shall be covered by the wheels of the proof rolling vehicle operating at a speed between 2 and 3 miles per hour.

Any areas that rut or pump excessively shall be allowed to dry or shall be undercut and backfilled with select material as directed by the Owner's Geotechnical Testing Firm.

After undercut and backfill operations are complete, a final proof rolling of the undercut areas will be performed in the presence of the Owner's Geotechnical Testing Firm.

Additional Excavation: When excavation has reached required invert/subgrade elevations, notify the Owner's Geotechnical Testing Firm, who will make an inspection of conditions.

Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

Do not allow water to accumulate in excavations. Remove water to prevent softening of excavation bottoms. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

Excavation for Pavement: Cut surface directly beneath proposed pavement to comply with cross-sections, elevations and grades as shown.

CONTRACTOR IS TO CONTACT NC ONE CALL 48 HOURS PRIOR TO ANY EXCAVATION. CONTRACTOR SHOULD UNDERSTAND THAT ONCE EXISTING UTILITIES ARE LOCATED THAT SAID LOCATION IS VALID ONLY FOR TEN DAYS.

Should it be necessary to cut pavement or otherwise work within a public street, the North Carolina Department of Transportation is to be contacted prior to work, and applicable permits obtained.

TRENCH BACKFILL:

Excavation, bedding, haunching & backfilling shall conform to Section 02210 TRENCHING AND BACKFILLING FOR UTILITIES, and Drawings.

Width of trenches at any point below top of pipe shall not be greater than outside diameter of pipe plus 16" for pipes measuring up to 30", and 24" for pipe measuring greater than 30", to permit satisfactory jointing and thorough tamping of bedding material under and around pipe. Care shall be taken not to over-excavate.

Bedding surface for piping shall provide a firm foundation of uniform density throughout entire length of pipe. Carefully bed pipe in a sand or stone material foundation as specified, that has been accurately shaped and rounded to conform to lowest 1/4 of outside portion of circular pipe, or lower curved portion of pipe arch for entire length of pipe or arch. When necessary, tamp bedding firmly. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making particular type joint.

Bed pipe located under pavement or building footprints in a sand or stone material foundation as specified and as indicated on Drawings.

Existing utility lines shall be protected from damage during excavation and backfilling, and, if damaged, shall be repaired by the Contractor at his expense. In the event that the Contractor damages any existing utility lines, he shall report thereof immediately. If it is determined that repairs shall be made by the Contractor, such repairs shall be ordered under terms of other sections of these specifications.

After bedding has been prepared and pipe installed, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6" in compacted depth. Bring backfill up evenly on both sides of pipe for its full length. Care shall be taken to ensure thorough compaction of fill under haunches of pipe. Thoroughly compact each layer to an elevation of at least 12" above top of pipe. Backfill and compact remainder of trench by spreading and rolling, or compact by mechanical rammers or tampers in layers not exceeding 8".

After bedding has been prepared and pipe installed for locations under pavement and building footprints, backfill and compact remainder of trench with selected Type II, III or IV material from excavation or borrow.

In compacting or rolling or operating heavy equipment parallel with pipe, displacement of or injury to pipe shall be avoided. Any pipe damaged thereby shall be repaired or replaced, at option of Engineer, and at expense of the Contractor.

When fill or backfill is required to be compacted to any specified density factor, tests shall be executed by an approved laboratory to ascertain compliance with requirements, at the expense of the Owner through the established Testing Allowance. One test shall be made for each 50 linear feet of open trench. Cost of laboratory services shall be borne by the Contractor as a part of costs for this section of work for any repeat tests for any specific area which fails to meet requirements.

Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (l degree C).

GENERAL BACKFILL:

Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

In excavations, use satisfactory excavated or borrow material.

Under grassed areas, use satisfactory excavated or borrow material.

Under walks and pavements, use subbase material, or satisfactory excavated or borrow material, or combination of both.

Backfill excavations as promptly as work permits, but not until completion of the following: Inspection, testing, approval, and recording locations of underground utilities.

Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontals so that fill material will bond with existing surface.

When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

Placement and Compaction: Place backfill and fill materials in layers not more than 8” in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.

Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content.

Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

COMPACTION:

General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D 698;

Structures, Building Slabs and Steps: Compact each layer of backfill or fill material at 95 % maximum density for cohesive material or 98 % for cohesionless material to within 2' of surface. From 2' deep to finish grade, compact 98% maximum density for cohesive material or 100% relative density for cohesionless materia.

Pavements: Compact each layer of backfill or fill material at 95% maximum dry density to within 6” of surface. From 6” deep to finish grade, compact to 100% maximum density in accordance with AASHTO-T99.

Lawn or Unpaved Areas: Compact top 6" of subgrade and each layer of backfill or fill material at 85% maximum density for cohesive soils and 90% relative density for cohesionless soils.

Walkways: Compact top 6" of subgrade and each layer of backfill or fill material at 90% maximum density for cohesive material or 95% relative density for cohesionless material.

Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

GRADING:

General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

Grade areas as shown on the Drawings to prevent ponding. Finish surface free from irregular surface changes, and as follows:

Lawn or Unpaved Areas: Finish areas to receive a minimum of 3” layer topsoil to within not more than 0.10' above or below required sub-grade elevations.

Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.05' above or below required subgrade elevation.

Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2" above or below required subgrade elevation.

Patches in driveways and roadways shall be graded to depth required to match existing pavement or to provide minimum pavement specified.

Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

PAVEMENT SUBBASE COURSE:

General: Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course.

Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12" width of shoulder simultaneously with compacting and rolling of each layer of subbase course.

Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

When a compacted subbase course is shown to be 6" thick or less, place material in a single layer. When shown to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

FIELD QUALITY CONTROL:

Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

MAINTENANCE:

Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

DISPOSAL OF EXCESS AND WASTE MATERIALS:

Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of off Owner's property.

Comply with and coordinate with the project Construction Waste Management Plan (CWMP).

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 - GENERAL

1.1 DESCRIPTION: Perform site preparations, excavation, and backfilling of all materials encountered and to the depths required to complete the work as shown on the Drawings.

1.2 EXISTING CONDITIONS: Every reasonable effort has been made to provide accurate information on existing site conditions. The Contractor should become familiar with the site and satisfy himself as to the scope of work involved and the materials to be encountered. Any significant change in conditions should be immediately brought to the attention of the Owner's representative.

PART 2 - MATERIALS

2.1 SOILS

2.1.1 General: Use soils free of organic matter, refuse, rocks and lumps greater than 4 inches in diameter and other deleterious matter.

2.1.2 Classification: For the purpose of this specification, soils to be used as fill material are grouped into seven classes according to soil properties and characteristics.

Class I	Clean gravel complying with ASTM C33, coarse aggregate No. 57.
Class II	Clean sand complying with ASTM C33, fine aggregate.
Class III	Clean gravels and sands complying with ASTM D2487, Types GW, GP, SW, and SP.
Class IV	Soil mixtures complying with ASTM D2487, Types GM, GC, SM, & SC.
Class V	Soil mixtures complying with ASTM D2487, Types ML and CL.
Class VI	Soil mixtures complying with ASTM D2487, Types MH and CL.
Class VII	Organic soil mixtures complying with ASTM D2487, Types OL, OH & PT.

PART 3 – EXECUTION

3.1 GENERAL

3.1.1 Familiarization: Prior to commencement of the earthwork, become thoroughly familiar with the site, the site conditions, and all portions of the work specified in this Section.

3.1.2 Approvals: Backfilling and grading operations shall not commence until all required inspections, tests and approvals have been completed. Work covered prior to inspection shall be uncovered for inspection purposes and backfilled at no additional cost to the Owner.

SURFACE PREPARATION

3.1.1 Clearing: Areas designated for clearing and required for construction operations shall be cleared of trees, brush, structures and other materials. Trees that are to remain shall be protected during clearing operations and subsequent work.

3.1.2 Grubbing: Roots, stumps and other materials shall be grubbed from the cleared areas to a depth of at least 18 inches. Tree stumps shall be grubbed in their entirety, including taproots where applicable.

3.1.3 Topsoil: Strip existing topsoil to a depth of 4 inches from areas to be excavated or graded. Stockpile the topsoil in a suitable area for use during final grading operations. Protect the topsoil from erosion.

3.1.4 Unsuitable Material: Remove sod, muck or other unsuitable material to firm subsoil in areas designated for filling or grading operations.

3.1.5 Disposal: Trees, stumps, roots, rubbish, unsuitable soil or other material resulting from surface preparation shall be removed from the site by the Contractor and disposed of.

3.2 EXCESS WATER CONTROL:

3.2.1 General: Grade and maintain all areas of the site to preclude surface runoff into excavations and prevent ponding of water.

3.2.2 Dewatering: Excavations shall be kept free of surface water and/or groundwater. Provide and maintain at all times the necessary means and devices to prevent water from entering the excavations and for removing all water entering the excavations.

3.3 TRENCHING, BACKFILLING AND COMPACTION FOR UTILITY SYSTEMS

3.3.1 General: Refer to specific utility sections in these Specifications for installation requirements. Trench, backfill, and compact as specified except as modified herein.

3.3.2 Trenching: Trench widths at and below the top of the pipe shall be the minimum necessary for proper installation. Trench banks above the top of the pipe shall be as vertical as practicable. Over-depth excavation shall be backfilled with suitable bedding material and compacted. The Contractor shall provide, at his expense and as directed by the Owner's testing firm representative, special bedding material or concrete encasement as may be necessary due to over excavation.

3.3.3 Depth: Trench to the lines and grades shown on the drawings. Where elevations are not shown, trench to depth sufficient to provide at least 36 inches of cover above the top of pipe, unless otherwise specified. Grade trenches to provide a constant slope free of sags and high spots.

3.3.4 Trench Bracing: Properly brace, sheet and support trench walls in strict conformance with all pertinent laws and regulations. Provide adequate bracing and shoring to protect adjacent improvements.

3.3.5 Bedding, Haunching, and Initial Backfill:

Storm sewer and sanitary sewer pipe beddings require minimum 6" No. 57 continuous Class I stone bedding material, coordinate thicknesses required with Drawing requirements. Tamp subgrade to provide firm, even bedding. Excavate bedding material to match the shape of the bottom of the pipe and bell, as detailed on the Drawings. Place Class I haunching material so as to provide full bearing around the bottom of the pipe.

Initial backfill shall be Class II, III, or IV placed in 12 inch maximum lifts to a level 12 inches above the top of pipe and compacted to a minimum 95 percent Standard Proctor by the AASHTO - T99 method. Coordinate with Drawings details.

3.3.6 Backfill: Backfill the remainder of the trench in accordance with the paragraphs below:

3.3.6.1 Pavement Areas: Compact the subgrade and fill material beneath paved areas and shoulders to a minimum 95 percent Standard Proctor by the AASHTO-T99 method. Compact top 6" of subgrade to 100 percent Standard Proctor by the AASHTO-T99 method.

3.3.6.2 Landscaped Areas: Compact the subgrade and fill to a minimum 90 percent standard proctor by the AASHTO-T99 method.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Provide soil treatment for termite control, as herein specified.

QUALITY ASSURANCE:

In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of substrate and application.

Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution.

JOB CONDITIONS:

Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

To insure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

SUBMITTALS:

Product Data: Submit manufacturer's technical data and application instructions.

SPECIFIC PRODUCT WARRANTY:

Furnish written warranty certifying that applied soil poisoning treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.

Provide warranty for a period of 5 years from date of treatment, signed by Applicator and Contractor.

PART 2: PRODUCTS

SOIL TREATMENT SOLUTION:

The pest control operator will submit the Safety Data Sheet and label of the termiticide he will use on the project. The termicide must be currently approved as a termiticide by the N. C. Structural Pest Control Committee.

PART 3: EXECUTION

APPLICATION:

Surface Preparation: Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placement of compacted fill under slabs, if recommended by toxicant manufacturer.

All treatments (excluding the rate of application and treating techniques) must be performed as outlined on the termiticide's label.

All treatments in regards to rate of application and treatment technique will be performed as outlined in the N. C. Structural Pest Control Committee's Rules and Regulations as currently applies to treatment of commercial buildings under construction.

All treatments performed pursuant to Rule. -506 shall be performed at the label recommended rate and concentration only.

Minimum Treatment Requirements:

1. Establish a vertical barrier in the soil along inside of the main foundation wall; the entire perimeter of all multiple masonry chimney bases, pillars, pilasters, and piers; and both sides of partition or inner walls with a termiticide from the top of the grade to the top of the footing.

2. After a building or structure has been completed and the excavation filled and leveled, so that the final grade has been reached along the outside of the main foundation wall, establish a vertical barrier in the soil adjacent to the outside of the main foundation wall with a termiticide from the top of the grade to the top of the footing, according to the label; except that, where drain tile, trench drains or other foundation drainage systems present a hazard of contamination outside the treatment zone, treatment shall be performed in a manner that will not introduce termiticide into the drainage system.

3. Establish a horizontal barrier in the soil within 3' of the main foundation, under slabs, such as patios, walkways, driveways, terraces, gutters, etc. Treatment shall be performed before slab is poured, but after fill material or fill dirt has been spread.

4. Establish a vertical barrier in the soil around all critical areas, such as expansion and construction joints and plumbing and utility conduits, at their point of penetration of the slab of floor or, for crawl space construction, at the point of contact with the soil.

Reapply soil treatment solution to areas distributed by subsequent excavation or other construction activities following application.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1:

DESCRIPTION OF WORK:

The work required is that necessary to conduct the construction in accordance with the requirements the North Carolina Sedimentation Pollution Control Act of 1973 and the rules and regulations promulgated pursuant to the provisions of said act.

Related Work Specified Elsewhere:

Fertilizing, Seeding and Mulching: Section 02480
Erosion Control Narrative: Section 02401

Codes and Standards: North Carolina Sedimentation Pollution Control Act of 1973 and the Rules and Regulations promulgated pursuant to the provisions of said act.

Local County Soil Erosion and Sedimentation Control Ordinance.

In the event of conflict between the regulations listed above and the requirements of these specifications, the more restrictive requirements shall apply.

PART 2: PRODUCTS

PART 3: EXECUTION

GENERAL:

Construct temporary and permanent erosion control measures as shown on the plans and as directed by the Engineer. All permanent erosion control work shall be incorporated into the project at the earliest practicable time. Temporary erosion control measures shall be coordinated with permanent erosion control measures and all other work on the project to assure economical, effective, and continuous erosion control throughout the construction and post construction period and to minimize siltation of rivers, streams, lakes, reservoirs, other water impoundments, ground surfaces, or other property.

The Contractor shall finish grade all disturbed areas and disc the ground surface upon completion of the grading.

The finish grading shall be acceptable to the Owner.

END OF SECTION

GO TO NEXT PAGE

Rivers & ASSOCIATES, INC.

ENGINEERS PLANNERS SURVEYORS LANDSCAPE ARCHITECTS

SOIL EROSION AND SEDIMENTATION CONTROL PLAN NARRATIVE

ALICE F. KEENE DISTRICT PARK

GREENVILLE, NORTH CAROLINA

MARCH 2, 2023

NORTH CAROLINA PROFESSIONAL SEAL 12324 ENGINEER J. STEPHEN JANOWSKI

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I. PROJECT DESCRIPTION

This project area includes the redevelopment of approximately 7.00 acres off of Country Home Rd.
The total area of disturbance is 7.00 acres

The temporary stockpile will have 1.5 to 1 side slopes and be for topsoil. It will be redistributed and the remainder permanently seeded. Upon the completion of the spread of topsoil it will be permanently seeded.

II. SITE DESCRIPTION

The site has slopes averaging 1.5%. Overall, elevations vary from a high point of 73 feet above sea level to 67 feet sea level. The on-site native soil consists of Lynchburg fine sandy loam and Goldsboro sandy loam.

III ADJACENT PROPERTY

The property is bounded on the west by SR1725 (County Home Rd), and on the north, east and south by woodland and agricultural land

IV. SOILS

According to the soil survey from the USDA the soil types on the site are primarily Lynchburg fine sandy loam, Goldsboro sandy loam soils.

V. PLANNED STORM WATER MANAGEMENT AND EROSION AND SEDIMENTATION CONTROL MEASURES

- **TEMPORARY GRAVEL CONSTRUCTION ENTRANCE**
  A Temporary Gravel Construction Entrance is to be used at all street connections.

- **TEMPORARY SILT FENCE**
  Temporary Silt Fences are to be placed at the toe of fill sites adjacent to the property line to collect sediment laden runoff. The silt fence will provide an excellent barrier to protect off-site facilities from sediments.

- **ROCK INLET SEDIMENT TRAP**
  To prevent sediment from entering yard inlets, grated storm drains or drop inlets during construction. This practice allows early use of the storm drain system.

- **GRASS LINED CHANNEL**
  Grass lined channels with temporary matting will be constructed at locations shown on plans.

- **TEMPORARY SKIMMER BASIN**
  This device will serve to prevent detain sediment-laden runoff and protect receiving streams, drainage systems, and adjacent property. This structure will be inspected after each period of significant rainfall and sediment will be removed and the trap restored to its original dimensions when sediment is found to have accumulated to one half of the design depth of the trap.

VI. CONSTRUCTION SCHEDULE

Phase 1

1. OBTAIN PLAN APPROVALS AND ALL APPLICABLE PERMITS.
2. FLAG LIMITS OF ROUGH GRADING.
3. HOLD PRECONSTRUCTION MEETING WITH GRADING CONTRACTOR, EROSION CONTROL ADMINISTRATOR, PROJECT ENGINEER AND OWNER BEFORE WORK BEGINS.
4. INSTALL THE PERIMETER SEDIMENT FENCES AS THE FIRST CONSTRUCTION ACTIVITY.
5. INSTALL TEMPORARY GRAVEL CONSTRUCTION ENTRANCE.
6. INSTALL CONCRETE WASHOUT PIT WITH SIGN.
7. INSTALL TEMPORARY SEDIMENT BASIN AND DIVERSION SWALES PER PLAN.
8. BEGIN CLEARING AND GRUBBING SITE IN DESIGNATED AREAS AND STOCKPILE IN DESIGNATED AREA.

Phase 2

9. INSTALL STORM DRAINAGE PIPING AND END OF DAY MEASURES.
10. INSTALL HARDWARE CLOTH AND INLET PROTECTION AROUND ALL DROP INLETS.
11. BEGIN IMPORTING FILL FOR THE CONSTRUCTION OF THE BUILDING PAD AND DRIVE AREAS.
12. FINAL GRADE THE BUILDING PAD, FINE GRADE AND POUR SIDEWALK AND LAY DOWN GRAVEL.
13. INSTALL CATCH BASIN FRAMES AND GRATES. REPLACE ROCK INLET PROTECTION WITH SEDIMENT BAGS.
14. PROVIDE A GROUND COVER (TEMPORARY OR PERMANENT) ON EXPOSED SLOPES 14 CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING FOR SLOPES 3:1 OR FLATTER INCLUDING ALL OTHER SLOPES 4:1 OR FLATTER. PROVIDE A GROUND COVER (TEMPORARY OR PERMANENT) ON EXPOSED SLOPES WITHIN 7 CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING FOR SLOPES 3:1 OR STEEPER.
15. CONSTRUCT PERMANENT SCM
16. ADDITIONAL EROSION AND SEDIMENTATION CONTROL MEASURES MAY BE REQUIRED BY THE STATE, OWNER OR CITY ENGINEER IF DEEMED NECESSARY.
17. AFTER SITE IS STABILIZED, REMOVE ALL TEMPORARY MEASURES, FINE GRADE DISTURBED AREAS, AND INSTALL PERMANENT VEGETATION ON THE DISTURBED AREAS.
18. MAINTAIN PERMANENT VEGETATION BY TOP DRESSING WITH 700 LBS PER ACRE OF FERTILIZER EVERY 6 MONTHS UNTIL THE COMPLETION OF THE PROJECT.
19. WITHIN 6" OF FINAL GRADE, RE-DISTRIBUTE 6" OF TOP SOIL
20. FINE GRADE, PERMANENTLY SEED AND MULCH ALL LANDSCAPED AREAS.
21. REMOVE ALL REMAINING TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES UPON COMPLETION AND STABILIZATION OF PROJECT.

VII. MAINTENANCE PLAN

1. All erosion and sediment control practices will be checked for stability and operation following every run-off producing rainfall but in no case less than once every week. Any needed repairs will be made immediately to maintain all practices as designed.
2. Sediment will be removed from behind the silt fence when it becomes 0.5 feet deep.
3. Sediment will be removed from the sediment trap when the storage has been approximately 50% filled. Gravel will be cleaned and replaced when the sediment pool no longer drains properly.
4. All seeded areas will be fertilized, re-seeded as necessary, and mulched according to specifications in the vegetative plan to maintain a vigorous, dense vegetative cover.

VIII. VICINITY PLAN

See Erosion Control Plan

IX. VEGETATION PLAN

See Construction Drawings

X. GROUND STABILIZATION (PER NCG010000)

1. Soil stabilization shall be achieved on any area of a site where land-disturbing activities have temporarily or permanently ceased according to the following schedule:
   a. All perimeter dikes, swales, ditches, perimeter slopes and all slopes steeper than 3 horizontal to 1 vertical (3:1) shall be provided temporary or permanent stabilization with ground cover as soon as practicable but in any event within 7 calendar days from the last land-disturbing activity.
   b. All other disturbed areas shall be provided temporary or permanent stabilization with ground cover as soon as practicable but in any event within 14 calendar days from the last land-disturbing activity.

2. Conditions - In meeting the stabilization requirements above, the following conditions or exemptions shall apply:
   a. Extensions of time may be approved by the permitting authority based on weather or other site-specific conditions that make compliance impracticable.
   b. All slopes 50' in length or greater shall apply the ground cover within 7 days except when the slope is flatter than 4:1. Slopes less than 50' shall apply ground cover within 14 days except when slopes are steeper than 3:1, the 7 day-requirement applies.
   c. Any sloped area flatter than 4:1 shall be exempt from the 7-day ground cover requirement.
   d. Slopes 10' or less in length shall be exempt from the 7-day ground cover requirement except when the slope is steeper than 2:1.
   e. Although stabilization is usually specified as ground cover, other methods, such as chemical stabilization, may be allowed on a case-by-case basis.
   f. For portions of projects within one mile and draining to trout waters and High Quality Waters as classified by the Environmental Management Commission, stabilization with ground cover shall be achieved as soon as practicable but in any event on all areas of the site within 7 calendar days from the last land-disturbing act.
   g. For portions of projects located in Outstanding Resource Waters watersheds as classified by the Environmental Management Commission, stabilization with ground cover shall be achieved as soon as practicable but in any event on all areas within 7 calendar days from the last land-disturbing act.
   h. Portions of a site that are lower in elevation than adjacent discharge locations and are not expected to discharge during construction may be exempt from the temporary ground cover requirements if identified on the approved E&SC plan or added by the permitting authority.

XI. SELF INSPECTION AND REPORTING REQUIREMENTS (PER NCG010000)

Minimum self-inspection and reporting requirements are as follows unless otherwise approved in writing by the Division of Water Quality.

1. A rain gauge shall be maintained in good working order on the site unless another rain monitoring device has been approved by the permitting authority.
2. A written record of the daily rainfall amounts shall be retained and all records shall be made available to DWQ or authorized agent upon request (Note: if no rainfall occurred, the permittee must record "zero").
3. Erosion and sedimentation control measures shall be inspected to ensure that they are operating correctly. Inspection records must be maintained for each inspection event and for each measure. At a minimum, inspection of measures must occur at the frequency indicated below:
   a. All erosion and sedimentation control measures must be inspected by or under the direction of the permittee at least once every seven calendar days, and
   b. All erosion and sediment control measures must be inspected by or under the direction of the permittee within 24 hours after any storm event of greater than 0.50 inches of rain per 24 hour period.
   c. Times when a determination that adverse weather conditions prevented inspections should be documented on the Inspection Record.
4. Once land disturbance has begun on the site, stormwater runoff discharge outfalls shall be inspected by observation for erosion, sedimentation and other stormwater discharge characteristics such as clarity, floating solids, and oil sheens. Inspections of the outfalls shall be made at least once every seven calendar days and within 24 hours after any storm event of greater than 0.50 inches of rain per 24 hour period.
5. Inspections are only required to be made during normal business hours. When adverse weather conditions would cause the safety of the inspection personnel to be in jeopardy, the inspection can be delayed until it is deemed safe to perform these duties. If the inspection cannot be done on that day, it must be completed on the following business day.
6. Twenty-four Hour Reporting for visible sediment deposition
   a. The permittee shall report to the Division of Water Quality central office or the appropriate regional office any visible sediment being deposited in any stream or wetland or any noncompliance which may endanger health or the environment. (See Section IX of this permit for contact information.) Any information shall be provided orally or electronically within 24 hours from the time the permittee became aware of the circumstances. Visible discoloration or suspended solids in the effluent should be recorded on the Inspection Record as provided below.
   b. A written submission shall be provided to the appropriate regional office of the DWQ within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the sediment deposition and actions taken to address the cause of the deposition. The Division of Water Quality staff may waive the requirement for a written report on a case-by-case basis.

7. Records of inspections made during the previous 30 days shall remain on the site and available for agency inspectors at all times during normal working hours, unless the permitting authority provides a site-specific exemption based on unique site conditions that make this requirement not practical. Older records must be maintained for a period of one year after project completion and made available upon request. The records must provide the details of each inspection including observations, and actions taken in accordance with this permit. The permittee shall record the required rainfall and monitoring observations on the "Inspection Record for Activities Under Stormwater General Permit NCG010000" form provided by the Division or a similar inspection form that is inclusive of all of the elements contained in the Division's form. Electronic storage of records will be allowed if approved by the permitting authority.
8. Inspection records must include, at a minimum, the following:
    a. Control Measure Inspections: Inspection records must include at a minimum:
        1. identification of the measures inspected,
        2. date and time of the inspection,
        3. name of the person performing the inspection,
        4. indication of whether the measures were operating properly,
        5. description of maintenance needs for the measure,
        6. corrective actions taken and
        7. date of actions taken.
    b. Stormwater Discharge Inspections: Inspection records must include at a minimum:
        1. identification of the discharge outfall inspected,
        2. date and time of the inspection,
        3. name of the person performing the inspection,
        4. evidence of indicators of stormwater pollution such as oil sheen, floating or suspended solids or discoloration,
        5. indication of visible sediment leaving the site,
        6. actions taken to correct/prevent sedimentation and
        7. date of actions taken.
    c. Visible Sedimentation Found Outside the Site Limits: Inspection records must include:
        1. an explanation as to the actions taken to control future releases,
        2. actions taken to clean up or stabilize the sediment that has left the site limits and
        3. the date of actions taken.
    d. Visible Sedimentation Found in Streams or Wetlands: All inspections should include evaluation of streams or wetlands onsite or offsite (where accessible) to determine if visible sedimentation has occurred.
9. Visible Stream Turbidity - If the discharge from a site results in visible stream turbidity, inspection records must record that evidence and actions taken to reduce sediment contributions. Sites discharging to streams named on the state's 303(d) list as impaired for sediment-related causes may be required to perform additional monitoring, inspections or application of more-stringent management practices if it is determined that the additional requirements are needed to assure compliance with the federal or state impaired-waters conditions. If a discharge covered by this permit enters a stream segment that is listed on the Impaired Stream List for sediment-related causes, and a Total Maximum Daily Load (TMDL) has been prepared for those pollutants, the permittee must implement measures to ensure that the discharge of pollutants from the site is consistent with the assumptions and meets the requirements of the approved TMDL. The DWQ 303(d) list can be found at: http://h2o.enr.state.nc.us/tmdl/General_303d.htm/

XII. EROSION AND SEDIMENTATION CONTROL DEVICES

- All erosion and sedimentation control devices shall remain in place and be maintained by the Contractor until all seeding is established and construction areas have been stabilized.

XIII. TEMPORARY SEEDING

- Seed in accordance with Soil Conservation Service recommendations with regard to seed type, rate of application, fertilizer, etc.

XIV. SPECIFICATIONS AND DETAILS

1. 6.02 Land Grading

a. Construct and maintain all erosion and sedimentation control practices and measures in accordance with the approved sedimentation control plan and construction schedule.
b. Remove good topsoil from areas to be graded and filled, and preserve it for use in finishing the grading of all critical areas.
c. Scarify areas to be topsoiled to a minimum depth of 2 inches before placing topsoil (Practice 6.04, Topsoiling).
d. Clear and grub areas to be filled by removing trees, vegetation, roots, or other objectionable material that would affect the planned stability of the fill.
e. Ensure that fill material is free of brush, rubbish, rocks, logs, stumps, building debris, and other materials inappropriate for constructing stable fills.
f. Place all fill in layers not to exceed 9 inches in thickness, and compact the layers as required to reduce erosion, slippage, settlement, or other related problems.
g. Do not incorporate frozen, soft, mucky, or highly compressible materials into fill slopes.
h. Do not place fill on a frozen foundation, due to possible subsidence and slippage.
i. Keep diversions and other water conveyance measures free of sediment during all phases of development.

j. Handle seeps or springs encountered during construction in accordance with approved methods (Practice 6.81, Subsurface Drain).
k. Permanently stabilize all graded areas immediately after final grading is completed on each area in the grading plan. Apply temporary stabilization measures on all graded areas when work is to be interrupted or delayed for 30 working days or longer.
l. Show topsoil stockpiles, borrow areas, and spoil areas on the plans, and make sure they are adequately protected from erosion. Include final stabilization of these areas in the plan.

2. 6.06 Temporary Gravel Construction Entrance

a. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade it.
b. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it.
c. Provide drainage to carry water to a sediment trap or other suitable outlet.
d. Use geotextile fabrics because they improve stability of the foundation in locations subject to seepage or high water table.

3. 6.14 Mulching

e. Select a material based on site and practice requirements, availability of material, labor, and equipment. Table 6.14a lists commonly used mulches and some alternatives.
f. Before mulching, complete the required grading, install sediment control practices, and prepare the seedbed. Apply seed before mulching except in the following cases:
   - Seed is applied as part of a hydroseeder slurry containing wood fiber mulch.
   - A hydroseeder slurry is applied over straw.

g. APPLICATION OF ORGANIC MULCH

Organic mulches are effective where they can be tacked securely to the surface.
Material and specifications are given in Table 6.14a.

Spread mulch uniformly by hand, or with a mulch blower. When spreading straw mulch by hand, divide the area to be mulched into sections of approximately 1,000 ft2, and place 70-90 lb of straw (1 1/2 to 2 bales) in each section to facilitate uniform distribution. After spreading mulch, no more than 25% of the ground surface should be visible. In hydroseeding operations a green dye, added to the slurry, assures a uniform application.

h. ANCHORING ORGANIC MULCH

Straw mulch must be anchored immediately after spreading. The following methods of anchoring mulch may be used:

Mulch anchoring tool—A tractor-drawn implement designed to punch mulch into the soil, a mulch anchoring tool provides maximum erosion control with straw. A regular farm disk, weighted and set nearly straight, may substitute, but will not do a job comparable to the mulch anchoring tool. The disk should not be sharp enough to cut the straw. These methods are limited to slopes no steeper than 3:1, where equipment can operate safely. Operate machinery on the contour.

Liquid mulch binders—Application of liquid mulch binders and tackifiers should be heaviest at the edges of areas and at crests of ridges and banks, to resist wind. Binder should be applied uniformly to the rest of the area. Binders may be applied after mulch is spread, or may be sprayed into the mulch as it is being blown onto the soil. Applying straw and binder together is the most effective method. Liquid binders include asphalt and an array of commercially available synthetic binders.

Emulsified asphalt is the most commonly used mulch binder. Any type thin enough to be blown from spray equipment is satisfactory. Asphalt is classified according to the time it takes to cure. Rapid setting (RS or CRS designation) is formulated for curing in less than 24 hours, even during periods of high humidity; it is best used in spring and fall. Medium setting (MS or CMS) is formulated for curing within 24 to 48 hours, and slow setting (SS or CSS) is formulated for use during hot, dry weather, requiring 48 hours or more curing time.

Apply asphalt at 0.10 gallons per square yard (10 gal/1,000 ft2). Heavier applications cause straw to “perch” over rills.

In traffic areas, uncured asphalt can be picked up on shoes and cause damage to rugs, clothing etc. Use types RS or CRS to minimize such problems.

Synthetic binders such as Petroset, Terratack, and Aerospray may be used, as recommended by the manufacturer, to anchor mulch. These are expensive, and therefore usually used in small areas or in residential areas where asphalt may be a problem (Use of trade names does not constitute an endorsement).

Mulch nettings—Lightweight plastic, cotton, jute, wire, or paper nets may be stapled over the mulch according to the manufacturer’s recommendations (see “Nets and Mats” below).

Peg and twine—Because it is labor-intensive, this method is feasible only in small areas where other methods

cannot be used. Drive 8-10 inch wooden pegs to within 3 inches of the soil surface, every 4 feet in all directions. Stakes may be driven before or after straw is spread. Secure mulch by stretching twine between pegs in a criss-cross-within-a-square pattern. Turn twine two or more times around each peg. Twine may be tightened over the mulch by driving pegs further into the ground.

Vegetation—Rye (grain) may be used to anchor mulch in fall plantings, and German millet in spring. Broadcast at 15 lb/acre before applying mulch.

i. CHEMICAL MULCHES

Chemical mulches may be effective for soil stabilization if used between May 1 and June 15, or Sept. 15 and Oct. 15, provided that they are used on slopes no steeper than 4:1, and that proper seedbed preparation has been accomplished, including surface roughening where required.

Chemical mulches may be used to bind other mulches, or with wood fiber in a hydroseeded slurry at any time. Follow the manufacturer's recommendations for application.

j. FIBERGLASS ROVING

Fiberglass roving ("roving") is wound into a cylindrical package so that it can be continuously withdrawn from the center using a compressed air ejector. Roving expands into a mat of glass fibers as it contacts the soil surface. It is often used over a straw mulch, but must still be tacked with asphalt.

Spread roving uniformly over the area at a rate of 0.25 to 0.35 lb/yd2. Anchor with asphalt immediately after application, at a rate of 0.25 to 0.35 gal/yd2.

As a channel lining, and at other sites of concentrated flow, the roving mat must be further anchored to prevent undermining. It may be secured with stakes placed at intervals no greater than 10 feet along the drainageway, and randomly throughout its width, but not more than 10 feet apart. As an option to staking, the roving can be buried to a depth of 5 inches at the upgrade end and at intervals of 50 feet along the length of the channel.

k. NETS AND MATS

Nets alone generally provide little moisture conservation benefits and onlylimited erosion protection. Therefore, they are usually used in conjunction with an organic mulch such as straw.

Except when wood fiber slurry is used, netting should always be installed over the mulch. Wood fiber may be sprayed on top of an installed net.

Mats, including "excelsior" (wood fiber) blankets, are considered protective mulches and may be used alone, on erodible soils, and during all times of the year. Place the matting in firm contact with the soil, and staple securely.

l. INSTALLATION OF NETTING AND MATTING

Products designed to control erosion should be installed in accordance with manufacturer's instructions. Any mat or blanket-type product used as a protective mulch should provide cover of at least 30% of the surface where it is applied. Installation is illustrated in Figure 6.14a.

1. Apply lime, fertilizer, and seed before laying the net or mat.
2. Start laying the net from the top of the channel or slope, and unroll it down the grade. Allow netting to lay loosely on the soil or mulch cover but without wrinkles—do not stretch.
3. To secure the net, bury the upslope end in a slot or trench no less than 6 inches deep, cover with soil, and tamp firmly as shown in Figure 6.14a. Staple the net every 12 inches across the top end and every 3 ft around the edges and bottom. Where 2 strips of net are laid side by side, the adjacent edges should be overlapped 3 inches and stapled together. Each strip of netting should also be stapled down the center, every 3 ft. Do not stretch the net when applying staples.
4. To join two strips, cut a trench to anchor the end of the new net. Overlap the end of the previous roll 18 inches, as shown in Figure 6.14a, and staple every 12 inches just below the anchor slot.

4. 6.51 Hardware Cloth & Gravel Inlet Protection (Temporary)

a. Uniformly grade a shallow depression approaching the inlet.
b. Drive 5-foot steel posts 2 feet into the ground surrounding the inlet. Space posts evenly around the perimeter of the inlet, a maximum of 4 feet apart.
c. Surround the posts with wire mesh hardware cloth. Secure the wire mesh to the steel posts at the top, middle, and bottom. Placing a 2-foot flap of the wire mesh under the gravel for anchoring is recommended.
d. Place clean gravel (NC DOT #5 or #57 stone) on a 2:1 slope with a height of 16 inches around the wire, and smooth to an even grade.

e. Once the contributing drainage area has been stabilized, remove accumulated sediment, and establish final grading elevations.
f. Compact the area properly and stabilized it with groundcover.

5. 6.62 Temporary Sediment Fence

a. MATERIALS

1. Use a synthetic filter fabric of at least 95% by weight of polyolefins or polyester, which is certified by the manufacturer or supplier as conforming to the requirements in ASTM D 6461, which is shown in part in Table 6.62b.
   Synthetic filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120º F.
2. Ensure that posts for sediment fences are 1.33 lb/linear ft steel with a minimum length of 5 feet. Make sure that steel posts have projections to facilitate fastening the fabric.
3. For reinforcement of standard strength filter fabric, use wire fence with a minimum 14 gauge and a maximum mesh spacing of 6 inches.

6. 6.64 Skimmer Sediment Basin

a. Site preparations- Clear, grub, and strip topsoil from areas under the

embankment to remove trees, vegetation, roots, and other objectionable material.

Delay clearing the pool area until the dam is complete and then remove brush, trees, and other objectionable materials to facilitate sediment cleanout. Stockpile all topsoil or soil containing organic matter for use on the outer shell of the embankment to facilitate vegetative establishment. Place temporary sediment control measures below the basin as needed.

b. Cut-off trench- Excavate a cut-off trench along the center line of the earth fill embankment. Cut the trench to stable soil material, but in no case make it less than 2 feet deep. The cut-off trench must extend into both abutments to at least the elevation of the riser crest. Make the minimum bottom width wide enough to permit operation of excavation and compaction equipment, but in no case less than 2 feet. Make side slopes of the trench no steeper than 1:1. Compaction requirements are the same as those for the embankment. Keep the trench dry during backfilling and compaction operations.

c. Embankment- Take fill material from the approved areas shown on the plans.
It should be clean mineral soil, free of roots, woody vegetation, rocks, and other objectionable material. Scarify areas on which fill is to be placed before placing fill.
The fill material must contain sufficient moisture so it can be formed by hand into a ball without crumbling. If water can be squeezed out of the ball, it is too wet for proper compaction. Place fill material in 6-to-8-inch continuous layers over the entire length of the fill area and compact it. Compaction may be obtained by routing the construction hauling equipment over the fill so that the entire surface of each layer is traversed by at least one wheel or tread track of heavy equipment, or a compactor may be used.
Construct the embankment to an elevation 10 percent higher than the design height to allow for settling.

d. Conduit spillways- Securely attach the riser to the barrel or barrel stub to make a watertight structural connection. Secure all connections between barrel sections by approved watertight assemblies. Place the barrel and riser on a firm, smooth foundation of impervious soil. Do not use pervious material such as sand, gravel, or crushed stone as backfill around the pipe or anti-seep collars. Place the fill material around the pipe spillway in 4-inch layers, and compact it under and around the pipe to at least the same density as the adjacent embankment. Care must be taken not to raise the pipe from firm contact with its foundation when compacting under the pipe haunches.

Place a minimum depth of 2 feet of compacted backfill over the pipe spillway before crossing it with construction equipment. Anchor the riser in place by concrete or other satisfactory means to prevent flotation. In no case should the pipe conduit be installed by cutting a trench through the dam after the embankment is complete

e. Emergency spillway- Install the emergency spillway in undisturbed soil. The achievement of planned elevations, grade, design width, and entrance and exit channel slopes are critical to the successful operation of the emergency spillway.

f. Inlets- Discharge water into the basin in a manner to prevent erosion. Use diversions with outlet protection to divert sediment-laden water to the upper end of the pool area to improve basin trap efficiency (*References: Runoff Control Measures and Outlet Protection*).

g. Erosion control- Construct the structure so that the disturbed area is minimized. Divert surface water away from bare areas. Complete the embankment before the area is cleared. Stabilize the emergency

spillway embankment and all other disturbed areas above the crest of the principal spillway immediately after construction (*References: Surface Stabilization*).

h. Install porous baffles as specified in Practice 6.65, Porous Baffles.

i. Safety- Sediment basins may attract children and can be dangerous. Avoid steep side slopes, and fence and mark basins with warning signs if trespassing is likely. Follow all state and local requirements.

APPENDIX

CALCULATIONS


SITE
1711
1725
Doris Cir
Worthington Ln
McLawhorn Farm Rd
Arrowhead Dr
Worthington Rd
County Home Rd
N
Google Earth

IDF Curve - Rainfall Intensity

Alice Keene, Greenville, NC

Input Data from NOAA	Average recurrance interval (years)					
T (min)	1	2	5	10	25	100
10	0.712	0.831	0.954	1.08	1.21	1.43
15	0.89	1.05	1.21	1.37	1.54	1.81
30	1.22	1.44	1.72	1.98	2.28	2.77

Calculation of Design Rainfall Intensity, i, using the equation: $i = g/(h + T)$

1 yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0087
10	4.27	0.23	Intercept = h/g	0.1480
15	3.56	0.28	**g** = 1/slope	**114.4**
30	2.44	0.41	**h** = g*intercept	**16.9**

2yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0073
10	4.99	0.20	Intercept = h/g	0.1278
15	4.20	0.24	**g** = 1/slope	**136.6**
30	2.88	0.35	**h** = g*intercept	**17.5**

5 yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0058
10	5.72	0.17	Intercept = h/g	0.1185
15	4.84	0.21	**g** = 1/slope	**173.8**
30	3.44	0.29	**h** = g*intercept	**20.6**

10 yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0049
10	6.48	0.15	Intercept = h/g	0.1074
15	5.48	0.18	**g** = 1/slope	**206.0**
30	3.96	0.25	**h** = g*intercept	**22.1**

25 yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0040
10	7.26	0.14	Intercept = h/g	0.0996
15	6.16	0.16	**g** = 1/slope	**249.2**
30	4.56	0.22	**h** = g*intercept	**24.8**

100 yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0031
10	8.58	0.12	Intercept = h/g	0.0880
15	7.24	0.14	**g** = 1/slope	**321.3**
30	5.54	0.18	**h** = g*intercept	**28.3**

1 year storm

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107 East Second Street
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(252) 752-4135
F-0334

STORM WATER DETENTION ROUTING
FOR
Alice Keene, Greenville, NC

10 Year 24-Hour Storm
2/20/2023

Site Conditions Predevelopment

Total watershed area						32.51	acres
Impervious	C=	0.95	CN=	95		1.07	acres
Lawn	C=	0.15	CN=	55		7.18	acres
Pasture	C=	0.45	CN=	60		24.26	acres
SCS Soil Group	Ly, GoA						
Hydraulic Length		Overland	330.00	Channelized		973.00	feet
Vertical Relief		Overland	1.00	Channelized		3.60	feet
10 Year 24h Rainfall						5.88	inches

Time of Concentration
channel flow

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
	12.67	+	13.49	38.82	minutes
Travel Factor	2.00		1.00		

Composite C = 0.40

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

$$I = \frac{g}{(h+T)}$$

	R	g	h		
Rainfall Intensity				3.38	inches per hr
	10	**206.0**	**22.1**		

Peak Discharge $Q = CIA$ **43.97** cfs

Site Conditions Post Development

Total watershed area						32.51	acres
Impervious	C=	0.95	CN=	95		3.08	acres
Lawn	C=	0.15	CN=	95		5.36	acres
Pasture	C=	0.45	CN=	60		24.07	acres
SCS Soil Group	Ly, GoA						
Hydraulic Length		Overland	330.00	Channelized		973.00	feet
Vertical Relief		Overland	1.00	Channelized		3.60	feet
10 yr 24 h rainfall						5.88	inches

Design Hydrograph Formulation

Composite CN 69.1

$$S = \frac{1000}{CN} - 10$$ 4.47

Runoff

$$Q^* = \frac{(P - 0.2S)^2}{P + 0.8S}$$ 2.63 inches

Time of Concentration
channel flow (not overland)

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
	12.67	+	13.49	38.82	minutes
Travel Factor	2.0		1.0		

Composite C = 0.45

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

$$I = \frac{g}{(h+T)}$$

	R	g	h		
Rainfall Intensity				3.38	inches per hr
	10	**206.0**	**22.1**		

Peak Discharge $Q = CIA$ **49.21 cfs**

Time to peak $T_p = \frac{Vol}{1.39 Q_p}$ 75.5 minutes

Storage Required $S = (Q_p - Q_o) T_p$ 23,756 cf
(Above 1st inch of runoff pool)

Allowable release at impoundment (pre-bypass) =	43.97 cfs
Peak rate of inflow at impoundment (pre-bypass) =	49.21 cfs
Allowable release at impoundment(post-bypass)=	**14.36** cfs
Peak rate of inflow at impoundment (post-bypass) =	**19.60** cfs

BYPASSED FLOW

	Area(ac)	C	I(in/hr)
Impervious	0.34	0.95	
Pasture	18.75	0.45	
Lawn	0.00	0.15	
Total	19.09	0.46	3.38

$Q_{bypassed}$ **29.61 cfs**

STAGE STORAGE DATA

Elevation	surface area	diff. elev	storage	accum. storage	Elevation	Stage
62.50	16,666				62.50	
		0.50	9,077			
63.00	19,643			9,077	63.00	0.5
		1.00	20,579			
64.00	21,514			29,656	64.00	1.50
		1.00	22,479			
65.00	23,444			52,135	65.00	2.5
		1.00	24,432			
66.00	25,419			76,566	66.00	3.5
		1.00	26,437			
67.00	27,454			103,003	67.00	4.5
		1.00	28,509			
68.00	29,564			131,512	68.00	5.5

Storage	Stage	LN(storage)	LN(Stage)	Z Computed Stage
76,566	3.5	11.25	1.25	3.53
103,003	4.5	11.54	1.50	4.50
131,512	5.5	11.79	1.70	5.50

$$b = \frac{\ln\left(\frac{S_2}{S_1}\right)}{\ln\left(\frac{Z_2}{Z_1}\right)}$$ 1.22

$$K_s = \frac{S_2}{Z_2{}^b}$$ 16,500.03

$$Z = \left[\frac{S}{K_s}\right]^{1/b}$$ 24.97

63.50 feet msl

Size Outlet Device for Control Structure

invert elevation =	62.50	feet msl
estimated orifice center elev. =	62.55	feet msl
proposed water surface elev. =	63.50	feet msl
Average head (h) =	0.33	feet
discharge (d) =	14.4	cfs
coefficient of discharge =	0.6	

Orifice equation

$$Q = C_d A\sqrt{2gh}$$

2.57 inches estimated based on 10 yr
1.25 inches try based on 1 yr

Inflow Hydrograph

Peak Inflow =	49.21	**19.60**
Time to Peak =	75.5 min	94.42

Time T (min)	Inflow Q (cfs)	Orifice Outflow Q (cfs)	Principal Outflow Q (cfs)	Structure Overflow Q (cfs)	Emerg Spillway Q (cfs)	Total Outflow Q (cfs)
0	0.00	0.00	0.00	0.0	0.0	0.0
3.00	0.08	0.00	0.00	0.0	0.0	0.0
6.00	0.30	0.00	0.00	0.0	0.0	0.0
9.00	0.68	0.00	0.00	0.0	0.0	0.0
12.00	1.19	0.00	0.00	0.0	0.0	0.0
15.00	1.84	0.00	0.00	0.0	0.0	0.0
18.00	2.62	0.01	0.00	0.0	0.0	0.0
21.00	3.50	0.02	0.00	0.0	0.0	0.0
24.00	4.49	0.02	0.00	0.0	0.0	0.0
27.00	5.55	0.03	0.00	0.0	0.0	0.0
30.00	6.68	0.04	0.00	0.0	0.0	0.0
33.00	7.86	0.04	0.00	0.0	0.0	0.0
36.00	9.07	0.05	0.00	0.0	0.0	0.0
39.00	10.30	0.05	0.00	0.0	0.0	0.1
42.00	11.51	0.06	0.00	0.0	0.0	0.1
45.00	12.70	0.07	0.00	0.0	0.0	0.1
48.00	13.84	0.07	0.00	0.0	0.0	0.1
51.00	14.92	0.08	0.00	0.0	0.0	0.1
54.00	15.92	0.08	0.14	0.0	0.0	0.2
57.00	16.82	0.09	0.42	0.0	0.0	0.5
60.00	17.62	0.09	0.76	0.0	0.0	0.9
63.00	18.29	0.10	1.19	0.0	0.0	1.3
66.00	18.84	0.10	1.68	0.0	0.0	1.8
69.00	19.24	0.11	2.23	0.0	0.0	2.3
72.00	19.50	0.11	2.78	0.0	0.0	2.9
75.00	19.60	0.11	3.32	0.0	0.0	3.4
78.00	19.55	0.12	3.94	0.0	0.0	4.1
81.00	19.36	0.12	4.50	0.0	0.0	4.6
84.00	19.01	0.12	5.08	0.0	0.0	5.2
87.00	18.52	0.13	5.68	0.0	0.0	5.8
90.00	17.89	0.13	6.19	0.0	0.0	6.3
93.00	17.14	0.13	6.65	0.0	0.0	6.8
96.00	16.31	0.13	7.12	0.0	0.0	7.3
99.00	15.48	0.13	7.49	0.0	0.0	7.6
102.00	14.71	0.14	7.86	0.0	0.0	8.0
105.00	13.97	0.14	8.11	0.0	0.0	8.2
108.00	13.26	0.14	8.36	0.0	0.0	8.5
111.00	12.60	0.14	8.55	0.0	0.0	8.7
114.00	11.96	0.14	8.74	0.0	0.0	8.9
117.00	11.36	0.14	8.87	0.0	0.0	9.0
120.00	10.79	0.14	9.00	0.0	0.0	9.1
123.00	10.25	0.14	9.06	0.0	0.0	9.2
126.00	9.73	0.14	9.13	0.0	0.0	9.3
129.00	9.24	0.14	9.13	0.0	0.0	9.3
132.00	8.78	0.14	9.13	0.0	0.0	9.3
135.00	8.33	0.14	9.13	0.0	0.0	9.3
138.00	7.91	0.14	9.06	0.0	0.0	9.2
141.00	7.52	0.14	9.00	0.0	0.0	9.1
144.00	7.14	0.14	8.93	0.0	0.0	9.1
147.00	6.78	0.14	8.87	0.0	0.0	9.0
150.00	6.44	0.14	8.74	0.0	0.0	8.9
153.00	6.11	0.14	8.61	0.0	0.0	8.8
156.00	5.81	0.14	8.55	0.0	0.0	8.7
159.00	5.51	0.14	8.42	0.0	0.0	8.6
162.00	5.24	0.14	8.23	0.0	0.0	8.4
165.00	4.97	0.14	8.11	0.0	0.0	8.2
168.00	4.72	0.14	7.98	0.0	0.0	8.1
171.00	4.49	0.14	7.86	0.0	0.0	8.0
174.00	4.26	0.13	7.67	0.0	0.0	7.8
177.00	4.05	0.13	7.49	0.0	0.0	7.6
180.00	3.84	0.13	7.37	0.0	0.0	7.5
183.00	3.65	0.13	7.18	0.0	0.0	7.3
186.00	3.46	0.13	7.06	0.0	0.0	7.2
189.00	3.29	0.13	6.89	0.0	0.0	7.0
192.00	3.12	0.13	6.71	0.0	0.0	6.8
195.00	2.97	0.13	6.59	0.0	0.0	6.7
198.00	2.82	0.13	6.42	0.0	0.0	6.5
201.00	2.68	0.13	6.24	0.0	0.0	6.4
204.00	2.54	0.13	6.13	0.0	0.0	6.3
207.00	2.41	0.13	5.96	0.0	0.0	6.1
210.00	2.29	0.13	5.79	0.0	0.0	5.9
213.00	2.18	0.13	5.62	0.0	0.0	5.7
216.00	2.07	0.13	5.51	0.0	0.0	5.6
219.00	1.96	0.12	5.35	0.0	0.0	5.5
222.00	1.86	0.12	5.24	0.0	0.0	5.4
225.00	1.77	0.12	5.08	0.0	0.0	5.2
228.00	1.68	0.12	4.97	0.0	0.0	5.1
231.00	1.60	0.12	4.81	0.0	0.0	4.9

Stormwater routing

T (time min)	Q (cfs)	Storage	Stage	Outflow	Elevation	Diameter 1.75 inch Orifice	1.00 Length (ft) 63.50 Weir	16.00 Top of Box 66.00 Weir	15.00 Emerg Spill 66.80	18.00 Outlet Orifice 62.50
0	0	-	0.00	0.00	62.50					
3.00	0.1	-	0.00	0.00	62.50	0.00	0.00	0.00	0.00	0.00
6.00	0.3	14	0.00	0.00	62.50	0.00	0.00	0.00	0.00	0.00
9.00	0.7	68	0.01	0.00	62.51	0.00	0.00	0.00	0.00	0.85
12.00	1.2	190	0.03	0.00	62.53	0.00	0.00	0.00	0.00	1.47
15.00	1.8	405	0.05	0.00	62.55	0.00	0.00	0.00	0.00	1.90
18.00	2.6	737	0.08	0.01	62.58	0.01	0.00	0.00	0.00	2.41
21.00	3.5	1,207	0.12	0.02	62.62	0.02	0.00	0.00	0.00	2.95
24.00	4.5	1,835	0.16	0.02	62.66	0.02	0.00	0.00	0.00	3.40
27.00	5.6	2,638	0.22	0.03	62.72	0.03	0.00	0.00	0.00	3.99
30.00	6.7	3,632	0.29	0.04	62.79	0.04	0.00	0.00	0.00	4.58
33.00	7.9	4,828	0.36	0.04	62.86	0.04	0.00	0.00	0.00	5.10
36.00	9.1	6,236	0.45	0.05	62.95	0.05	0.00	0.00	0.00	5.70
39.00	10.3	7,860	0.54	0.05	63.04	0.05	0.00	0.00	0.00	6.25
42.00	11.5	9,704	0.65	0.06	63.15	0.06	0.00	0.00	0.00	6.86
45.00	12.7	11,764	0.76	0.07	63.26	0.07	0.00	0.00	0.00	7.41
48.00	13.8	14,038	0.88	0.07	63.38	0.07	0.00	0.00	0.00	7.98
51.00	14.9	16,516	1.00	0.08	63.50	0.08	0.00	0.00	0.00	8.50
54.00	15.9	19,187	1.13	0.22	63.63	0.08	0.14	0.00	0.00	9.04
57.00	16.8	22,012	1.27	0.51	63.77	0.09	0.42	0.00	0.00	9.58
60.00	17.6	24,949	1.40	0.85	63.90	0.09	0.76	0.00	0.00	10.06
63.00	18.3	27,967	1.54	1.29	64.04	0.10	1.19	0.00	0.00	10.55
66.00	18.8	31,028	1.68	1.78	64.18	0.10	1.68	0.00	0.00	11.02
69.00	19.2	34,098	1.82	2.33	64.32	0.11	2.23	0.00	0.00	11.47
72.00	19.5	37,141	1.95	2.89	64.45	0.11	2.78	0.00	0.00	11.88
75.00	19.6	40,131	2.07	3.43	64.57	0.11	3.32	0.00	0.00	12.24
78.00	19.6	43,041	2.20	4.06	64.70	0.12	3.94	0.00	0.00	12.61
81.00	19.4	45,829	2.31	4.62	64.81	0.12	4.50	0.00	0.00	12.93
84.00	19.0	48,482	2.42	5.20	64.92	0.12	5.08	0.00	0.00	13.23
87.00	18.5	50,968	2.53	5.80	65.03	0.13	5.68	0.00	0.00	13.53
90.00	17.9	53,257	2.62	6.31	65.12	0.13	6.19	0.00	0.00	13.77
93.00	17.1	55,342	2.70	6.78	65.20	0.13	6.65	0.00	0.00	13.97
96.00	16.3	57,207	2.78	7.26	65.28	0.13	7.12	0.00	0.00	14.18
99.00	15.3	58,831	2.84	7.62	65.34	0.13	7.49	0.00	0.00	14.33
102.00	14.3	60,216	2.90	7.99	65.40	0.14	7.86	0.00	0.00	14.48
105.00	14.0	61,345	2.94	8.24	65.44	0.14	8.11	0.00	0.00	14.58
108.00	13.3	62,375	2.98	8.50	65.48	0.14	8.36	0.00	0.00	14.68
111.00	12.6	63,233	3.01	8.69	65.51	0.14	8.55	0.00	0.00	14.75
114.00	12.0	63,937	3.04	8.88	65.54	0.14	8.74	0.00	0.00	14.83
117.00	11.4	64,491	3.06	9.01	65.56	0.14	8.87	0.00	0.00	14.88
120.00	10.8	64,915	3.08	9.14	65.58	0.14	9.00	0.00	0.00	14.93
123.00	10.2	65,211	3.09	9.20	65.59	0.14	9.06	0.00	0.00	14.95
126.00	9.7	65,399	3.10	9.27	65.60	0.14	9.13	0.00	0.00	14.97
129.00	9.2	65,482	3.10	9.27	65.60	0.14	9.13	0.00	0.00	14.97
132.00	8.8	65,477	3.10	9.27	65.60	0.14	9.13	0.00	0.00	14.97
135.00	8.3	65,388	3.10	9.27	65.60	0.14	9.13	0.00	0.00	14.97
138.00	7.9	65,219	3.09	9.20	65.59	0.14	9.06	0.00	0.00	14.95
141.00	7.5	64,987	3.08	9.14	65.58	0.14	9.00	0.00	0.00	14.93
144.00	7.1	64,695	3.07	9.07	65.57	0.14	8.93	0.00	0.00	14.90
147.00	6.8	64,347	3.06	9.01	65.56	0.14	8.87	0.00	0.00	14.88
150.00	6.4	63,945	3.04	8.88	65.54	0.14	8.74	0.00	0.00	14.83
153.00	6.1	63,506	3.02	8.75	65.52	0.14	8.61	0.00	0.00	14.78
156.00	5.8	63,031	3.01	8.69	65.51	0.14	8.55	0.00	0.00	14.75
159.00	5.5	62,513	2.99	8.56	65.49	0.14	8.42	0.00	0.00	14.71
162.00	5.2	61,964	2.96	8.37	65.46	0.14	8.23	0.00	0.00	14.63
165.00	5.0	61,401	2.94	8.24	65.44	0.14	8.11	0.00	0.00	14.58
168.00	4.7	60,812	2.92	8.12	65.42	0.14	7.98	0.00	0.00	14.53
171.00	4.5	60,201	2.90	7.99	65.40	0.14	7.86	0.00	0.00	14.48
174.00	4.3	59,570	2.87	7.81	65.37	0.13	7.67	0.00	0.00	14.41
177.00	4.0	58,932	2.84	7.62	65.34	0.13	7.49	0.00	0.00	14.33
180.00	3.8	58,288	2.82	7.50	65.32	0.13	7.37	0.00	0.00	14.28
183.00	3.6	57,630	2.79	7.32	65.29	0.13	7.18	0.00	0.00	14.21
186.00	3.5	56,969	2.77	7.20	65.27	0.13	7.06	0.00	0.00	14.15
189.00	3.3	56,297	2.74	7.02	65.24	0.13	6.89	0.00	0.00	14.08
192.00	3.1	55,627	2.71	6.84	65.21	0.13	6.71	0.00	0.00	14.00
195.00	3.0	54,958	2.69	6.72	65.19	0.13	6.59	0.00	0.00	13.95
198.00	2.8	54,282	2.66	6.55	65.16	0.13	6.42	0.00	0.00	13.87
201.00	2.7	53,612	2.63	6.37	65.13	0.13	6.24	0.00	0.00	13.79
204.00	2.5	52,946	2.61	6.26	65.11	0.13	6.13	0.00	0.00	13.74
207.00	2.4	52,278	2.58	6.09	65.08	0.13	5.96	0.00	0.00	13.66
210.00	2.3	51,617	2.55	5.92	65.05	0.13	5.79	0.00	0.00	13.58
213.00	2.2	50,965	2.52	5.75	65.02	0.13	5.62	0.00	0.00	13.50
216.00	2.1	50,322	2.50	5.64	65.00	0.13	5.51	0.00	0.00	13.45
219.00	2.0	49,680	2.47	5.47	64.97	0.12	5.35	0.00	0.00	13.37
222.00	1.9	49,048	2.45	5.36	64.95	0.12	5.24	0.00	0.00	13.31
225.00	1.8	48,419	2.42	5.20	64.92	0.12	5.08	0.00	0.00	13.23
228.00	1.7	47,801	2.40	5.09	64.90	0.12	4.97	0.00	0.00	13.18
231.00	1.6	47,188	2.37	4.93	64.87	0.12	4.81	0.00	0.00	13.09

Results of routing the 10 Year storm

Use orifice =	**1.75**	**inches**	
Peak outflow =	**9.27**	**cfs**	Less than Predeveloped Flow = 14.36
Peak Stage=	**3.10**	**ft**	
Water Elevation=	**65.60**	**msl**	
Peak Storage =	**65,482**	**cf**	
Design Spillway	**63.50**	**msl**	Temporary Pool Elevation for 1st inch of runoff
Length of weir	**1**	**ft**	
Structure Overflow	**66.00**	**msl**	Top of Outlet Control Structure
Length of weir	**16.00**	**ft**	

Routing Equations for Table Above

Synthetic Hydrograph

$$Qt = \frac{Qp}{2}\left[1-\cos\left(\pi\left(\frac{t}{Tp}\right)\right)\right]$$

$$0 \le t \le 1.25Tp$$

$$Q = 4.34\,Qp\exp\left[-1.30\left(\frac{t}{Tp}\right)\right]$$

$$t > 1.25Tp$$

Routing Equations

$$Storage\,(S_{ij}) = (I_i - Q_i)\Delta t_{ij}$$

Stage/Storage Equation

Stage $Z = \left[\frac{S}{K_s}\right]^{\frac{1}{b}}$

$$K_s = \frac{S_2}{Z_2^b}$$

$$b = \frac{\ln\left(\frac{S_1}{S_2}\right)}{\ln\left(\frac{Z_1}{Z_2}\right)}$$

Outflow

$$Q_{outflow} = \sum(Q_{orif} + Q_{weir} + Q_{spillway} + \cdots)$$

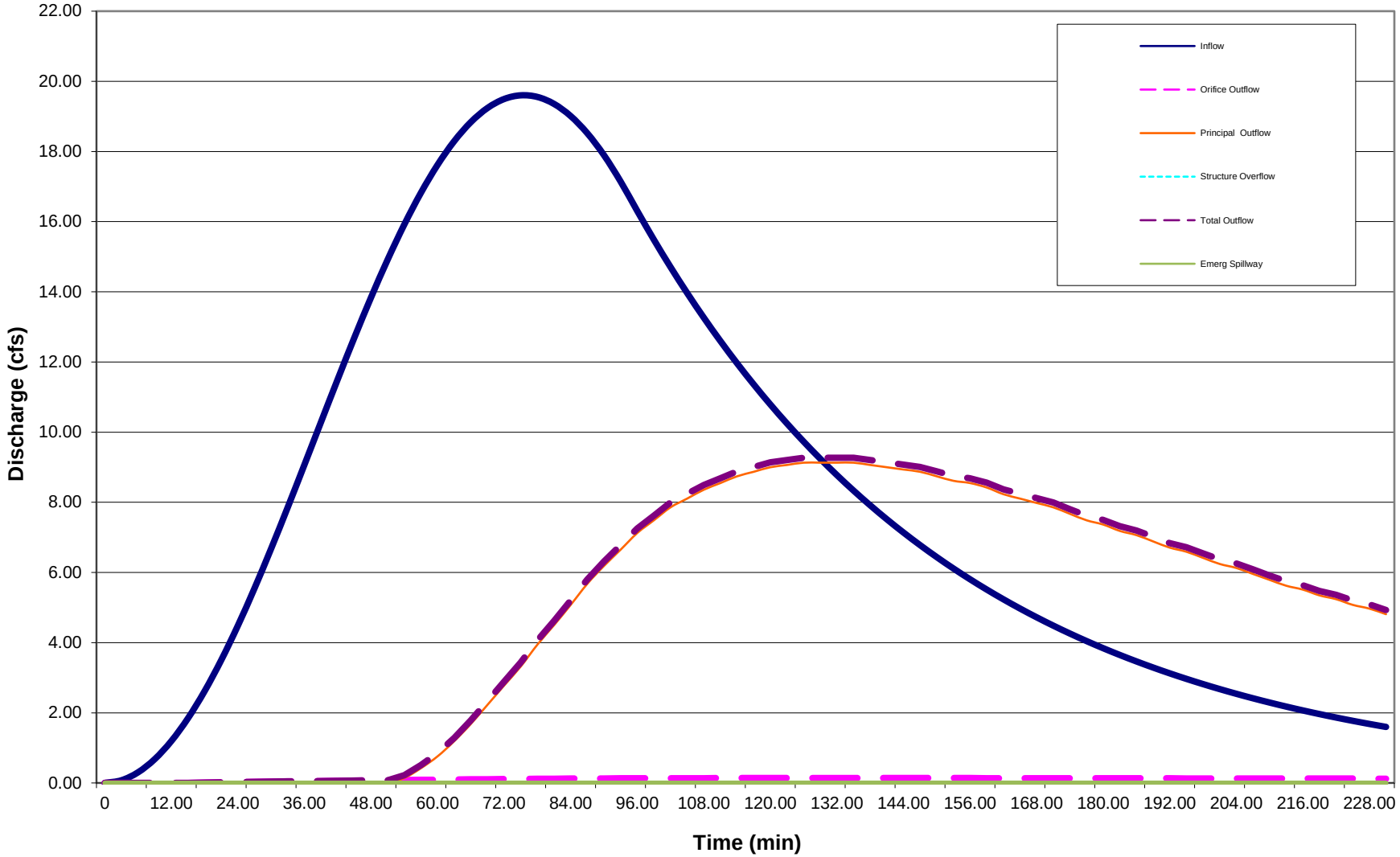
Outflow from Orifice

$$Q_{orifice} = C_d A\sqrt{2gh}$$

Outflow from Weir

$$Q_{weir} = C_w L H^{\frac{3}{2}}$$

Routing Hydrograph (10-YR)



Sediment Basin
Alice Keene
Greenville, NC

Okay		
13.42	Disturbed Area (Acres)	
19.60	Peak Flow from 10-year Storm (cfs)	
24156	Required Volume ft^3	
8538	Required Surface Area ft^2	
65.3	Suggested Width ft	
130.7	Suggested Length ft	
70	Trial Top Width at Spillway Invert ft	
235	Trial Top Length at Spillway Invert ft	
2	Trial Side Slope Ratio Z:1	
2	Trial Depth ft	(2 to 13 feet above grade)
62	Bottom Width ft	
227	Bottom Length ft	
14074	Bottom Area ft^2	
30503	Actual Volume ft^3	**Okay**
16450	Actual Surface Area ft^2	**Okay**

Use Spillway Capacity Sheet to Size Primary and Emergency Spillways

6	Skimmer Size (inches)
0.417	Head on Skimmer (feet)
2.5	Orifice Size (1/4 inch increments)
3.27	Dewatering Time (days)
	Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

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IDF Curve - Rainfall Intensity

ALICE KEENE
GREENVILLE, NC

Input Data from NOAA		
	Average recurrance interval (years)	
T (min)	2	10
10	0.831	1.08
15	1.05	1.37
30	1.44	1.98

Calculation of Design Rainfall Intensity, i, using the equation: i = g/(h + T)

2 yr

Data from IDF graph		
T, min	i, in/hr	1/i, hr/in
10	4.99	0.20
15	4.20	0.24
30	2.88	0.35

Equation Constants (g & h)	
Slope = 1/g	0.0073
Intercept = h/g	0.1278
g = 1/slope	**136.6**
h = g*intercept	**17.5**

Calculation of Design Rainfall Intensity, i, using the equation: i = g/(h + T)

10 yr

Data from IDF graph		
T, min	i, in/hr	1/i, hr/in
10	6.48	0.15
15	5.48	0.18
30	3.96	0.25

Equation Constants (g & h)	
Slope = 1/g	0.0049
Intercept = h/g	0.1074
g = 1/slope	**206.0**
h = g*intercept	**22.1**

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SWALE CALCULATIONS for Temporary Swale

ALICE KEENE

GREENVILLE, NC

Swale 1 in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	0.65

Land Type		Rational C	CN	Acres
Area Impervious		0.95	98	0.07
Denuded with temporary seeding		0.35	60	0.58
Total watershed area				0.65
Composite		0.41		

	Overland	Channelized
Hydraulic Length (ft)	197	200
Vertical Relief (ft)	2.00	4.00

Time of Concentration

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland	Channelized	Total	
Time (min)	5.35	2.08	10.00	If Tc<10, use 10 min
Travel Factor	2	1		

Rainfall Intensity =	I = g/(h+T)	5.0	inches per hr
Peak Discharge =	Q=CIA	1.3	cfs

Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	2.00%	3.37 fps	0.45 ft

Tractive Force	
Td= YDS (lb/sf)	0.556

use temporary liner
Straw netting Td= 1.45 lb/sf ok

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SWALE CALCULATIONS for Temporary Swale

ALICE KEENE

GREENVILLE, NC

Swale 2 in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	0.14

Land Type		Rational C	CN	Acres
Area Impervious		0.95	98	0.06
denuded with temporary seeding		0.35	60	0.08
Total watershed area				0.14
Composite		0.61		

	Overland	Channelized
Hydraulic Length (ft)	20	200
Vertical Relief (ft)	1.50	4.00

Time of Concentration

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland	Channelized	Total	
Time (min)	0.43	2.08	10.00	If Tc<10, use 10 min
Travel Factor	2	1		

Rainfall Intensity =	I = g/(h+T)	5.0	inches per hr
Peak Discharge =	Q=CIA	0.4	cfs

Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	2.00%	2.57 fps	0.29 ft

Tractive Force	
Td= YDS (lb/sf)	0.358

use temporary liner
June netting = Td= 0.45 lb/sf ok

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SWALE CALCULATIONS for Temporary Swale

ALICE KEENE

GREENVILLE, NC

Swale 3 in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	0.16

Land Type		Rational C	CN	Acres
Area Impervious			98	0.05
denuded with temporary seeding		0.35	60	0.11
Total watershed area				0.16
Composite		0.24		

	Overland	Channelized
Hydraulic Length (ft)	20	200
Vertical Relief (ft)	1.00	4.00

Time of Concentration

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland	Channelized	Total	
Time (min)	0.50	2.08	10.00	If Tc<10, use 10 min
Travel Factor	2	1		

Rainfall Intensity =	I = g/(h+T)	5.0	inches per hr
Peak Discharge =	Q=CIA	0.2	cfs

Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	2.00%	1.96 fps	0.22 ft

Tractive Force	
Td= YDS (lb/sf)	0.276

use temporary liner
June netting = Td= 0.45 lb/sf ok

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SWALE CALCULATIONS for Temporary Swale

ALICE KEENE

GREENVILLE, NC

Swale 4 in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	0.29

Land Type		Rational C	CN	Acres
Area Impervious			98	0.09
denuded with temporary seeding		0.35	60	0.20
Total watershed area				0.29
Composite		0.24		

	Overland	Channelized
Hydraulic Length (ft)	24	330
Vertical Relief (ft)	1.00	1.70

Time of Concentration

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland	Channelized	Total	
Time (min)	0.61	5.16	10.00	If Tc<10, use 10 min
Travel Factor	2	1		

Rainfall Intensity =	I = g/(h+T)	5.0	inches per hr
Peak Discharge =	Q=CIA	0.3	cfs

Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	0.52%	1.58 fps	0.33 ft

Tractive Force	
Td= YDS (lb/sf)	0.107

use temporary liner
June netting = Td= 0.45 lb/sf ok

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SWALE CALCULATIONS for Temporary Swale

ALICE KEENE

GREENVILLE, NC

Swale 5 in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	0.71

Land Type		Rational C	CN	Acres
Area Impervious			98	0.09
denuded with temporary seeding		0.35	60	0.62
Total watershed area				0.71
Composite		0.31		

	Overland	Channelized
Hydraulic Length (ft)	40	260
Vertical Relief (ft)	1.00	2.30

Time of Concentration

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland	Channelized	Total	
Time (min)	1.11	3.49	10.00	If Tc<10, use 10 min
Travel Factor	2	1		

Rainfall Intensity =	I = g/(h+T)	5.0	inches per hr
Peak Discharge =	Q=CIA	1.1	cfs

Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	0.88%	2.27 fps	0.49 ft

Tractive Force	
Td= YDS (lb/sf)	0.269

use temporary liner
June netting = Td= 0.45 lb/sf ok

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SWALE CALCULATIONS for Temporary Swale

ALICE KEENE

GREENVILLE, NC

Swale 6 in temporary condition

Outlet Based on 2 year storm

Total watershed area (Ac)	0.19

Land Type		Rational C	CN	Acres
Area Impervious			98	0.04
denuded with temporary seeding		0.35	60	0.15
Total watershed area				0.19
Composite		0.28		

	Overland	Channelized
Hydraulic Length (ft)	35	148
Vertical Relief (ft)	1.00	3.00

Time of Concentration

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland	Channelized	Total	
Time (min)	0.95	1.64	10.00	If Tc<10, use 10 min
Travel Factor	2	1		

Rainfall Intensity =	I = g/(h+T)	5.0	inches per hr
Peak Discharge =	Q=CIA	0.3	cfs

Right Side Slope	Left Side Slope	n=	Slope	Channel Velocity	Flow Depth
2.00	2.00	0.022	2.03%	1.98 fps	0.26 ft

Tractive Force	
Td= YDS (lb/sf)	0.325

use temporary liner
June netting = Td= 0.45 lb/sf ok

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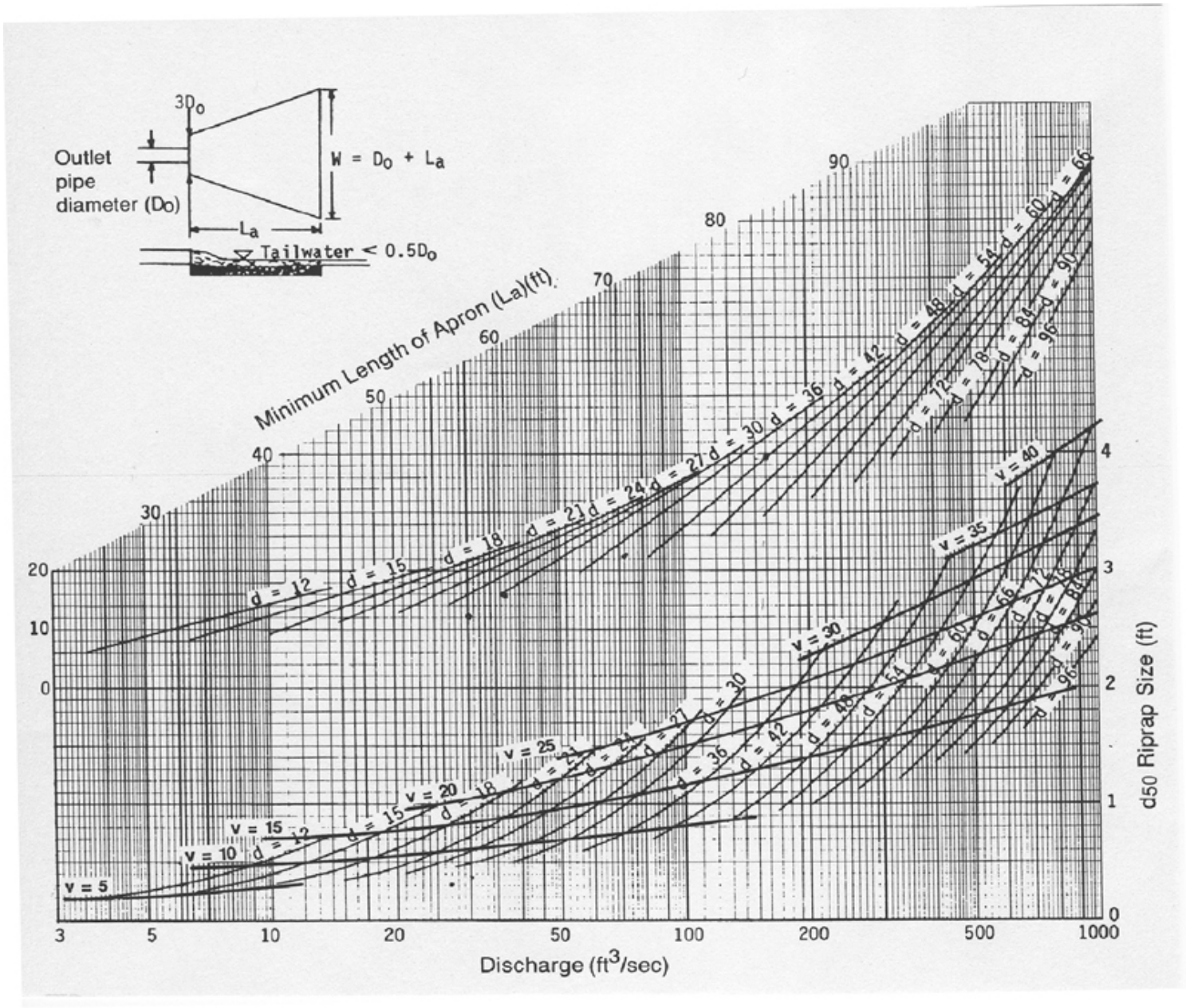
Pipe Calculations - Alice Keene Greenville, NC.

						Intensity		Pipe Data											
Name	Design Storm Return Period (Years)	Drainage Areas	Area (ac)	C	T_C (min)	I (in/hr)	Q = CIA (cfs)	Type	N	Beginning Invert (ft)	Ending Invert (ft)	L (ft)	% Slope	Size (in)	x	# of Pipes	Velocity (ft/sec)	Q Avail. (cfs)	Flow Type
						10yr													
DI 6 - DI 5	10	6	0.53	0.40	5.00	7.59	1.61	HP	0.012	64.22	63.97	86	0.291	12	x	1	2.65	2.09	Open Channel
DI 5 - DI 4	10	6,5	0.57	0.40	5.54	7.44	1.69	HP	0.012	63.97	63.74	76	0.303	15	x	1	3.13	3.86	Open Channel
DI 4 - DI 3	10	6,5,4	0.91	0.57	5.95	7.34	3.80	HP	0.012	63.74	63.45	98	0.296	15	x	1	3.10	3.82	Open Channel
DI 3 - DI 2	10	6,5,4,3	1.18	0.59	6.47	7.20	4.98	RCP	0.012	63.45	63.17	94	0.298	18	x	1	3.51	6.23	Open Channel
DI 2 - DI 1	10	6,5,4,3,2	1.79	0.57	6.92	7.09	7.20	RCP	0.012	63.17	62.82	116	0.302	24	x	1	4.28	13.50	Open Channel
DI 1 - FES 1	10	7,6,5,4,3,2,1	10.21	0.28	7.37	6.98	19.73	RCP	0.012	62.82	62.50	108	0.296	30	x	1	4.92	24.25	Open Channel
CB - FES 2	10	8	0.63	0.93	5.00	7.59	4.44	RCP	0.012	63.50	62.50	112	0.893	18	x	1	6.08	10.78	Open Channel
FES 3 - DI 1	10	7	7.41	0.18	5.00	7.59	10.20	RCP	0.012	63.50	62.80	97	0.722	24	x	1	6.62	20.87	Open Channel
OCS - FES 4	10						9.27	RCP	0.012	62.50	62.30	79	0.253	24	x	1	3.92	12.36	Open Channel

Rivers & Associates
102 E. Second Street
Greenville, NC 27834
252-752-4135

JOB Alice F. Keene
SHEET NO. 1 OF 1
CALCULATED BY DH DATE 3/3/2023
CHECKED BY DATE 3/3/2023
SCALE nts



Given Information

Q_{10} = 19.73 **cfs**
D_o = 30 "
Class 'B' stone unit weight = 110 pcf
Is flow below minimum for Pipe Diameter: YES
If flow is higher, then chart consultation is needed

Calculated Information

Width at entrance = $3D_o$ = 7.5 ft use 8.0 ft
Width at exit ($D_o + 0.4xL_a$) = 4.9 ft use 5.0 ft
Length of Apron (from chart) L = 6 ft
Thickness = 24 " thick Class 'B' stone
Tonnage = 4.29 tons use 5 tons

Apron at FES 1:

Use 8 ft x 5 ft x 6 ft,5 tons.

Rivers & Associates
102 E. Second Street
Greenville, NC 27834
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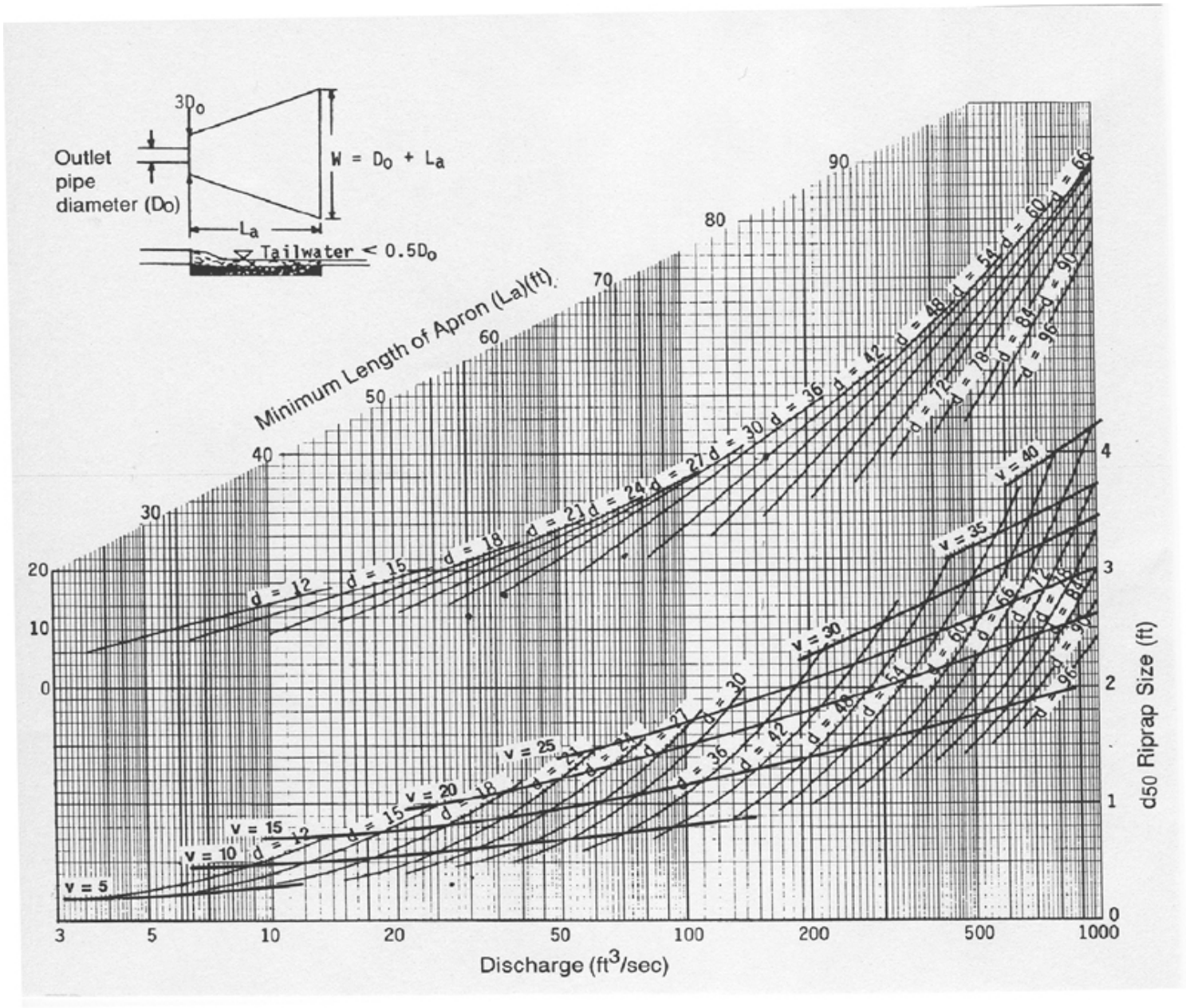
JOB Alice F. Keene
SHEET NO. 2 OF 3
CALCULATED BY DH DATE 3/3/2023
CHECKED BY DATE 3/3/2023
SCALE nts



Given Information

Q_{10} = 4.44 **cfs**
D_o = 18 "
Class 'B' stone unit weight = 110 pcf
Is flow below minimum for Pipe Diameter: YES
If flow is higher, then chart consultation is needed

Calculated Information

Width at entrance = $3D_o$ = 4.5 ft use 5.0 ft
Width at exit ($D_o + 0.4xL_a$) = 3.1 ft use 4.0 ft
Length of Apron (from chart) L = 4 ft
Thickness = 24 " thick Class 'B' stone
Tonnage = 1.98 tons use 2 tons

Apron at FES 2:

Use 5 ft x 4 ft x 4 ft,2 tons.

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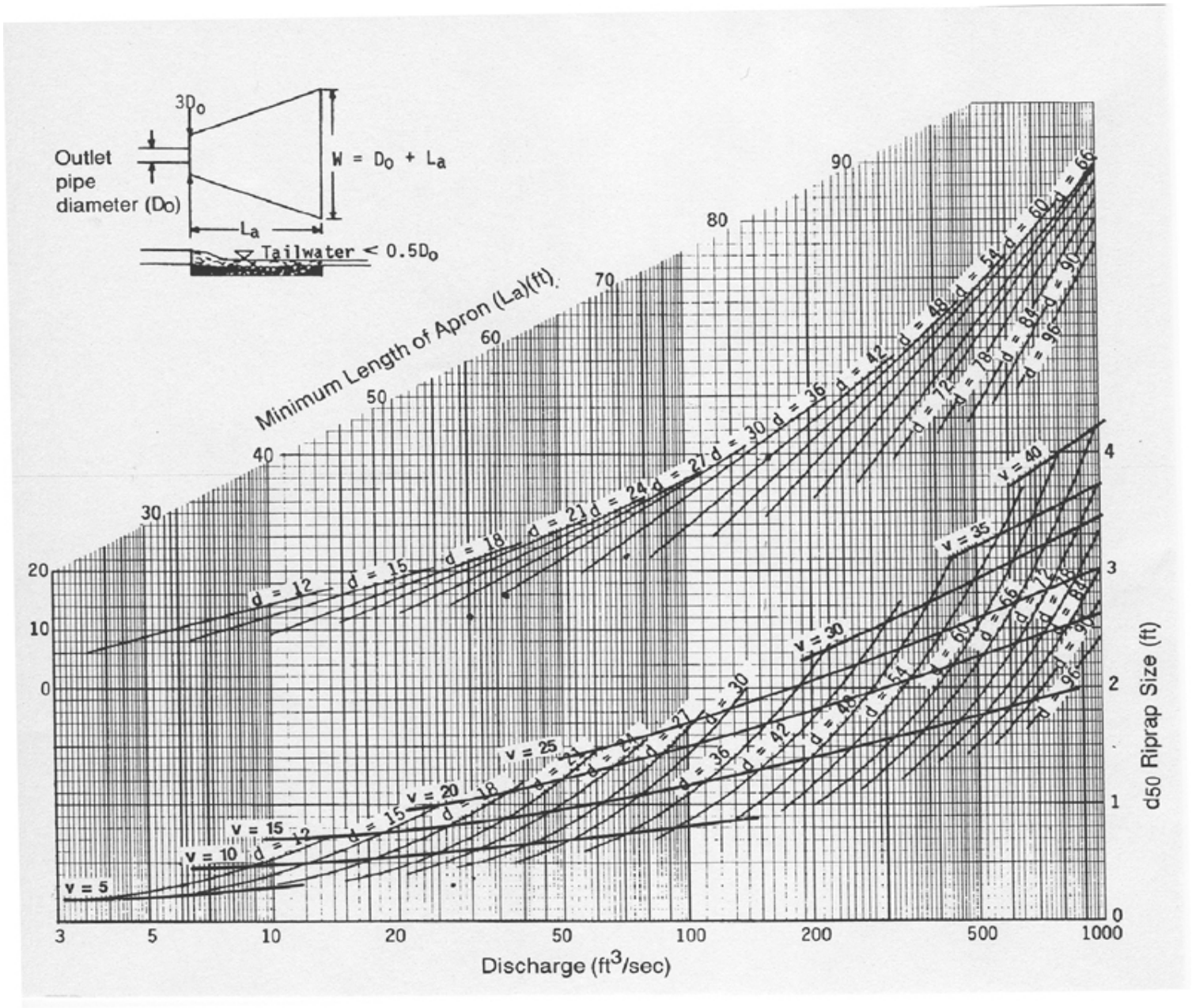
JOB Alice F. Keene
SHEET NO. 3 OF 3
CALCULATED BY DH DATE 3/3/2023
CHECKED BY DATE 3/3/2023
SCALE nts



Given Information

Q_{10} = 9.27 **cfs**
D_o = 24 "
Class 'B' stone unit weight = 110 pcf
Is flow below minimum for Pipe Diameter: YES
If flow is higher, then chart consultation is needed

Calculated Information

Width at entrance = $3D_o$ = 6 ft use 6.0 ft
Width at exit ($D_o + 0.4xL_a$) = 5.2 ft use 6.0 ft
Length of Apron (from chart) L = 8 ft
Thickness = 18 " thick Class 'B' stone
Tonnage = 3.96 tons use 4 tons

Apron at FES ≠ 4

Use 6 ft x 6 ft x 8 ft,4 tons.

EROSION CONTROL LEGEND

TST #	TEMPORARY SEDIMENT TRAP
	LIMITS OF CONSTRUCTION / DISTURBANCE
	TEMPORARY DIVERSION SWALE
	TEMPORARY ROCK CHECK DAM
	TEMPORARY STORM INLET SEDIMENT TRAP
	TEMPORARY SEDIMENT FENCE
	EXCELSIOR NETTING DITCH LINER
	STONE RIP RAP

LEGEND IS FOR REFERENCE ONLY; SYMBOLS / ABBREVIATIONS SHOWN DO NOT NECESSARILY APPLY TO THIS PROJECT.

NOTE: SEE GRADING & DRAINAGE LEGEND ON C-201 FOR OTHER SYMBOLS AND ABBREVIATIONS

North Carolina 811 www.nc811.org

EACH PERSON CONTRACTOR PERFORMING EXCAVATING OR UNDERGROUND WORK SHALL NOTIFY THE NORTH CAROLINA 811 CENTER AT LEAST THREE (3) BUT NOT MORE THAN FIVE (5) FULL WORKING DAYS BEFORE THE DATE SHALL STARTED BY NOTIFICATION AT LEAST 72 HOURS PRIOR TO EXCAVATION. CONTRACTOR SHALL CONFIRM THAT ALL UTILITIES HAVE BEEN LOCATED AND MARKED. CONTRACTOR SHALL CONTACT ALL UTILITY COMPANY FOR ANY UTILITIES NOT MEMBERS WITH THE 811 SYSTEM. CONTRACTOR SHALL USE ALL CARE NECESSARY WHEN EXCAVATING IN AREAS KNOWN OR SUSPECTED CONTAIN UNDERGROUND UTILITIES. FAILURE TO NOTIFY...

Hite associates
ARCHITECTURE / PLANNING / TECHNOLOGY
2600 Meridian Drive / Greenville, NC 27834 / tel (252) 757-0333

HITE ASSOCIATES, P.A. CORPORATION LICENSE NUMBER C-1618 REGISTERED PROFESSIONAL ENGINEERS GREENVILLE, NC

CIVIL ENGINEERING CONSULTANT:
J. STEPHEN JANKOWSKI P.E.
Rivers & Associates, Inc.
License No. F-0304
107 East Second Street Greenville, NC
(252)-214-3002

COMMUNITY CENTER AND GYMNASIUM FOR
Alice F. Keene District Park
4561 County Home Road, Greenville, NC 27858

Project No. 22207
Date: December 1, 2022
Drawing no. C 202

Pump House
Pioneer Water Tank Model XL 33/50 30,000 Gallon Capacity
Existing Building FFE=69.67'
Proposed New Gymnasium Addition FFE=69.67'
Alternate Plan C-901
TOTAL DISTURBED AREA = 7.0 Acres
Forebay Bot.=59.00'
Wet DetentIonPond WS 62.50' Bottom = 59.00' (SA = 16,685 S.F.)
LIMITS OF CONSTRUCTION
COUNTY HOME ROAD (60' R/W - SR 1725)
Existing Building FFE=71.90'

SWALE 1 DA 0.65 ac
SWALE 2 DA 0.14 ac
SWALE 3 DA 0.16 ac
SWALE 4 DA 0.29 ac
SWALE 5 DA 0.71 ac
SWALE 6 DA 0.19 ac

PROPOSED SWALES DA MAP

DA#1
1.01 ac

DA#2
0.61 ac

DA#3
0.27 ac

DA#4
0.34 ac

DA
0.16 ac

DA#5
0.04 ac

DA#6
0.03 ac

DA#7= 7.41ac

DA#8
0.53 ac

TOTAL DISTURBED AREA = 7.0 Acres

Existing Building FFE=69.67

Proposed New Gymnasium Addition F.F.E=69.67'

Pump House

Wet DetentIonPond
WS 62.50'
Bottom = 59.00'
(SA = 16,685 S.F.)

Forebay Bot.=59.00'

Existing Building FFE=71.90'

COUNTY HOME ROAD (60' R/W - SR 1725)

LIMITS OF CONSTRUCTION

TEMPORARY SILT FENCE

TEMPORARY ROCK SILT FENCE OUTLET

EROSION CONTROL LEGEND

TST #	TEMPORARY SEDIMENT TRAP
	LIMITS OF CONSTRUCTION / DISTURBANCE
	TEMPORARY DIVERSION SWALE
	TEMPORARY ROCK CHECK DAM
	TEMPORARY STORM INLET SEDIMENT TRAP
	TEMPORARY SEDIMENT FENCE
	EXCELSIOR NETTING DITCH LINER
	STONE RIP RAP

LEGEND IS FOR REFERENCE ONLY. SYMBOLS / ABBREVIATIONS SHOWN DO NOT NECESSARILY APPLY TO THIS PROJECT.

NOTE: SEE GRADING & DRAINAGE LEGEND ON C-201 FOR OTHER SYMBOLS AND ABBREVIATIONS

North Carolina 811 www.nc811.org

POST DEVELOPMENT DA MAP

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COMMUNITY CENTER AND GYMNASIUM FOR
Alice F. Keene District Park
4561 County Home Road, Greenville, NC 27858

Project No. 22207
Date: December 1, 2022
Drawing no. C 202

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Pitt County, North Carolina

February 28, 2023

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:4,050 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Pitt County, North Carolina
Survey Area Data: Version 20, Sep 14, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 9, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ExA	Exum fine sandy loam, 0 to 1 percent slopes	2.6	7.1%
GoA	Goldsboro sandy loam, 0 to 1 percent slopes	9.0	24.3%
Ly	Lynchburg fine sandy loam, 0 to 2 percent slopes, Atlantic Coast Flatwoods	22.0	59.5%
NrB	Norfolk sandy loam, 1 to 6 percent slopes	3.1	8.5%
OcB	Ocilla loamy fine sand, 0 to 4 percent slopes	0.1	0.2%
Os	Osier loamy sand, loamy substratum (Plummer)	0.1	0.4%
Totals for Area of Interest		**37.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not

mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Pitt County, North Carolina

ExA—Exum fine sandy loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 3tyv
Elevation: 20 to 160 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Exum and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Exum

Setting

Landform: Broad interstream divides on marine terraces, flats on marine terraces
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy and silty marine deposits

Typical profile

Ap - 0 to 8 inches: very fine sandy loam
E - 8 to 12 inches: silt loam
Bt - 12 to 70 inches: clay loam
C - 70 to 100 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

GoA—Goldsboro sandy loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 3tyx
Elevation: 20 to 330 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Goldsboro and similar soils: 90 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Goldsboro

Setting

Landform: Broad interstream divides on marine terraces, flats on marine terraces
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 7 inches: fine sandy loam
E - 7 to 13 inches: fine sandy loam
Bt - 13 to 40 inches: sandy clay loam
Btg - 40 to 80 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Rains, undrained

Percent of map unit: 3 percent

Landform: Broad interstream divides on marine terraces, carolina bays on marine terraces, flats on marine terraces
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Woodington, undrained

Percent of map unit: 2 percent
Landform: Depressions on marine terraces, flats on marine terraces, broad interstream divides on marine terraces
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Ly—Lynchburg fine sandy loam, 0 to 2 percent slopes, Atlantic Coast Flatwoods

Map Unit Setting

National map unit symbol: 2vx8k
Elevation: 0 to 100 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 64 to 70 degrees F
Frost-free period: 200 to 310 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Lynchburg and similar soils: 82 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lynchburg

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 6 inches: fine sandy loam
E - 6 to 13 inches: fine sandy loam
Bt - 13 to 21 inches: sandy clay loam
Btg - 21 to 45 inches: sandy clay loam
BCg - 45 to 63 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Rains, undrained

Percent of map unit: 5 percent
Landform: Broad interstream divides on marine terraces, flats on marine terraces, carolina bays on marine terraces
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Rains, drained

Percent of map unit: 5 percent
Landform: Broad interstream divides on marine terraces, flats on marine terraces, carolina bays on marine terraces
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

NrB—Norfolk sandy loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: 3tz7
Elevation: 20 to 160 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Norfolk and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norfolk

Setting

Landform: Ridges on marine terraces, broad interstream divides on marine terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 9 inches: sandy loam
E - 9 to 15 inches: sandy loam
Bt1 - 15 to 19 inches: sandy clay loam
Bt2 - 19 to 100 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 40 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

OcB—Ocilla loamy fine sand, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: 3tz9
Elevation: 20 to 160 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days
Farmland classification: Not prime farmland

Map Unit Composition

Ocilla and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ocilla

Setting

Landform: Flats on marine terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy and sandy marine deposits

Typical profile

Ap - 0 to 4 inches: loamy fine sand
E1 - 4 to 15 inches: loamy fine sand
E2 - 15 to 28 inches: loamy fine sand
Bt1 - 28 to 49 inches: sandy loam
Bt2 - 49 to 59 inches: sandy clay loam
Bt3 - 59 to 80 inches: sandy clay loam

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Hydric soil rating: No

Os—Osier loamy sand, loamy substratum (Plummer)

Map Unit Setting

National map unit symbol: 3tzc
Elevation: 80 to 330 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 210 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Plummer, undrained, and similar soils: 40 percent
Osier, undrained, and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plummer, Undrained

Setting

Landform: Depressions, drainageways, flats
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy and sandy marine deposits

Typical profile

A - 0 to 9 inches: loamy sand
Eg - 9 to 50 inches: loamy sand
Btg - 50 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Very rare
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Description of Osier, Undrained

Setting

Landform: Depressions, drainageways, flats
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy fluviomarine deposits

Typical profile

A - 0 to 8 inches: loamy sand
Cg1 - 8 to 48 inches: loamy sand
Cg2 - 48 to 80 inches: coarse sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

GO TO NEXT PAGE

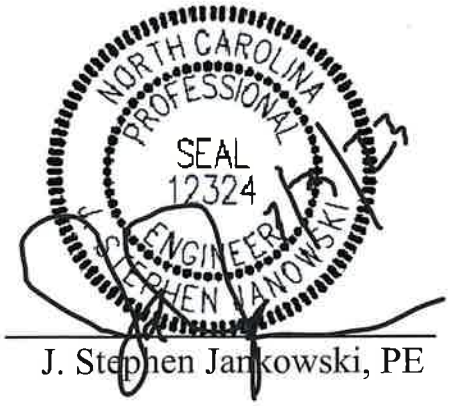
STORM WATER NARRATIVE AND CALCULATIONS FOR WET POND

ALICE F. KEENE DISTRICT PARK

GREENVILLE, NORTH CAROLINA

Rivers & ASSOCIATES, INC.
Since 1918

ENGINEERS, PLANNERS, SURVEYORS & LANDSCAPE ARCHITECTS



J. Stephen Jankowski, PE

107 E. 2nd Street
Greenville, NC 27858
252-752-4135

March 3, 2022

Denis Hyska


SITE
1711
1725
Doris Cir
Worthington Ln
McLawhorn Farm Rd
Arrowhead Dr
Worthington Rd
County Home Rd
N
Google Earth

Project: Community Center and Gymnasium for Alice F. Keene District Park, Greenville, NC
Calculated By: Denis Hyska

Project No.: 2022101
1/20/2023

Wetpond Design Calculations

SCM 1

Pollutant / Nutrient Removal

Total Suspended Solids (TSS)	85%
Nitrogen	30%
Phosphorus	30%

Basin Characteristics

Post-development Drainage Area

Area to Pond

Description	Acres
Post-Dev Impervious	2.38
Future Impervious	
Lawn/Open Space	10.30
Pond	0.74
Total to Pond	**13.42**
Pond Basin Cc	**NA**

Estimated Impervious

Buildings

Description	Qty	Inc Area	Total Area
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00
Sub Total	**0**		**0.00**

Parking

Description	Qty	Inc Area	Total Area
			0.00
			0.00
			0.00
Sub Total	**0**		**0.00**

Other

			0.00
Grand Total			**0.00**

Surface Area to Drainage Area Ratio for Permanent Pool Sizing

Drainage Area to SCM

Impervious Area	Acres
Offsite Impervious Area	0.00
Onsite Impervious Area	2.38
Total Impervious Area	**2.38**
Total Drainage Area To SCM	**13.42**
Percent Impervious Area	**18%**

Required Surface Area of Permanent Pool *(Main Pool Only)*

Average Depth (ft) =	3.5
SA/DA Ratio =	0.70
Required SA (ft2) =	4,118
SA as Shown (ft2) =	11,811

SA/DA Ratio from latest NCDENR BMP Manual

Min Req SA/DA = ((0.84 + 0.69)/2) - ((0.51+0.43)/2)) * 0.8) + ((0.51+0.43)/2) = *0.7044*

Based on Peadmont SA/DA Table on Page C-3 of BMP Manual.

SA / DA Pond Volumes and Areas (Below Permanent / Normal Pool)

Elevation (ft)	Main Area (sf)	Forebay Area (sf)	Depth (ft)	Main Inc. Vol (cf)	Forebay Inc. Vol (cf)	Total Vol (cf)
56.0	4643			Bottom of Sediment Storage		
57.0	5590		0.0	Top of Sediment Storage		
58.0	6507		1.0	6049	0	6049
59.0	7476		2.0	6992	0	6992
60.0	8195	2684	3.0	7836	1342	16169
61.0	8960	3093	4.0	8578	2889	27635
62.0	9733	3518	5.0	9347	3306	40287
62.5	11811	4855	5.5	5386	2093	47766
Total			**5.5**	**44186**	**9629**	**53815**
Verify the Forebay Volume Is Approximately (18% - 22%) of the Permanent Pool Volume.						**21.8%**

Water Quality and Quantity Volumes (Above Permanent / Normal Pool)

Elevation (ft)	Main + Forebay Area (sf)		Depth (ft)	Inc Total Vol (cf)	Accum' Total Vol (cf)	
62.50	16666		0.00	Permanent Pool Elevation		Notes
63.00	19643		0.50	9077	9077	
63.50	20525		1.00	10042	19119	WQE / TPE
64.00	21514		1.50	10510	29629	
65.00	23444		2.50	22479	52108	
66.00	25419		3.50	24432	76540	
67.00	27454		4.50	26437	102976	
68.00	29564		5.50	28509	131485	

Verify the Average Depth of Pool (D_{avg}) - Equation 2.

$d_{avg} = [V_{perm\ pool} - [0.5 \times Depth_{max\ over\ shelf} \times Perimeter_{perm\ pool} \times Width_{submerged\ part\ of\ shelf}] / A_{bottom\ of\ shelf}$

V_{perm} =	44,186	C.F. (Main Pond)
Abottom of shelf =	9,733	S.F. (Main Pond)
Depth of Water $_{over\ shelf}$ =	0.50	FT
Perimeter $_{perm\ pool}$ =	552	S.F. (Main Pond)
Width $_{submerged\ part\ of\ shelf}$ =	5.00	FT
D_{avg} =	4.47	FT
Depth for SA/DA =	**4.00**	**FT (Round D_{av} down to nearest 0.5 ft)**

Water Quality Runoff Volume Calculation

SIMPLE METHOD:

$R_V = 0.05 + 0.8 \times I_A$

I_A = 18%

R_V = 0.1919

DV = 3630 * R_D * R_V * A

DV = Design Volume =	**9347**	**CF**
RD = Design Storm Depth =	1.0	inch
A = Drainage Area =	13.42	acres

Minimum Required Water Quality Storage Volume = 9,347 cu. ft.

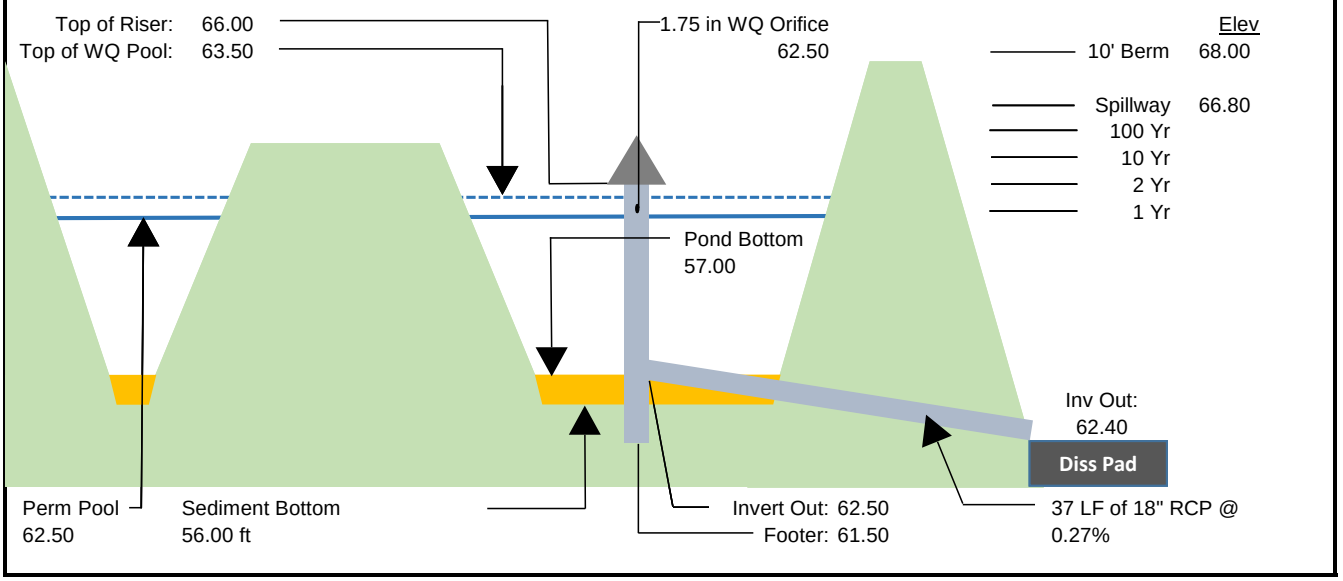
Volume Storage For Runoff Above Permanent Pool (Provided)

Depth	PPE SA (SF)	Top Temp Pool SA (SF)	Volume (CF)	Elevation
1	**16,666**	**20,525**	**19,119**	**63.50**

Size Water Quality Orifice for (2-5) Day Drawdown for Design WQ Volume	
$Q = CdA(2gh)^{1/2}$	(Orifice Equation; Cd=0.60)
1.75	Orfice Diameter (inches)
0.93	Driving Head to Centroid of Orfice (ft)
0.04	Q Drawdown Rate (cfs)
9,347	Water Quality Volume (V_{WQ})
$V_{WQ}/(Q \times 86{,}400)$	Drawdown Time (days)
2.4	**Drawdown Time (days) (2 - 5 days)**

Pond / Riser Data & Elevations			
Pond Type	Wet Pond		
TSS Removal	85%		
Top of Pond / Berm	68.00 ft		
Secondary Spillway Width	10.00 ft		
Bottom of Secondary Spillway	66.80 ft		
Top of Riser	66.00 ft	(at least 1' Above TPE)	
Riser Type / Size	4x4 ft	NCDOT Drop Inlet	
Top of Water Quality / Temp Pool Elev	63.50 ft	(1" Runoff)	
Top of Veg. Shelf	63.00 ft		
Permanent Pool Elevation (Normal Pool)	62.50 ft		
Water Quality Orifice Elevation & Size	62.50 ft		1.75 in
Orifice Elevation & Size	62.00 ft		24.00 in
Bottom of Veg. Shelf	62.00 ft		
Top of Sediment Storage / Pond Bottom	57.00 ft		
Bottom of Sediment Storage	56.00 ft	(Min 1 ft)	
Invert Out of Riser	62.50 ft		
Outlet Pipe Size	18.00 in	Diameter RCP	
Outlet Pipe Length & Slope	37.00 ft		0.27 %
Downstream Outlet Elevation	62.40 ft		
1 Yr Water Surface Elev / Peak Flow (CFS)	ft		CFS
2 Yr Water Surface Elev Peak Flow (CFS)	ft		CFS
10 Yr Water Surface Elev Peak Flow (CFS)	ft		CFS
100 Yr Water Surface Elev Peak Flow (CFS)	ft		CFS

Pond Detail



Anti-Bouyancy Calculations for the Riser Structure

Riser Dimensions		Weight of Structure		Displaced Volume	
Outside Width	5.00 ft	Walls =	4725 LBS	V = LxWx(HT+Footer) = C.F.	
Inside Width	4.00 ft	Base =	3750 LBS		
Outside Length	5.00 ft			Displaced Water =	
Inside Length	4.00 ft	Outlet Pipe =	132 LBS	C.F. * 62.4 PCF = LBS	
Height	3.50 ft	WQ Orifice =	1 LBS		
Footer Thick' (ft)	1.00 ft			Add 15% Factor of Safety	
Wall Thick' (ft)	0.50 ft				
Top Slab (ft)	0.50 ft	Weir #1 =	0 LBS	V =	113 C.F.
Areas removed from Riser		Weir #2 =	0 LBS	Disp. Water =	07,020 LBS
Outlet Pipe	1.77 ft	Weir #3 =	0 LBS	15% F.S. =	1,053 LBS
WQ Orifice	0.02 ft	Weir #4 =	0 LBS		
Wier #1	0.00 ft	Other #1 =	0 LBS	Saftety Factor	18.82%
Wier #2	0.00 ft				
Wier #3	0.00 ft	**Weight =**	**8,341 LBS**	**Weight =**	**08,073 LBS**
Wier #4	0.00 ft	**Precast Concrete Riser Structure to be 5 ft x 5 ft x 1 ft Footing**			
Other	0.00 ft				

Planting Summary Requirements

Dam / Berm				Non-Clumping Turf Grass		
Vegetated Shelf (6' Wide)		Area of Shelf =	See Pond Plan	(50 Plants per 200 SF of Area)		
Quantity	Type	Symbol	Common Name	Scientific Name	Planting Size	Notes
See Pond Plan	Herbaceous	SW	Swamp Milkweed	Asclepias Incarnata	4" Pot	24"-36" OC
See Pond Plan	Herbaceous	WT	White Turtlehead	Chelone Glabra	4" Pot	24"-36" OC
See Pond Plan	Herbaceous	SR	Scarlet rose mallow	Hibiscus Coccineus	4" Pot	24"-36" OC
See Pond Plan	Herbaceous	SM	Seashore Mallow	Kosteletzkya Virginica	4" Pot	24"-36" OC
See Pond Plan	Herbaceous	LL	Longleaf lobelia	Lobelia Elongata	4" Pot	24"-36" OC
See Pond Plan	Herbaceous	JP	Joe Pye Weed	Eupat' Fistulosus	4" Pot	24"-36" OC

Design of the wet pond in accordance with the MDC guidance of the State of North Carolina stormwater manual.

MDC 1. MAIN POOL SURFACE AND VOLUME

The main pool volume is calculated using the SA/DA Tables with Average Depth Method for Peadmontl.

For 3.5 feet avg depth SA/DA = ((0.84 + 0.69)/2) - ((0.51+0.43)/2)) * 0.8) + ((0.51+0.43)/2) = 0.704%

Required SA = (0.704 / 100) x 13.42 ac x 43560 = 4118 sf

Total area draining to SCM = 13.42 ac

SA provided: 11811 sf

Volume of the main pool: 44186 cf (see next pages for more details)

MDC 2. MAIN POOL DEPTH

The average depth pool shall be three to eight feet below the permanent pool elevation.
The calculation of the average depth excludes both the volume and area of any portion of the vegetated shelf.

davg = [Vperm pool - [0.5 x Depth max over shelf x Perimeter perm pool x Width submerged part of shelf] / Abottom of shelf
The average depth of the main pool will be 3.5 ft. (Round D_{avg} down to nearest 0.5 ft)

MDC 3. SEDIMENT STORAGE

The forebays and the main pool will have 12 inch sediment storage below the designed depths.

MDC 4. LOCATION OF THE INLET AND OUTLET

The inlets and the outlet are located on the opposite sides of the wet pond avoiding the possibility of shortcuts.

MDC 5. FOREBAY

The total volume of the forebay is 21.8% of the volume of the main pool.

MDC 6. VEGETATED SHELF

The vegetated shelf is completely above the permanent pool. It has a 10 feet width and 10:1 slope.

MDC 7. DRAWDOWN TIME

The design volume draws down to the permanent pool elevation in 3 days.

MDC 8. PROTECTION OF THE RECEIVING STREAM

The wet pond discharges the runoff in a manner that minimizes the hydrologic impact of the receiving channel.

MDC 9. FOUNTAINS

No fountain will be used in the wet pond.

MDC 10. TRASH RACK

There will be a trash rack provided.

MDC 11. VEGETATION

The vegetated shelf area of the wet pond is approximately 8000 sf. The density of the plants within the shelf area will be 50 plants per 200 sf.

The embankment and slopes of the pond will be vegetated only with non-clumping turf grass.

IDF Curve - Rainfall Intensity

Alice Keene, Greenville, NC

Input Data from NOAA	Average recurrance interval (years)					
T (min)	1	2	5	10	25	100
10	0.712	0.831	0.954	1.08	1.21	1.43
15	0.89	1.05	1.21	1.37	1.54	1.81
30	1.22	1.44	1.72	1.98	2.28	2.77

Calculation of Design Rainfall Intensity, i, using the equation: $i = g/(h + T)$

1 yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0087
10	4.27	0.23	Intercept = h/g	0.1480
15	3.56	0.28	**g** = 1/slope	**114.4**
30	2.44	0.41	**h** = g*intercept	**16.9**

2yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0073
10	4.99	0.20	Intercept = h/g	0.1278
15	4.20	0.24	**g** = 1/slope	**136.6**
30	2.88	0.35	**h** = g*intercept	**17.5**

5 yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0058
10	5.72	0.17	Intercept = h/g	0.1185
15	4.84	0.21	**g** = 1/slope	**173.8**
30	3.44	0.29	**h** = g*intercept	**20.6**

10 yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0049
10	6.48	0.15	Intercept = h/g	0.1074
15	5.48	0.18	**g** = 1/slope	**206.0**
30	3.96	0.25	**h** = g*intercept	**22.1**

25 yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0040
10	7.26	0.14	Intercept = h/g	0.0996
15	6.16	0.16	**g** = 1/slope	**249.2**
30	4.56	0.22	**h** = g*intercept	**24.8**

100 yr

Data from IDF graph			Equation Constants (g & h)	
T, min	i, in/hr	1/i, hr/in	Slope = 1/g	0.0031
10	8.58	0.12	Intercept = h/g	0.0880
15	7.24	0.14	**g** = 1/slope	**321.3**
30	5.54	0.18	**h** = g*intercept	**28.3**

1 year storm

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STORM WATER DETENTION ROUTING
FOR
Alice Keene, Greenville, NC

1 Year 24-Hour Storm
2/20/2023

Site Conditions Predevelopment

Total watershed area					32.51	acres
Impervious	C=	0.95	CN=	95	1.07	acres
Lawn	C=	0.15	CN=	55	7.18	acres
Pasture	C=	0.45	CN=	60	24.26	acres
SCS Soil Group	Ly, GoA			B		
Hydraulic Length		Overland	330	Channelized	973.0	feet
Vertical Relief		Overland	1.00	Channelized	3.6	feet
1 yr 24h rainfall					3.13	inches

Time of Concentration
channel flow

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
	12.7	+	13.49	38.82	minutes
Travel Factor	2		1		

Composite C = 0.40

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

$$I = \frac{g}{(h+T)}$$

	R	g	h		
Rainfall Intensity	**1**	**114.4**	**16.9**	2.05	inches per hr

Peak Discharge $Q = CIA$ **26.69** cfs

1 year storm

Site Conditions Post Development

Total watershed area					32.51	acres
Impervious	C=	0.95	CN=	95	3.08	acres
Lawn	C=	0.15	CN=	95	5.36	acres
Pasture	C=	0.45	CN=	60	24.07	acres
						32.51

SCS Soil Group	Ly, GoA			B		
Hydraulic Length		Overland	330	Channelized	973	feet
Vertical Relief		Overland	1	Channelized	3.60	feet
1 yr 24 h rainfall					3.13	inches

Design Hydrograph Formulation

Composite CN 69.1

$$S = \frac{1000}{CN} - 10$$ 4.47

Runoff

$$Q^* = \frac{(P - 0.2S)^2}{P + 0.8S}$$ 0.74 inches

Time of Concentration
channel flow (not overland)

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
Travel Factor	12.7	+	13.49	38.8	minutes
	2.0		1.0		

Composite C = 0.45

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

Rainfall Intensity $I = \frac{g}{(h+T)}$	R	g	h		
	1	**114.4**	**16.9**	2.05	inches per hr

Peak Discharge $Q = CIA$ **29.88 cfs**

Time to peak $T_p = \frac{Vol}{1.39 Q_p}$ 35.26 minutes

Storage Required $S = (Q_P - Q_o) T_P$ 6,733 cf

6,733

Allowable release at impoundment (pre-bypass) = 26.69 cfs
Peak rate of inflow at impoundment (pre-bypass) = 29.88 cfs
Allowable release at impoundment(post-bypass)= **8.72** cfs
Peak rate of inflow at impoundment (post-bypass) = **11.90** cfs

BYPASSED FLOW

	Area(ac)	C	I(in/hr)	
Impervious	0.34	0.95		
Pasture	18.75	0.45		$Q_{bypassed}$ **17.97 cfs**
Lawn	0.00	0.15		
				19.090
Total	19.090	0.46	2.05	

STAGE STORAGE DATA

Elevation	surface area	diff. elev	storage	accum. storage	Elevation	Stage
62.50	16,666				62.50	
		0.50	9,077			
63.00	19,643			9,077	63.00	0.5
		1.00	20,579			
64.00	21,514			29,656	64.00	1.5
		1.00	22,479			
65.00	23,444			52,135	65.00	2.5
		1.00	24,432			
66.00	25,419			76,566	66.00	3.5
		1.00	26,437			
67.00	27,454			103,003	67.00	4.5
		1.00	28,509			
68.00	29,564			131,512	68.00	5.5

Storage elevation@minimum storage volume **63.50** msl — Computed Temporary Pool Elevation — 1" runoff

63.50 — Set the Temporary Pool Elevation

Storage	Stage	LN(storage)	LN(Stage)	Z Computed Stage
76,566	3.5	11.25	1.25	3.53
103,003	4.5	11.54	1.50	4.50
131,512	5.5	11.79	1.70	5.50

$$b = \frac{\ln\left(\frac{S_2}{S_1}\right)}{\ln\left(\frac{Z_2}{Z_1}\right)}$$ 1.22

$$K_s = \frac{S_2}{Z_2^{\,b}}$$ 16,500.03

$$Z = \left[\frac{S}{K_s}\right]^{1/b}$$ 24.97

63.50 feet msl

Storage for first 1" 9400 cf

Size Outlet Device for Control Structure

invert elevation =	62.50	feet msl	
estimated orifice center elev. =	62.57	feet msl	
Average Head Elevation =	63.50	feet msl	
Average Head =	0.33	feet	1/3 head
discharge (d) =	8.7	cfs	
coefficient of discharge =	0.6		
Q of orifice	0.046	cfs	Based on Trial Diameter
Draw down of temporary pool	2.34	days	

Orifice equation

$$Q = C_d A\sqrt{2gh}$$

2.00 inches Calculated

1.75 inches try

Inflow Hydrograph

Peak Inflow = 29.88 11.90 after bypass
Time to Peak = 35.3 min 44 1.25 times

Time T (min)	Inflow Q (cfs)	Orifice Outflow Q (cfs)	Principal Outflow Q (cfs)	Structure Overflow Q (cfs)	Emerg Spillway Q (cfs)	Total Outflow Q (cfs)
0	0.00	0.00	0.00	0.00	0.0	0.00
3.00	0.21	0.00	0.00	0.00	0.0	0.00
6.00	0.83	0.00	0.00	0.00	0.0	0.00
9.00	1.81	0.00	0.00	0.00	0.0	0.00
12.00	3.09	0.00	0.00	0.00	0.0	0.00
15.00	4.56	0.02	0.00	0.00	0.0	0.02
18.00	6.14	0.03	0.00	0.00	0.0	0.03
21.00	7.70	0.03	0.00	0.00	0.0	0.03
24.00	9.14	0.04	0.00	0.00	0.0	0.04
27.00	10.36	0.05	0.00	0.00	0.0	0.05
30.00	11.26	0.05	0.00	0.00	0.0	0.05
33.00	11.78	0.06	0.00	0.00	0.0	0.06
36.00	11.89	0.07	0.00	0.00	0.0	0.07
39.00	11.58	0.07	0.00	0.00	0.0	0.07
42.00	10.87	0.08	0.00	0.00	0.0	0.08
45.00	9.83	0.08	0.07	0.00	0.0	0.15
48.00	8.80	0.08	0.19	0.00	0.0	0.28
51.00	7.88	0.09	0.35	0.00	0.0	0.44
54.00	7.06	0.09	0.47	0.00	0.0	0.56
57.00	6.32	0.09	0.57	0.00	0.0	0.66
60.00	5.66	0.09	0.65	0.00	0.0	0.74
63.00	5.06	0.09	0.68	0.00	0.0	0.77
66.00	4.53	0.09	0.79	0.00	0.0	0.88
69.00	4.06	0.09	0.88	0.00	0.0	0.97
72.00	3.63	0.09	0.94	0.00	0.0	1.03
75.00	3.25	0.10	1.03	0.00	0.0	1.12
78.00	2.91	0.10	1.06	0.00	0.0	1.16
81.00	2.61	0.10	1.12	0.00	0.0	1.22
84.00	2.33	0.10	1.16	0.00	0.0	1.25
87.00	2.09	0.10	1.19	0.00	0.0	1.29
90.00	1.87	0.10	1.19	0.00	0.0	1.29
93.00	1.68	0.10	1.22	0.00	0.0	1.32
96.00	1.50	0.10	1.22	0.00	0.0	1.32
99.00	1.34	0.10	1.22	0.00	0.0	1.32
102.00	1.20	0.10	1.22	0.00	0.0	1.32
105.00	1.08	0.10	1.22	0.00	0.0	1.32
108.00	0.96	0.10	1.22	0.00	0.0	1.32
111.00	0.86	0.10	1.22	0.00	0.0	1.32
114.00	0.77	0.10	1.19	0.00	0.0	1.29
117.00	0.69	0.10	1.19	0.00	0.0	1.29
120.00	0.62	0.10	1.16	0.00	0.0	1.25
123.00	0.55	0.10	1.16	0.00	0.0	1.25
126.00	0.50	0.10	1.12	0.00	0.0	1.22
129.00	0.44	0.10	1.12	0.00	0.0	1.22
132.00	0.40	0.10	1.09	0.00	0.0	1.19
135.00	0.36	0.10	1.09	0.00	0.0	1.19
138.00	0.32	0.10	1.06	0.00	0.0	1.16
141.00	0.29	0.10	1.03	0.00	0.0	1.12
144.00	0.26	0.10	1.00	0.00	0.0	1.09
147.00	0.23	0.10	1.00	0.00	0.0	1.09
150.00	0.20	0.10	0.97	0.00	0.0	1.06
153.00	0.18	0.09	0.94	0.00	0.0	1.03
156.00	0.16	0.09	0.94	0.00	0.0	1.03
159.00	0.15	0.09	0.91	0.00	0.0	1.00
162.00	0.13	0.09	0.88	0.00	0.0	0.97
165.00	0.12	0.09	0.88	0.00	0.0	0.97
168.00	0.11	0.09	0.85	0.00	0.0	0.94
171.00	0.09	0.09	0.82	0.00	0.0	0.91
174.00	0.08	0.09	0.79	0.00	0.0	0.88
177.00	0.08	0.09	0.79	0.00	0.0	0.88
180.00	0.07	0.09	0.76	0.00	0.0	0.85
183.00	0.06	0.09	0.73	0.00	0.0	0.82
186.00	0.05	0.09	0.73	0.00	0.0	0.82
189.00	0.05	0.09	0.70	0.00	0.0	0.79
192.00	0.04	0.09	0.70	0.00	0.0	0.79
195.00	0.04	0.09	0.68	0.00	0.0	0.77
198.00	0.03	0.09	0.65	0.00	0.0	0.74
201.00	0.03	0.09	0.65	0.00	0.0	0.74
204.00	0.03	0.09	0.62	0.00	0.0	0.71
207.00	0.03	0.09	0.62	0.00	0.0	0.71
210.00	0.02	0.09	0.59	0.00	0.0	0.69
213.00	0.02	0.09	0.57	0.00	0.0	0.66
216.00	0.02	0.09	0.57	0.00	0.0	0.66
219.00	0.02	0.09	0.54	0.00	0.0	0.63
222.00	0.01	0.09	0.54	0.00	0.0	0.63
225.00	0.01	0.09	0.52	0.00	0.0	0.61

228.00	0.01	0.09	0.52	0.00	0.0	0.61
231.00	0.01	0.09	0.49	0.00	0.0	0.58
234.00	0.01	0.09	0.49	0.00	0.0	0.58
237.00	0.01	0.09	0.47	0.00	0.0	0.56
240.00	0.01	0.09	0.47	0.00	0.0	0.56
243.00	0.01	0.09	0.44	0.00	0.0	0.53
246.00	0.01	0.09	0.44	0.00	0.0	0.53
249.00	0.01	0.09	0.44	0.00	0.0	0.53
252.00	0.00	0.09	0.42	0.00	0.0	0.51
255.00	0.00	0.09	0.42	0.00	0.0	0.51
258.00	0.00	0.09	0.40	0.00	0.0	0.49
261.00	0.00	0.09	0.40	0.00	0.0	0.49
264.00	0.00	0.09	0.38	0.00	0.0	0.46
267.00	0.00	0.09	0.38	0.00	0.0	0.46
270.00	0.00	0.09	0.38	0.00	0.0	0.46
273.00	0.00	0.09	0.35	0.00	0.0	0.44
276.00	0.00	0.09	0.35	0.00	0.0	0.44
279.00	0.00	0.09	0.33	0.00	0.0	0.42

Stormwater routing

						Diameter	1.00	16.00	15.00	18.00
						1.75 inch	Length (ft) 63.50	Top of Box 66.00	Emerg Spill 66.80	Outlet Orifice 62.50
T (time min)	Q (cfs)	Storage	Stage	Outflow	Elevation	Orifice	Weir	Weir		
0	0	-	0.00	0.00	62.50					
3.00	0.2	-	0.00	0.00	62.50	0.00	0.0	0.0	0.0	0.00
6.00	0.8	38	0.01	0.00	62.51	0.00	0.0	0.0	0.0	0.85
9.00	1.8	187	0.03	0.00	62.53	0.00	0.0	0.0	0.0	1.47
12.00	3.1	513	0.06	0.00	62.56	0.00	0.0	0.0	0.0	2.08
15.00	4.6	1,069	0.11	0.02	62.61	0.02	0.0	0.0	0.0	2.82
18.00	6.1	1,887	0.17	0.03	62.67	0.03	0.0	0.0	0.0	3.51
21.00	7.7	2,988	0.25	0.03	62.75	0.03	0.0	0.0	0.0	4.25
24.00	9.1	4,369	0.34	0.04	62.84	0.04	0.0	0.0	0.0	4.96
27.00	10.4	6,007	0.44	0.05	62.94	0.05	0.0	0.0	0.0	5.64
30.00	11.3	7,863	0.54	0.05	63.04	0.05	0.0	0.0	0.0	6.25
33.00	11.8	9,879	0.66	0.06	63.16	0.06	0.0	0.0	0.0	6.91
36.00	11.9	11,988	0.77	0.07	63.27	0.07	0.0	0.0	0.0	7.46
39.00	11.6	14,116	0.88	0.07	63.38	0.07	0.0	0.0	0.0	7.98
42.00	10.9	16,187	0.98	0.08	63.48	0.08	0.0	0.0	0.0	8.42
45.00	9.8	18,130	1.08	0.15	63.58	0.08	0.1	0.0	0.0	8.84
48.00	8.5	19,868	1.16	0.28	63.66	0.08	0.2	0.0	0.0	9.16
51.00	7.0	21,345	1.24	0.44	63.74	0.09	0.4	0.0	0.0	9.47
54.00	5.4	22,519	1.29	0.56	63.79	0.09	0.5	0.0	0.0	9.66
57.00	3.8	23,387	1.33	0.66	63.83	0.09	0.6	0.0	0.0	9.81
60.00	2.4	23,959	1.36	0.74	63.86	0.09	0.6	0.0	0.0	9.92
63.00	5.1	24,266	1.37	0.77	63.87	0.09	0.7	0.0	0.0	9.95
66.00	4.5	25,040	1.41	0.88	63.91	0.09	0.8	0.0	0.0	10.10
69.00	4.1	25,697	1.44	0.97	63.94	0.09	0.9	0.0	0.0	10.21
72.00	3.6	26,253	1.46	1.03	63.96	0.09	0.9	0.0	0.0	10.28
75.00	3.3	26,722	1.49	1.12	63.99	0.10	1.0	0.0	0.0	10.38
78.00	2.9	27,105	1.50	1.16	64.00	0.10	1.1	0.0	0.0	10.42
81.00	2.6	27,421	1.52	1.22	64.02	0.10	1.1	0.0	0.0	10.48
84.00	2.3	27,671	1.53	1.25	64.03	0.10	1.2	0.0	0.0	10.52
87.00	2.1	27,865	1.54	1.29	64.04	0.10	1.2	0.0	0.0	10.55
90.00	1.9	28,009	1.54	1.29	64.04	0.10	1.2	0.0	0.0	10.55
93.00	1.7	28,114	1.55	1.32	64.05	0.10	1.2	0.0	0.0	10.59
96.00	1.5	28,178	1.55	1.32	64.05	0.10	1.2	0.0	0.0	10.59
99.00	1.3	28,210	1.55	1.32	64.05	0.10	1.2	0.0	0.0	10.59
102.00	1.2	28,214	1.55	1.32	64.05	0.10	1.2	0.0	0.0	10.59
105.00	1.1	28,193	1.55	1.32	64.05	0.10	1.2	0.0	0.0	10.59
108.00	1.0	28,149	1.55	1.32	64.05	0.10	1.2	0.0	0.0	10.59
111.00	0.9	28,084	1.55	1.32	64.05	0.10	1.2	0.0	0.0	10.59
114.00	0.8	28,002	1.54	1.29	64.04	0.10	1.2	0.0	0.0	10.55
117.00	0.7	27,909	1.54	1.29	64.04	0.10	1.2	0.0	0.0	10.55
120.00	0.6	27,802	1.53	1.25	64.03	0.10	1.2	0.0	0.0	10.52
123.00	0.6	27,687	1.53	1.25	64.03	0.10	1.2	0.0	0.0	10.52
126.00	0.5	27,561	1.52	1.22	64.02	0.10	1.1	0.0	0.0	10.48
129.00	0.4	27,431	1.52	1.22	64.02	0.10	1.1	0.0	0.0	10.48
132.00	0.4	27,291	1.51	1.19	64.01	0.10	1.1	0.0	0.0	10.45
135.00	0.4	27,149	1.51	1.19	64.01	0.10	1.1	0.0	0.0	10.45
138.00	0.3	26,999	1.50	1.16	64.00	0.10	1.1	0.0	0.0	10.42
141.00	0.3	26,848	1.49	1.12	63.99	0.10	1.0	0.0	0.0	10.38
144.00	0.3	26,697	1.48	1.09	63.98	0.10	1.0	0.0	0.0	10.35
147.00	0.2	26,546	1.48	1.09	63.98	0.10	1.0	0.0	0.0	10.35
150.00	0.2	26,391	1.47	1.06	63.97	0.10	1.0	0.0	0.0	10.31
153.00	0.2	26,236	1.46	1.03	63.96	0.09	0.9	0.0	0.0	10.28
156.00	0.2	26,084	1.46	1.03	63.96	0.09	0.9	0.0	0.0	10.28
159.00	0.1	25,928	1.45	1.00	63.95	0.09	0.9	0.0	0.0	10.24
162.00	0.1	25,774	1.44	0.97	63.94	0.09	0.9	0.0	0.0	10.21
165.00	0.1	25,624	1.44	0.97	63.94	0.09	0.9	0.0	0.0	10.21
168.00	0.1	25,470	1.43	0.94	63.93	0.09	0.8	0.0	0.0	10.17
171.00	0.1	25,320	1.42	0.91	63.92	0.09	0.8	0.0	0.0	10.13
174.00	0.1	25,173	1.41	0.88	63.91	0.09	0.8	0.0	0.0	10.10
177.00	0.1	25,030	1.41	0.88	63.91	0.09	0.8	0.0	0.0	10.10
180.00	0.1	24,885	1.40	0.85	63.90	0.09	0.8	0.0	0.0	10.06
183.00	0.1	24,744	1.39	0.82	63.89	0.09	0.7	0.0	0.0	10.03
186.00	0.1	24,607	1.39	0.82	63.89	0.09	0.7	0.0	0.0	10.03
189.0	0.0	24,469	1.38	0.79	63.88	0.09	0.7	0.0	0.0	9.99
192.0	0.0	24,334	1.38	0.79	63.88	0.09	0.7	0.0	0.0	9.99
195.0	0.0	24,199	1.37	0.77	63.87	0.09	0.7	0.0	0.0	9.95
198.0	0.0	24,068	1.36	0.74	63.86	0.09	0.6	0.0	0.0	9.92
201.0	0.0	23,941	1.36	0.74	63.86	0.09	0.6	0.0	0.0	9.92
204.0	0.0	23,814	1.35	0.71	63.85	0.09	0.6	0.0	0.0	9.88
207.0	0.0	23,691	1.35	0.71	63.85	0.09	0.6	0.0	0.0	9.88
210.0	0.0	23,567	1.34	0.69	63.84	0.09	0.6	0.0	0.0	9.84
213.0	0.0	23,448	1.33	0.66	63.83	0.09	0.6	0.0	0.0	9.81

1 year storm

216.0	0.0	23,333	1.33	0.66	63.83	0.09	0.6	0.0	0.0	9.81
219.0	0.0	23,218	1.32	0.63	63.82	0.09	0.5	0.0	0.0	9.77
222.0	0.0	23,107	1.32	0.63	63.82	0.09	0.5	0.0	0.0	9.77
225.0	0.0	22,995	1.31	0.61	63.81	0.09	0.5	0.0	0.0	9.73
228.0	0.0	22,888	1.31	0.61	63.81	0.09	0.5	0.0	0.0	9.73
231.0	0.0	22,781	1.30	0.58	63.80	0.09	0.5	0.0	0.0	9.70
234.0	0.0	22,678	1.30	0.58	63.80	0.09	0.5	0.0	0.0	9.70
237.0	0.0	22,575	1.29	0.56	63.79	0.09	0.5	0.0	0.0	9.66
240.0	0.0	22,476	1.29	0.56	63.79	0.09	0.5	0.0	0.0	9.66
243.0	0.0	22,377	1.28	0.53	63.78	0.09	0.4	0.0	0.0	9.62
246.0	0.0	22,283	1.28	0.53	63.78	0.09	0.4	0.0	0.0	9.62
249.0	0.0	22,188	1.28	0.53	63.78	0.09	0.4	0.0	0.0	9.62
252.0	0.0	22,093	1.27	0.51	63.77	0.09	0.4	0.0	0.0	9.58
255.0	0.0	22,002	1.27	0.51	63.77	0.09	0.4	0.0	0.0	9.58
258.0	0.0	21,911	1.26	0.49	63.76	0.09	0.4	0.0	0.0	9.55
261.0	0.0	21,825	1.26	0.49	63.76	0.09	0.4	0.0	0.0	9.55
264.0	0.0	21,738	1.25	0.46	63.75	0.09	0.4	0.0	0.0	9.51
267.0	0.0	21,655	1.25	0.46	63.75	0.09	0.4	0.0	0.0	9.51
270.0	0.0	21,572	1.25	0.46	63.75	0.09	0.4	0.0	0.0	9.51
273.0	0.0	21,490	1.24	0.44	63.74	0.09	0.4	0.0	0.0	9.47
276.0	0.0	21,411	1.24	0.44	63.74	0.09	0.4	0.0	0.0	9.47
279.0	0.0	21,332	1.23	0.42	63.73	0.09	0.3	0.0	0.0	9.43

Results of routing the 1 year storm

Use orifice =	**1.75**	**inches**	
Peak outflow =	**1.32**	**cfs**	Less than post-bypass allowable release of 8.72 cfs
Peak Stage=	**1.55**	**ft**	
Water Elevation=	**64.05**	**msl**	
Peak Storage =	**28,214**	**cf**	
Weir	**63.50**	**msl**	Design Volum Elevation for minimum 1st inch of runoff
Length of weir	**1.00**	**ft**	To control 1 year storm
Structure Overflow	**66.00**	**msl**	Top of Outlet Control Structure
Length of weir	**16.00**	**ft**	

Routing Equations for Table Above

Synthetic Hydrograph

$$Qt = \frac{Qp}{2}\left[1 - \cos\left(\pi\left(\frac{t}{Tp}\right)\right)\right]$$

$$0 \le t \le 1.25\,Tp$$

$$Q = 4.34\,Qp \exp\left[-1.30\left(\frac{t}{Tp}\right)\right]$$

$$t > 1.25\,Tp$$

Routing Equations

$$Storage\,(S_{ij}) = (I_i - Q_i)\Delta t_{ij}$$

Stage/Storage Equation

Stage

$$Z = \left[\frac{S}{K_s}\right]^{1/b}$$

$$K_s = \frac{S_2}{Z_2^b}$$

$$b = \frac{\ln\left(\frac{S_2}{S_1}\right)}{\ln\left(\frac{Z_2}{Z_1}\right)}$$

Outflow

$$Q_{outflow} = \sum(Q_{orif} + Q_{weir} + Q_{spillway} + \cdots)$$

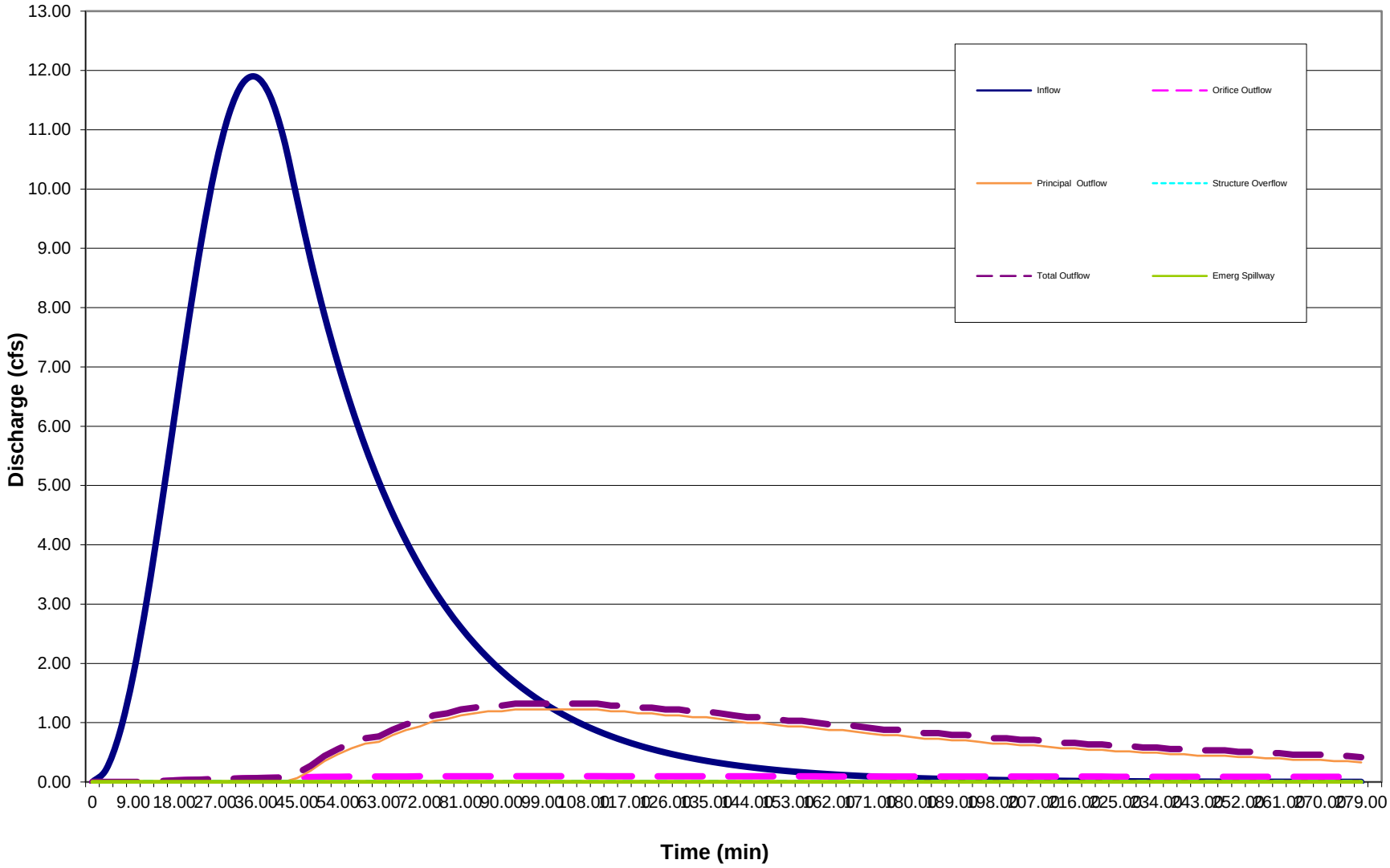
Outflow from Orifice

$$Q_{orifice} = C_d A\sqrt{2gh}$$

Outflow from Weir

$$Q_{weir} = C_w L H^{\frac{3}{2}}$$

Routing Hydrograph (1 Yr Storm)



107 East Second Street
Greenville, NC 27858
(252) 752-4135
F-0334

STORM WATER DETENTION ROUTING
FOR
Alice Keene, Greenville, NC

2 Year 24-Hour Storm
2/20/2023

Site Conditions Predevelopment

Total watershed area					32.51	acres
Impervious	C=	0.95	CN=	95	1.07	acres
Lawn	C=	0.15	CN=	55	7.18	acres
Pasture	C=	0.45	CN=	60	24.26	acres

SCS Soil Group	Ly, GoA				
Hydraulic Length		Overland	330	Channelized	973 feet
Vertical Relief		Overland	1.00	Channelized	3.60 feet
2 Year 24 h Rainfall					3.81 inches

Time of Concentration
channel flow

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
Travel Factor	12.67	+	13.49	38.82	minutes
	2		1		

Composite C = 0.40

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

$$I = \frac{g}{(h+T)}$$

R	g	h		
2	**136.6**	**17.5**	2.43	inches per hr

Peak Discharge $Q = CIA$ **31.58** cfs

Site Conditions Post Development

Total watershed area					32.51	acres
Impervious	C=	0.95	CN=	95	3.08	acres
Lawn	C=	0.15	CN=	95	5.36	acres
Pasture	C=	0.45	CN=	60	24.07	acres

SCS Soil Group	Ly, GoA				
Hydraulic Length		Overland	330.00	Channelized	973.00 feet
Vertical Relief		Overland	1.00	Channelized	3.60 feet
5 yr 24 h rainfall					3.81 inches

Design Hydrograph Formulation

Composite CN 69.1

$$S = \frac{1000}{CN} - 10$$ 4.47

Runoff

$$Q^* = \frac{(P - 0.2S)^2}{P + 0.8S}$$ 1.15 inches

Time of Concentration
channel flow (not overland)

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
Travel Factor	12.7	+	13.5	38.8	minutes
	2.0		1.0		

Composite C = 0.45

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

$$I = \frac{g}{(h+T)}$$

R	g	h		
2	**136.6**	**17.5**	2.43	inches per hr

Peak Discharge $Q = CIA$ **35.35 cfs**

Time to peak $T_p = \frac{Vol}{1.39 Q_p}$ 46.0 minutes

Storage Required $S = (Q_p - Q_o) T_p$ 10,399 cf
(Above 1st inch of runoff pool)

Allowable release at impoundment (pre-bypass) = 31.58 cfs
Peak rate of inflow at impoundment (pre-bypass) = 35.35 cfs
Allowable release at impoundment(post-bypass)= **10.32** cfs
Peak rate of inflow at impoundment (post-bypass) = **14.08** cfs

BYPASSED FLOW

	Area(ac)	C	I(in/hr)
Impervious	0.34	0.95	
Pasture	18.75	0.45	
Lawn	0.00	0.15	
Total	19.09	0.46	2.43

$Q_{bypassed}$ **21.27 cfs**

STAGE STORAGE DATA

Elevation	surface area	diff. elev	storage	accum. storage	Elevation	Stage
62.50	16,666				62.50	
		0.50	9,077			
63.00	19,643			9,077	63.00	0.5
		1.00	20,579			
64.00	21,514			29,656	64.00	2
		1.00	22,479			
65.00	23,444			52,135	65.00	2.5
		1.00	24,432			
66.00	25,419			76,566	66.00	3.5
		1.00	26,437			
67.00	27,454			103,003	67.00	4.5
		1.00	28,509			
68.00	29,564			131,512	68.00	5.5

Storage	Stage	LN(storage)	LN(Stage)	Z Computed Stage
76,566	3.5	11.25	1.25	3.53
103,003	4.5	11.54	1.50	4.50
131,512	6	11.79	1.70	5.50

$$b = \frac{\ln\left(\frac{S_2}{S_1}\right)}{\ln\left(\frac{Z_2}{Z_1}\right)}$$ 1.22

$$K_s = \frac{S_2}{Z_2^{\,b}}$$ 16,500.03

$$Z = \left[\frac{S}{K_s}\right]^{1/b}$$ 24.97

63.50 feet msl

Size Outlet Device for Control Structure

invert elevation =	62.50	feet msl
estimated orifice center elev. =	62.57	feet msl
proposed water surface elev. =	63.50	feet msl
Average head (h) =	0.33	feet
discharge (d) =	10.3	cfs
coefficient of discharge =	0.6	

Orifice equation

$$Q = C_d A\sqrt{2gh}$$

2.17 inches estimated based on 2 yr
1.75 inches use orifice based on 1 yr

Inflow Hydrograph

Peak Inflow = 35.35 **14.08**
Time to Peak = 46.0 min 58 1.25 times

Time T (min)	Inflow Q (cfs)	Orifice Outflow Q (cfs)	Principal Outflow Q (cfs)	Structure Overflow Q (cfs)	Emerg Spillway Q (cfs)	Total Outflow Q (cfs)
0	0.00	0.00	0.00	0.0	0.00	0.0
3.00	0.15	0.00	0.00	0.0	0.00	0.0
6.00	0.58	0.00	0.00	0.0	0.00	0.0
9.00	1.29	0.00	0.00	0.0	0.00	0.0
12.00	2.23	0.00	0.00	0.0	0.00	0.0
15.00	3.38	0.01	0.00	0.0	0.00	0.0
18.00	4.67	0.02	0.00	0.0	0.00	0.0
21.00	6.07	0.03	0.00	0.0	0.00	0.0
24.00	7.51	0.04	0.00	0.0	0.00	0.0
27.00	8.93	0.04	0.00	0.0	0.00	0.0
30.00	10.27	0.05	0.00	0.0	0.00	0.0
33.00	11.47	0.06	0.00	0.0	0.00	0.1
36.00	12.49	0.06	0.00	0.0	0.00	0.1
39.00	13.28	0.07	0.00	0.0	0.00	0.1
42.00	13.82	0.07	0.00	0.0	0.00	0.1
45.00	14.06	0.08	0.02	0.0	0.00	0.1
48.00	14.02	0.08	0.19	0.0	0.00	0.3
51.00	13.69	0.09	0.44	0.0	0.00	0.5
54.00	13.07	0.09	0.73	0.0	0.00	0.8
57.00	12.21	0.10	1.03	0.0	0.00	1.1
60.00	11.23	0.10	1.33	0.0	0.00	1.4
63.00	10.31	0.10	1.61	0.0	0.00	1.7
66.00	9.48	0.10	1.83	0.0	0.00	1.9
69.00	8.71	0.10	2.03	0.0	0.00	2.1
72.00	8.00	0.11	2.19	0.0	0.00	2.3
75.00	7.35	0.11	2.31	0.0	0.00	2.4
78.00	6.75	0.11	2.35	0.0	0.00	2.5
81.00	6.20	0.11	2.39	0.0	0.00	2.5
84.00	5.70	0.11	2.35	0.0	0.00	2.5
87.00	5.24	0.11	2.31	0.0	0.00	2.4
90.00	4.81	0.11	2.27	0.0	0.00	2.4
93.00	4.42	0.11	2.19	0.0	0.00	2.3
96.00	4.06	0.11	2.27	0.0	0.00	2.4
99.00	3.73	0.11	2.31	0.0	0.00	2.4
102.00	3.43	0.11	2.35	0.0	0.00	2.5
105.00	3.15	0.11	2.39	0.0	0.00	2.5
108.00	2.89	0.11	2.39	0.0	0.00	2.5
111.00	2.66	0.11	2.43	0.0	0.00	2.5
114.00	2.44	0.11	2.43	0.0	0.00	2.5
117.00	2.24	0.11	2.43	0.0	0.00	2.5
120.00	2.06	0.11	2.39	0.0	0.00	2.5
123.00	1.89	0.11	2.39	0.0	0.00	2.5
126.00	1.74	0.11	2.39	0.0	0.00	2.5
129.00	1.60	0.11	2.35	0.0	0.00	2.5
132.00	1.47	0.11	2.31	0.0	0.00	2.4
135.00	1.35	0.11	2.31	0.0	0.00	2.4
138.00	1.24	0.11	2.27	0.0	0.00	2.4
141.00	1.14	0.11	2.23	0.0	0.00	2.3
144.00	1.05	0.11	2.19	0.0	0.00	2.3
147.00	0.96	0.11	2.15	0.0	0.00	2.3
150.00	0.88	0.11	2.11	0.0	0.00	2.2
153.00	0.81	0.11	2.07	0.0	0.00	2.2
156.00	0.75	0.10	2.03	0.0	0.00	2.1
159.00	0.69	0.10	1.99	0.0	0.00	2.1
162.00	0.63	0.10	1.95	0.0	0.00	2.1
165.00	0.58	0.10	1.87	0.0	0.00	2.0
168.00	0.53	0.10	1.83	0.0	0.00	1.9
171.00	0.49	0.10	1.79	0.0	0.00	1.9
174.00	0.45	0.10	1.76	0.0	0.00	1.9
177.00	0.41	0.10	1.72	0.0	0.00	1.8
180.00	0.38	0.10	1.68	0.0	0.00	1.8
183.00	0.35	0.10	1.65	0.0	0.00	1.7
186.00	0.32	0.10	1.61	0.0	0.00	1.7
189.00	0.29	0.10	1.54	0.0	0.00	1.6
192.00	0.27	0.10	1.50	0.0	0.00	1.6
195.00	0.25	0.10	1.46	0.0	0.00	1.6
198.00	0.23	0.10	1.43	0.0	0.00	1.5
201.00	0.21	0.10	1.39	0.0	0.00	1.5
204.00	0.19	0.10	1.36	0.0	0.00	1.5
207.00	0.18	0.10	1.33	0.0	0.00	1.4
210.00	0.16	0.10	1.29	0.0	0.00	1.4
213.00	0.15	0.10	1.26	0.0	0.00	1.4
216.00	0.14	0.10	1.22	0.0	0.00	1.3
219.00	0.13	0.10	1.19	0.0	0.00	1.3
222.00	0.12	0.10	1.16	0.0	0.00	1.3
225.00	0.11	0.10	1.12	0.0	0.00	1.2
228.00	0.10	0.10	1.09	0.0	0.00	1.2
231.00	0.09	0.10	1.06	0.0	0.00	1.2

Stormwater routing

T (time min	Q (cfs)	Storage	Stage	Outflow	Elevation	Diameter 1.75 inch Orifice	1.00 Length (ft) 63.50 Weir	16.00 Top of Box 66.00 Weir	15.00 Emerg Spill 66.80	18.00 Outlet Orifice 62.50
0	0	-	0.00	0.00	62.50					
3.00	0.1	-	0.00	0.00	62.50	0.00	0.00	0.00	0.00	0.00
6.00	0.6	26	0.01	0.00	62.51	0.00	0.00	0.00	0.00	0.85
9.00	1.3	131	0.02	0.00	62.52	0.00	0.00	0.00	0.00	1.20
12.00	2.2	363	0.04	0.00	62.54	0.00	0.00	0.00	0.00	1.70
15.00	3.4	764	0.08	0.01	62.58	0.01	0.00	0.00	0.00	2.41
18.00	4.7	1,370	0.13	0.02	62.63	0.02	0.00	0.00	0.00	3.07
21.00	6.1	2,208	0.19	0.03	62.69	0.03	0.00	0.00	0.00	3.71
24.00	7.5	3,296	0.27	0.04	62.77	0.04	0.00	0.00	0.00	4.42
27.00	8.9	4,641	0.35	0.04	62.85	0.04	0.00	0.00	0.00	5.03
30.00	10.3	6,240	0.45	0.05	62.95	0.05	0.00	0.00	0.00	5.70
33.00	11.5	8,079	0.56	0.06	63.06	0.06	0.00	0.00	0.00	6.36
36.00	12.5	10,134	0.67	0.06	63.17	0.06	0.00	0.00	0.00	6.96
39.00	13.3	12,371	0.79	0.07	63.29	0.07	0.00	0.00	0.00	7.56
42.00	13.8	14,750	0.91	0.07	63.41	0.07	0.00	0.00	0.00	8.11
45.00	14.1	17,223	1.04	0.10	63.54	0.08	0.02	0.00	0.00	8.67
48.00	14.0	19,736	1.16	0.28	63.66	0.08	0.19	0.00	0.00	9.16
51.00	13.7	22,210	1.28	0.53	63.78	0.09	0.44	0.00	0.00	9.62
54.00	13.1	24,578	1.39	0.82	63.89	0.09	0.73	0.00	0.00	10.03
57.00	12.2	26,783	1.49	1.12	63.99	0.10	1.03	0.00	0.00	10.38
60.00	11.1	28,778	1.58	1.42	64.08	0.10	1.33	0.00	0.00	10.69
63.00	9.9	30,525	1.66	1.71	64.16	0.10	1.61	0.00	0.00	10.96
66.00	8.5	31,995	1.72	1.94	64.22	0.10	1.83	0.00	0.00	11.15
69.00	7.1	33,179	1.77	2.13	64.27	0.10	2.03	0.00	0.00	11.31
72.00	5.6	34,069	1.81	2.29	64.31	0.11	2.19	0.00	0.00	11.44
75.00	4.3	34,673	1.84	2.42	64.34	0.11	2.31	0.00	0.00	11.54
78.00	3.0	35,008	1.85	2.46	64.35	0.11	2.35	0.00	0.00	11.57
81.00	1.9	35,108	1.86	2.50	64.36	0.11	2.39	0.00	0.00	11.60
84.00	1.0	35,005	1.85	2.46	64.35	0.11	2.35	0.00	0.00	11.57
87.00	0.4	34,752	1.84	2.42	64.34	0.11	2.31	0.00	0.00	11.54
90.00	0.1	34,393	1.83	2.38	64.33	0.11	2.27	0.00	0.00	11.50
93.00	4.4	33,978	1.81	2.29	64.31	0.11	2.19	0.00	0.00	11.44
96.00	4.1	34,361	1.83	2.38	64.33	0.11	2.27	0.00	0.00	11.50
99.00	3.7	34,665	1.84	2.42	64.34	0.11	2.31	0.00	0.00	11.54
102.00	3.4	34,902	1.85	2.46	64.35	0.11	2.35	0.00	0.00	11.57
105.00	3.1	35,076	1.86	2.50	64.36	0.11	2.39	0.00	0.00	11.60
108.00	2.9	35,193	1.86	2.50	64.36	0.11	2.39	0.00	0.00	11.60
111.00	2.7	35,264	1.87	2.54	64.37	0.11	2.43	0.00	0.00	11.63
114.00	2.4	35,285	1.87	2.54	64.37	0.11	2.43	0.00	0.00	11.63
117.00	2.2	35,267	1.87	2.54	64.37	0.11	2.43	0.00	0.00	11.63
120.00	2.1	35,214	1.86	2.50	64.36	0.11	2.39	0.00	0.00	11.60
123.00	1.9	35,135	1.86	2.50	64.36	0.11	2.39	0.00	0.00	11.60
126.00	1.7	35,026	1.86	2.50	64.36	0.11	2.39	0.00	0.00	11.60
129.00	1.6	34,889	1.85	2.46	64.35	0.11	2.35	0.00	0.00	11.57
132.00	1.5	34,735	1.84	2.42	64.34	0.11	2.31	0.00	0.00	11.54
135.00	1.4	34,564	1.84	2.42	64.34	0.11	2.31	0.00	0.00	11.54
138.00	1.2	34,372	1.83	2.38	64.33	0.11	2.27	0.00	0.00	11.50
141.00	1.1	34,168	1.82	2.33	64.32	0.11	2.23	0.00	0.00	11.47
144.00	1.0	33,953	1.81	2.29	64.31	0.11	2.19	0.00	0.00	11.44
147.00	1.0	33,729	1.80	2.25	64.30	0.11	2.15	0.00	0.00	11.41
150.00	0.9	33,497	1.79	2.21	64.29	0.11	2.11	0.00	0.00	11.38
153.00	0.8	33,258	1.78	2.17	64.28	0.11	2.07	0.00	0.00	11.35
156.00	0.7	33,013	1.77	2.13	64.27	0.10	2.03	0.00	0.00	11.31
159.00	0.7	32,763	1.76	2.09	64.26	0.10	1.99	0.00	0.00	11.28
162.00	0.6	32,510	1.75	2.05	64.25	0.10	1.95	0.00	0.00	11.25
165.00	0.6	32,254	1.73	1.97	64.23	0.10	1.87	0.00	0.00	11.19
168.00	0.5	32,003	1.72	1.94	64.22	0.10	1.83	0.00	0.00	11.15
171.00	0.5	31,750	1.71	1.90	64.21	0.10	1.79	0.00	0.00	11.12
174.00	0.4	31,496	1.70	1.86	64.20	0.10	1.76	0.00	0.00	11.09
177.00	0.4	31,242	1.69	1.82	64.19	0.10	1.72	0.00	0.00	11.06
180.00	0.4	30,989	1.68	1.78	64.18	0.10	1.68	0.00	0.00	11.02
183.00	0.3	30,736	1.67	1.75	64.17	0.10	1.65	0.00	0.00	10.99
186.00	0.3	30,484	1.66	1.71	64.16	0.10	1.61	0.00	0.00	10.96
189.00	0.3	30,234	1.64	1.64	64.14	0.10	1.54	0.00	0.00	10.89
192.00	0.3	29,992	1.63	1.60	64.13	0.10	1.50	0.00	0.00	10.86
195.00	0.2	29,753	1.62	1.56	64.12	0.10	1.46	0.00	0.00	10.82
198.00	0.2	29,516	1.61	1.53	64.11	0.10	1.43	0.00	0.00	10.79
201.00	0.2	29,281	1.60	1.49	64.10	0.10	1.39	0.00	0.00	10.76
204.00	0.2	29,050	1.59	1.46	64.09	0.10	1.36	0.00	0.00	10.72
207.00	0.2	28,822	1.58	1.42	64.08	0.10	1.33	0.00	0.00	10.69
210.00	0.2	28,598	1.57	1.39	64.07	0.10	1.29	0.00	0.00	10.66
213.00	0.1	28,377	1.56	1.36	64.06	0.10	1.26	0.00	0.00	10.62
216.00	0.1	28,160	1.55	1.32	64.05	0.10	1.22	0.00	0.00	10.59
219.00	0.1	27,947	1.54	1.29	64.04	0.10	1.19	0.00	0.00	10.55
222.00	0.1	27,737	1.53	1.25	64.03	0.10	1.16	0.00	0.00	10.52
225.00	0.1	27,532	1.52	1.22	64.02	0.10	1.12	0.00	0.00	10.48
228.00	0.1	27,332	1.51	1.19	64.01	0.10	1.09	0.00	0.00	10.45
231.00	0.1	27,135	1.50	1.16	64.00	0.10	1.06	0.00	0.00	10.42

Results of routing the 2 Year storm

Use orifice =	**1.75**	**inches**	
Peak outflow =	**2.54**	**cfs**	Less than post-bypass allowable release o 10.3 cfs
Peak Stage=	**1.87**	**ft**	
Water Elevation=	**64.37**	**msl**	
Peak Storage =	**35,285**	**cf**	
Design Spillway	**63.50**	**msl**	Temporary Pool Elevation for 1st inch of runoff
Length of weir	**1.00**	**ft**	To control 1 yr, 5 yr and 10 yr
Structure Overflow	**66.00**	**msl**	Top of Outlet Control Structure
Length of weir	**16.00**	**ft**	

Routing Equations for Table Above

Synthetic Hydrograph

$$Q_t = \frac{Q_p}{2}\left[1-\cos\left(\pi\left(\frac{t}{T_p}\right)\right)\right]$$

$0 \le t \le 1.25T_p$

$$Q = 4.34\,Q_p \exp\left[-1.30\left(\frac{t}{T_p}\right)\right]$$

$t > 1.25T_p$

Routing Equations

$$Storage\,(S_{ij}) = (I_i - Q_i)\Delta t_{ij}$$

Stage/Storage Equation

Stage

$$Z = \left[\frac{S}{K_1}\right]^{\frac{1}{m}}$$

$$K_1 = \frac{S_1}{Z_1^m}$$

$$m = \frac{\ln\left(\frac{S_1}{S_2}\right)}{\ln\left(\frac{Z_1}{Z_2}\right)}$$

Outflow

$$Q_{outflow} = \sum\left(Q_{orif} + Q_{weir} + Q_{spillway} + \cdots\right)$$

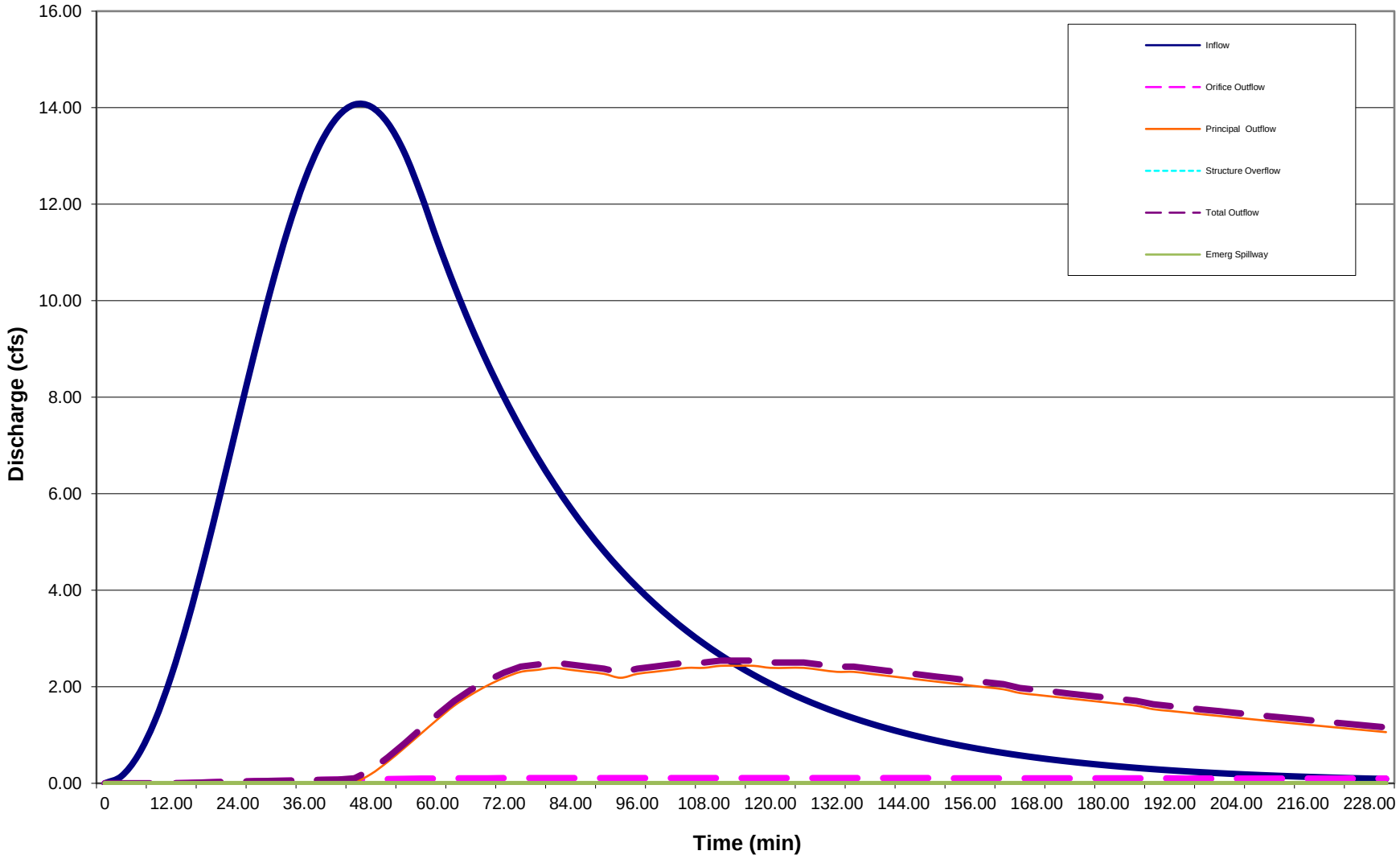
Outflow from Orifice

$$Q_{orifice} = C_d A\sqrt{2gh}$$

Outflow from Weir

$$Q_{weir} = C_w L H^{\frac{3}{2}}$$

Routing Hydrograph (2-YR)



107 East Second Street
Greenville, NC 27858
(252) 752-4135
F-0334

STORM WATER DETENTION ROUTING
FOR
Alice Keene, Greenville, NC

5 Year 24-Hour Storm
2/20/2023

Site Conditions Predevelopment

Total watershed area						32.51	acres
Impervious	C=	0.95	CN=	95		1.07	acres
Lawn	C=	0.15	CN=	55		7.18	acres
Pasture	C=	0.45	CN=	60		24.26	acres
SCS Soil Group	Ly, GoA						
Hydraulic Length		Overland	330.00	Channelized		973.00	feet
Vertical Relief		Overland	1.00	Channelized		3.60	feet
5 Year 24 h Rainfall						4.92	inches

Time of Concentration
channel flow

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
	12.67	+	13.49	38.82	minutes
Travel Factor	2.00		1.00		

Composite C = 0.40

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

		R	g	h		
Rainfall Intensity =	$I = \frac{g}{(h+T)}$	**5**	**173.8**	**20.6**	2.92	inches per hr

Peak Discharge $Q = CIA$ **38.05** cfs

Site Conditions Post Development

Total watershed area						32.51	acres
Impervious	C=	0.95	CN=	95		3.08	acres
Lawn	C=	0.15	CN=	95		5.36	acres
Pasture	C=	0.45	CN=	60		24.07	acres
SCS Soil Group	Ly, GoA						
Hydraulic Length		Overland	330	Channelized		973	feet
Vertical Relief		Overland	1.0	Channelized		4	feet
5 yr 24 h rainfall						4.92	inches

Design Hydrograph Formulation

Composite CN 69.1

$$S = \frac{1000}{CN} - 10$$ 4.47

Runoff

$$Q^* = \frac{(P - 0.2S)^2}{P + 0.8S}$$ 1.91 inches

Time of Concentration
channel flow (not overland)

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
	12.7	+	13.5	38.8	minutes
Travel Factor	2.0		1.0		

Composite C = 0.45

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

		R	g	h		
Rainfall Intensity =	$I = \frac{g}{(h+T)}$	**5**	**173.8**	**20.6**	2.92	inches per hr

Peak Discharge $Q = CIA$ **42.59 cfs**

Time to peak $T_p = \frac{Vol}{1.39 Q_p}$ 63.3 minutes

Storage Required $S = (Q_p - Q_o) T_p$ 17,237 cf
(Above 1st inch of runoff pool)

Allowable release at impoundment (pre-bypass) = 38.05 cfs
Peak rate of inflow at impoundment (pre-bypass) = 42.59 cfs
Allowable release at impoundment(post-bypass)= **12.43** cfs
Peak rate of inflow at impoundment (post-bypass) = **16.97** cfs

BYPASSED FLOW

	Area(ac)	C	I(in/hr)
Impervious	0.34	0.95	
Pasture	18.75	0.45	
Lawn	0.00	0.15	
Total	19.09	0.46	2.92

$Q_{bypassed}$ **25.62 cfs**

5 year storm

STAGE STORAGE DATA

Elevation	surface area	diff. elev	storage	accum. storage	Elevation	Stage
62.50	16,666				62.50	
		0.500	9,077			
63.00	19,643			9,077	63.00	0.5
		1.000	20,579			
64.00	21,514			29,656	64.00	2
		1.000	22,479			
65.00	23,444			52,135	65.00	2.5
		1.000	24,432			
66.00	25,419			76,566	66.00	3.5
		1.000	26,437			
67.00	27,454			103,003	67.00	4.5
		1.000	28,509			
68.00	29,564			131,512	68.00	5.5

Storage	Stage	LN(storage)	LN(Stage)	Z Computed Stage
76,566	3.5	11.25	1.25	3.53
103,003	4.5	11.54	1.50	4.50
131,512	6	11.79	1.70	5.50

$$b = \frac{\ln\left(\frac{S_2}{S_1}\right)}{\ln\left(\frac{Z_2}{Z_1}\right)}$$ 1.22

$$K_s = \frac{S_2}{Z_2^{\,b}}$$ 16,500.03

$$Z = \left[\frac{S}{K_s}\right]^{1/b}$$ 24.97

63.50 feet msl

Size Outlet Device for Control Structure

invert elevation =	62.50	feet msl
estimated orifice center elev. =	62.57	feet msl
proposed water surface elev. =	63.50	feet msl
Average head (h) =	0.33	feet
discharge (d) =	12.4	cfs
coefficient of discharge =	0.6	

Orifice equation

$$Q = C_d A\sqrt{2gh}$$

2.39 inches estimated based on 5 yr
1.75 inches use orifice based on 1 yr

Inflow Hydrograph

Peak Inflow = 42.59 **16.97**
Time to Peak = 63.3 min 79 1.25 times

Time T (min)	Inflow Q (cfs)	Orifice Outflow Q (cfs)	Principal Outflow Q (cfs)	Structure Overflow Q (cfs)	Emerg Spillway Q (cfs)	Total Outflow Q (cfs)
0	0.00	0.00	0.00	0.0	0.00	0.0
3.00	0.09	0.00	0.00	0.0	0.00	0.0
6.00	0.37	0.00	0.00	0.0	0.00	0.0
9.00	0.83	0.00	0.00	0.0	0.00	0.0
12.00	1.46	0.00	0.00	0.0	0.00	0.0
15.00	2.24	0.00	0.00	0.0	0.00	0.0
18.00	3.16	0.01	0.00	0.0	0.00	0.0
21.00	4.20	0.02	0.00	0.0	0.00	0.0
24.00	5.33	0.03	0.00	0.0	0.00	0.0
27.00	6.53	0.03	0.00	0.0	0.00	0.0
30.00	7.78	0.04	0.00	0.0	0.00	0.0
33.00	9.04	0.05	0.00	0.0	0.00	0.0
36.00	10.29	0.05	0.00	0.0	0.00	0.1
39.00	11.49	0.06	0.00	0.0	0.00	0.1
42.00	12.64	0.07	0.00	0.0	0.00	0.1
45.00	13.69	0.07	0.00	0.0	0.00	0.1
48.00	14.62	0.08	0.00	0.0	0.00	0.1
51.00	15.42	0.08	0.09	0.0	0.00	0.2
54.00	16.07	0.09	0.33	0.0	0.00	0.4
57.00	16.55	0.09	0.68	0.0	0.00	0.8
60.00	16.85	0.10	1.06	0.0	0.00	1.2
63.00	16.96	0.10	1.50	0.0	0.00	1.6
66.00	16.89	0.10	1.95	0.0	0.00	2.1
69.00	16.64	0.11	2.43	0.0	0.00	2.5
72.00	16.20	0.11	2.87	0.0	0.00	3.0
75.00	15.59	0.11	3.37	0.0	0.00	3.5
78.00	14.83	0.12	3.80	0.0	0.00	3.9
81.00	13.92	0.12	4.19	0.0	0.00	4.3
84.00	13.13	0.12	4.55	0.0	0.00	4.7
87.00	12.34	0.12	4.86	0.0	0.00	5.0
90.00	11.61	0.12	5.13	0.0	0.00	5.3
93.00	10.91	0.12	5.35	0.0	0.00	5.5
96.00	10.26	0.13	5.57	0.0	0.00	5.7
99.00	9.65	0.13	5.79	0.0	0.00	5.9
102.00	9.07	0.13	5.90	0.0	0.00	6.0
105.00	8.53	0.13	6.07	0.0	0.00	6.2
108.00	8.02	0.13	6.13	0.0	0.00	6.3
111.00	7.54	0.13	6.24	0.0	0.00	6.4
114.00	7.09	0.13	6.24	0.0	0.00	6.4
117.00	6.67	0.13	6.30	0.0	0.00	6.4
120.00	6.27	0.13	6.30	0.0	0.00	6.4
123.00	5.90	0.13	6.30	0.0	0.00	6.4
126.00	5.54	0.13	6.30	0.0	0.00	6.4
129.00	5.21	0.13	6.24	0.0	0.00	6.4
132.00	4.90	0.13	6.19	0.0	0.00	6.3
135.00	4.61	0.13	6.13	0.0	0.00	6.3
138.00	4.33	0.13	6.07	0.0	0.00	6.2
141.00	4.07	0.13	6.01	0.0	0.00	6.1
144.00	3.83	0.13	5.90	0.0	0.00	6.0
147.00	3.60	0.13	5.79	0.0	0.00	5.9
150.00	3.39	0.13	5.73	0.0	0.00	5.9
153.00	3.18	0.13	5.62	0.0	0.00	5.7
156.00	2.99	0.13	5.51	0.0	0.00	5.6
159.00	2.82	0.12	5.40	0.0	0.00	5.5
162.00	2.65	0.12	5.29	0.0	0.00	5.4
165.00	2.49	0.12	5.18	0.0	0.00	5.3
168.00	2.34	0.12	5.08	0.0	0.00	5.2
171.00	2.20	0.12	4.97	0.0	0.00	5.1
174.00	2.07	0.12	4.86	0.0	0.00	5.0
177.00	1.95	0.12	4.76	0.0	0.00	4.9
180.00	1.83	0.12	4.60	0.0	0.00	4.7
183.00	1.72	0.12	4.50	0.0	0.00	4.6
186.00	1.62	0.12	4.40	0.0	0.00	4.5
189.00	1.52	0.12	4.29	0.0	0.00	4.4
192.00	1.43	0.12	4.19	0.0	0.00	4.3
195.00	1.34	0.12	4.09	0.0	0.00	4.2
198.00	1.26	0.12	3.94	0.0	0.00	4.1
201.00	1.19	0.12	3.85	0.0	0.00	4.0
204.00	1.12	0.12	3.75	0.0	0.00	3.9
207.00	1.05	0.12	3.65	0.0	0.00	3.8
210.00	0.99	0.12	3.56	0.0	0.00	3.7
213.00	0.93	0.11	3.46	0.0	0.00	3.6
216.00	0.87	0.11	3.37	0.0	0.00	3.5
219.00	0.82	0.11	3.27	0.0	0.00	3.4
222.00	0.77	0.11	3.18	0.0	0.00	3.3
225.00	0.73	0.11	3.09	0.0	0.00	3.2
228.00	0.68	0.11	3.00	0.0	0.00	3.1
231.00	0.64	0.11	2.91	0.0	0.00	3.0

Stormwater routing

T (time min	Q (cfs)	Storage	Stage	Outflow	Elevation	Diameter 1.75 inch Orifice	1.00 Length (ft) 63.50 Weir	16.00 Top of Box 66.00 Weir	15.00 Emerg Spill 66.80	18.00 Outlet Orifice 62.50
0	0	-	0.00	0.00	62.50					
3.00	0.1	-	0.00	0.00	62.50	0.00	0.00	0.00	0.00	0.00
6.00	0.4	17	0.00	0.00	62.50	0.00	0.00	0.00	0.00	0.00
9.00	0.8	84	0.01	0.00	62.51	0.00	0.00	0.00	0.00	0.85
12.00	1.5	233	0.03	0.00	62.53	0.00	0.00	0.00	0.00	1.47
15.00	2.2	496	0.06	0.00	62.56	0.00	0.00	0.00	0.00	2.08
18.00	3.2	899	0.09	0.01	62.59	0.01	0.00	0.00	0.00	2.55
21.00	4.2	1,466	0.14	0.02	62.64	0.02	0.00	0.00	0.00	3.18
24.00	5.3	2,218	0.19	0.03	62.69	0.03	0.00	0.00	0.00	3.71
27.00	6.5	3,172	0.26	0.03	62.76	0.03	0.00	0.00	0.00	4.34
30.00	7.8	4,342	0.33	0.04	62.83	0.04	0.00	0.00	0.00	4.89
33.00	9.0	5,734	0.42	0.05	62.92	0.05	0.00	0.00	0.00	5.51
36.00	10.3	7,352	0.51	0.05	63.01	0.05	0.00	0.00	0.00	6.07
39.00	11.5	9,194	0.62	0.06	63.12	0.06	0.00	0.00	0.00	6.70
42.00	12.6	11,252	0.73	0.07	63.23	0.07	0.00	0.00	0.00	7.27
45.00	13.7	13,515	0.85	0.07	63.35	0.07	0.00	0.00	0.00	7.84
48.00	14.6	15,966	0.97	0.08	63.47	0.08	0.00	0.00	0.00	8.38
51.00	15.4	18,584	1.10	0.18	63.60	0.08	0.09	0.00	0.00	8.92
54.00	16.1	21,329	1.23	0.42	63.73	0.09	0.33	0.00	0.00	9.43
57.00	16.5	24,146	1.37	0.77	63.87	0.09	0.68	0.00	0.00	9.95
60.00	16.8	26,986	1.50	1.16	64.00	0.10	1.06	0.00	0.00	10.42
63.00	17.0	29,811	1.63	1.60	64.13	0.10	1.50	0.00	0.00	10.86
66.00	16.9	32,576	1.75	2.05	64.25	0.10	1.95	0.00	0.00	11.25
69.00	16.6	35,248	1.87	2.54	64.37	0.11	2.43	0.00	0.00	11.63
72.00	16.2	37,785	1.97	2.98	64.47	0.11	2.87	0.00	0.00	11.94
75.00	15.6	40,165	2.08	3.48	64.58	0.11	3.37	0.00	0.00	12.27
78.00	14.8	42,345	2.17	3.91	64.67	0.12	3.80	0.00	0.00	12.53
81.00	13.9	44,310	2.25	4.31	64.75	0.12	4.19	0.00	0.00	12.76
84.00	12.9	46,040	2.32	4.67	64.82	0.12	4.55	0.00	0.00	12.95
87.00	11.8	47,522	2.38	4.99	64.88	0.12	4.86	0.00	0.00	13.12
90.00	10.6	48,744	2.43	5.25	64.93	0.12	5.13	0.00	0.00	13.26
93.00	10.9	49,703	2.47	5.47	64.97	0.12	5.35	0.00	0.00	13.37
96.00	10.3	50,683	2.51	5.69	65.01	0.13	5.57	0.00	0.00	13.47
99.00	9.6	51,506	2.55	5.92	65.05	0.13	5.79	0.00	0.00	13.58
102.00	9.1	52,178	2.57	6.03	65.07	0.13	5.90	0.00	0.00	13.63
105.00	8.5	52,726	2.60	6.20	65.10	0.13	6.07	0.00	0.00	13.71
108.00	8.0	53,146	2.61	6.26	65.11	0.13	6.13	0.00	0.00	13.74
111.00	7.5	53,463	2.63	6.37	65.13	0.13	6.24	0.00	0.00	13.79
114.00	7.1	53,674	2.63	6.37	65.13	0.13	6.24	0.00	0.00	13.79
117.00	6.7	53,804	2.64	6.43	65.14	0.13	6.30	0.00	0.00	13.82
120.00	6.3	53,847	2.64	6.43	65.14	0.13	6.30	0.00	0.00	13.82
123.00	5.9	53,818	2.64	6.43	65.14	0.13	6.30	0.00	0.00	13.82
126.00	5.5	53,722	2.64	6.43	65.14	0.13	6.30	0.00	0.00	13.82
129.00	5.2	53,563	2.63	6.37	65.13	0.13	6.24	0.00	0.00	13.79
132.00	4.9	53,354	2.62	6.31	65.12	0.13	6.19	0.00	0.00	13.77
135.00	4.6	53,100	2.61	6.26	65.11	0.13	6.13	0.00	0.00	13.74
138.00	4.3	52,803	2.60	6.20	65.10	0.13	6.07	0.00	0.00	13.71
141.00	4.1	52,467	2.59	6.14	65.09	0.13	6.01	0.00	0.00	13.69
144.00	3.8	52,095	2.57	6.03	65.07	0.13	5.90	0.00	0.00	13.63
147.00	3.6	51,700	2.55	5.92	65.05	0.13	5.79	0.00	0.00	13.58
150.00	3.4	51,283	2.54	5.86	65.04	0.13	5.73	0.00	0.00	13.55
153.00	3.2	50,838	2.52	5.75	65.02	0.13	5.62	0.00	0.00	13.50
156.00	3.0	50,377	2.50	5.64	65.00	0.13	5.51	0.00	0.00	13.45
159.00	2.8	49,901	2.48	5.53	64.98	0.12	5.40	0.00	0.00	13.39
162.00	2.6	49,414	2.46	5.42	64.96	0.12	5.29	0.00	0.00	13.34
165.00	2.5	48,915	2.44	5.31	64.94	0.12	5.18	0.00	0.00	13.28
168.00	2.3	48,408	2.42	5.20	64.92	0.12	5.08	0.00	0.00	13.23
171.00	2.2	47,893	2.40	5.09	64.90	0.12	4.97	0.00	0.00	13.18
174.00	2.1	47,373	2.38	4.99	64.88	0.12	4.86	0.00	0.00	13.12
177.00	1.9	46,848	2.36	4.88	64.86	0.12	4.76	0.00	0.00	13.06
180.00	1.8	46,320	2.33	4.72	64.83	0.12	4.60	0.00	0.00	12.98
183.00	1.7	45,799	2.31	4.62	64.81	0.12	4.50	0.00	0.00	12.93
186.00	1.6	45,278	2.29	4.52	64.79	0.12	4.40	0.00	0.00	12.87
189.00	1.5	44,756	2.27	4.41	64.77	0.12	4.29	0.00	0.00	12.81
192.00	1.4	44,236	2.25	4.31	64.75	0.12	4.19	0.00	0.00	12.76
195.00	1.3	43,717	2.23	4.21	64.73	0.12	4.09	0.00	0.00	12.70
198.00	1.3	43,201	2.20	4.06	64.70	0.12	3.94	0.00	0.00	12.61
201.00	1.2	42,698	2.18	3.96	64.68	0.12	3.85	0.00	0.00	12.56
204.00	1.1	42,199	2.16	3.86	64.66	0.12	3.75	0.00	0.00	12.50
207.00	1.1	41,705	2.14	3.77	64.64	0.12	3.65	0.00	0.00	12.44
210.00	1.0	41,216	2.12	3.67	64.62	0.12	3.56	0.00	0.00	12.38
213.00	0.9	40,733	2.10	3.58	64.60	0.11	3.46	0.00	0.00	12.32
216.00	0.9	40,257	2.08	3.48	64.58	0.11	3.37	0.00	0.00	12.27
219.00	0.8	39,787	2.06	3.39	64.56	0.11	3.27	0.00	0.00	12.21
222.00	0.8	39,326	2.04	3.29	64.54	0.11	3.18	0.00	0.00	12.15
225.00	0.7	38,872	2.02	3.20	64.52	0.11	3.09	0.00	0.00	12.09
228.00	0.7	38,426	2.00	3.11	64.50	0.11	3.00	0.00	0.00	12.03
231.00	0.6	37,989	1.98	3.02	64.48	0.11	2.91	0.00	0.00	11.97

Results of routing the 5 Year storm

Use orifice =	**1.75**	**inches**	
Peak outflow =	**6.43**	**cfs**	Less than post-bypass allowable release o 12.4 cfs
Peak Stage=	**2.64**	**ft**	
Water Elevation=	**65.14**	**msl**	
Peak Storage =	**53,847**	**cf**	
Design Spillway	**63.50**	**msl**	Temporary Pool Elevation for 1st inch of runoff
Length of weir	**1.00**	**ft**	To control 1 yr, 5 yr and 10 yr
Structure Overflow	**66.00**	**msl**	Top of Outlet Control Structure
Length of weir	**16.00**	**ft**	

Routing Equations for Table Above

Synthetic Hydrograph

$$Q_t = \frac{Q_p}{2}\left[1 - \cos\left(\pi\left(\frac{t}{T_p}\right)\right)\right]^n$$

$0 \le t \le 1.25T_p$

$$Q_t = 4.34\,Q_p \exp\left[-1.30\left(\frac{t}{T_p}\right)\right]$$

$t > 1.25T_p$

Routing Equations

$$Storage\,(S_{ij}) = (I_i - Q_i)\Delta t_{ij}$$

Stage/Storage Equation

Stage $$Z = \left[\frac{S}{K_s}\right]^{\frac{1}{n}}$$

$$K_s = \frac{S_2}{Z_2^{\,n}}$$

$$n = \frac{\log\left(\frac{S_1}{S_2}\right)}{\log\left(\frac{Z_1}{Z_2}\right)}$$

Outflow

$$Q_{outflow} = \sum\left(Q_{orif} + Q_{weir} + Q_{spillway} + \cdots\right)$$

Outflow from Orifice

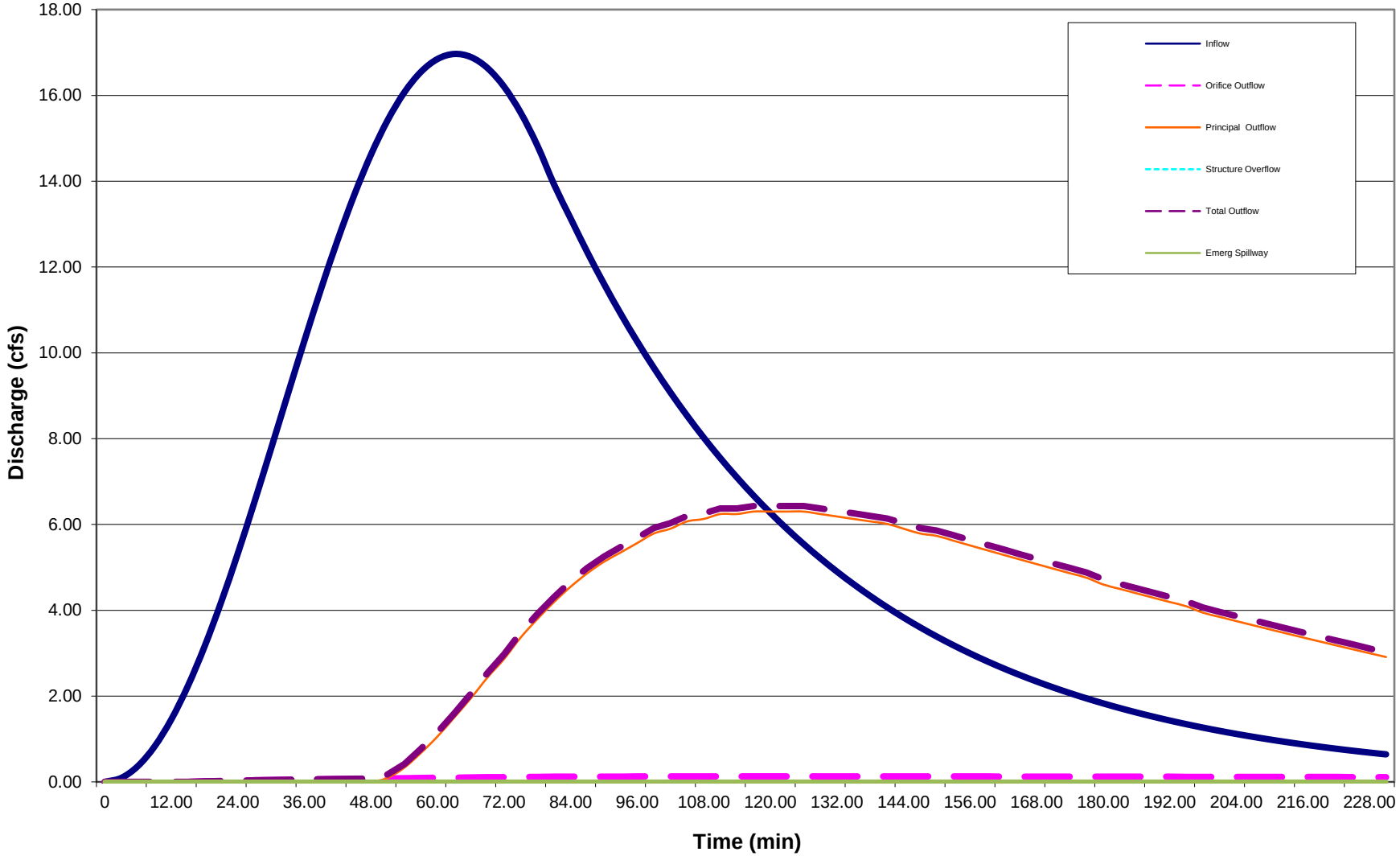
$$Q_{orifice} = C_d A\sqrt{2gh}$$

Outflow from Weir

$$Q_{weir} = C_w L H^{\frac{3}{2}}$$

5 year storm

Routing Hydrograph (5-YR)



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F-0334

STORM WATER DETENTION ROUTING
FOR
Alice Keene, Greenville, NC

10 Year 24-Hour Storm
2/20/2023

Site Conditions Predevelopment

Total watershed area						32.51	acres
Impervious	C=	0.95	CN=	95		1.07	acres
Lawn	C=	0.15	CN=	55		7.18	acres
Pasture	C=	0.45	CN=	60		24.26	acres
SCS Soil Group	Ly, GoA						
Hydraulic Length		Overland	330.00	Channelized		973.00	feet
Vertical Relief		Overland	1.00	Channelized		3.60	feet
10 Year 24h Rainfall						5.88	inches

Time of Concentration
channel flow

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
	12.67	+	13.49	38.82	minutes
Travel Factor	2.00		1.00		

Composite C = 0.40

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

$$I = \frac{g}{(h+T)}$$

	R	g	h		
Rainfall Intensity				3.38	inches per hr
	10	**206.0**	**22.1**		

Peak Discharge $Q = CIA$ **43.97** cfs

Site Conditions Post Development

Total watershed area						32.51	acres
Impervious	C=	0.95	CN=	95		3.08	acres
Lawn	C=	0.15	CN=	95		5.36	acres
Pasture	C=	0.45	CN=	60		24.07	acres
SCS Soil Group	Ly, GoA						
Hydraulic Length		Overland	330.00	Channelized		973.00	feet
Vertical Relief		Overland	1.00	Channelized		3.60	feet
10 yr 24 h rainfall						5.88	inches

Design Hydrograph Formulation

Composite CN 69.1

$$S = \frac{1000}{CN} - 10$$ 4.47

Runoff

$$Q^* = \frac{(P - 0.2S)^2}{P + 0.8S}$$ 2.63 inches

Time of Concentration
channel flow (not overland)

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
	12.67	+	13.49	38.82	minutes
Travel Factor	2.0		1.0		

Composite C = 0.45

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

$$I = \frac{g}{(h+T)}$$

	R	g	h		
Rainfall Intensity				3.38	inches per hr
	10	**206.0**	**22.1**		

Peak Discharge $Q = CIA$ **49.21 cfs**

Time to peak $T_p = \frac{Vol}{1.39 Q_p}$ 75.5 minutes

Storage Required $S = (Q_p - Q_o) T_p$ 23,756 cf
(Above 1st inch of runoff pool)

Allowable release at impoundment (pre-bypass) =	43.97 cfs
Peak rate of inflow at impoundment (pre-bypass) =	49.21 cfs
Allowable release at impoundment(post-bypass)=	**14.36** cfs
Peak rate of inflow at impoundment (post-bypass) =	**19.60** cfs

BYPASSED FLOW

	Area(ac)	C	I(in/hr)
Impervious	0.34	0.95	
Pasture	18.75	0.45	
Lawn	0.00	0.15	
Total	19.09	0.46	3.38

$Q_{bypassed}$ **29.61 cfs**

10 year storm

STAGE STORAGE DATA

Elevation	surface area	diff. elev	storage	accum. storage	Elevation	Stage
62.50	16,666				62.50	
		0.50	9,077			
63.00	19,643			9,077	63.00	0.5
		1.00	20,579			
64.00	21,514			29,656	64.00	1.50
		1.00	22,479			
65.00	23,444			52,135	65.00	2.5
		1.00	24,432			
66.00	25,419			76,566	66.00	3.5
		1.00	26,437			
67.00	27,454			103,003	67.00	4.5
		1.00	28,509			
68.00	29,564			131,512	68.00	5.5

Storage	Stage	LN(storage)	LN(Stage)	Z Computed Stage
76,566	3.5	11.25	1.25	3.53
103,003	4.5	11.54	1.50	4.50
131,512	5.5	11.79	1.70	5.50

$$b = \frac{\ln\left(\frac{S_2}{S_1}\right)}{\ln\left(\frac{Z_2}{Z_1}\right)}$$ 1.22

$$K_s = \frac{S_2}{Z_2{}^b}$$ 16,500.03

$$Z = \left[\frac{S}{K_s}\right]^{1/b}$$ 24.97

63.50 feet msl

Size Outlet Device for Control Structure

invert elevation =	62.50	feet msl
estimated orifice center elev. =	62.55	feet msl
proposed water surface elev. =	63.50	feet msl
Average head (h) =	0.33	feet
discharge (d) =	14.4	cfs
coefficient of discharge =	0.6	

Orifice equation

$$Q = C_d A\sqrt{2gh}$$

2.57 inches estimated based on 10 yr
1.25 inches try based on 1 yr

10 year storm

Inflow Hydrograph

Peak Inflow =	49.21	**19.60**
Time to Peak =	75.5 min	94.42

Time T (min)	Inflow Q (cfs)	Orifice Outflow Q (cfs)	Principal Outflow Q (cfs)	Structure Overflow Q (cfs)	Emerg Spillway Q (cfs)	Total Outflow Q (cfs)
0	0.00	0.00	0.00	0.0	0.0	0.0
3.00	0.08	0.00	0.00	0.0	0.0	0.0
6.00	0.30	0.00	0.00	0.0	0.0	0.0
9.00	0.68	0.00	0.00	0.0	0.0	0.0
12.00	1.19	0.00	0.00	0.0	0.0	0.0
15.00	1.84	0.00	0.00	0.0	0.0	0.0
18.00	2.62	0.01	0.00	0.0	0.0	0.0
21.00	3.50	0.02	0.00	0.0	0.0	0.0
24.00	4.49	0.02	0.00	0.0	0.0	0.0
27.00	5.55	0.03	0.00	0.0	0.0	0.0
30.00	6.68	0.04	0.00	0.0	0.0	0.0
33.00	7.86	0.04	0.00	0.0	0.0	0.0
36.00	9.07	0.05	0.00	0.0	0.0	0.0
39.00	10.30	0.05	0.00	0.0	0.0	0.1
42.00	11.51	0.06	0.00	0.0	0.0	0.1
45.00	12.70	0.07	0.00	0.0	0.0	0.1
48.00	13.84	0.07	0.00	0.0	0.0	0.1
51.00	14.92	0.08	0.00	0.0	0.0	0.1
54.00	15.92	0.08	0.14	0.0	0.0	0.2
57.00	16.82	0.09	0.42	0.0	0.0	0.5
60.00	17.62	0.09	0.76	0.0	0.0	0.9
63.00	18.29	0.10	1.19	0.0	0.0	1.3
66.00	18.84	0.10	1.68	0.0	0.0	1.8
69.00	19.24	0.11	2.23	0.0	0.0	2.3
72.00	19.50	0.11	2.78	0.0	0.0	2.9
75.00	19.60	0.11	3.32	0.0	0.0	3.4
78.00	19.55	0.12	3.94	0.0	0.0	4.1
81.00	19.36	0.12	4.50	0.0	0.0	4.6
84.00	19.01	0.12	5.08	0.0	0.0	5.2
87.00	18.52	0.13	5.68	0.0	0.0	5.8
90.00	17.89	0.13	6.19	0.0	0.0	6.3
93.00	17.14	0.13	6.65	0.0	0.0	6.8
96.00	16.31	0.13	7.12	0.0	0.0	7.3
99.00	15.48	0.13	7.49	0.0	0.0	7.6
102.00	14.71	0.14	7.86	0.0	0.0	8.0
105.00	13.97	0.14	8.11	0.0	0.0	8.2
108.00	13.26	0.14	8.36	0.0	0.0	8.5
111.00	12.60	0.14	8.55	0.0	0.0	8.7
114.00	11.96	0.14	8.74	0.0	0.0	8.9
117.00	11.36	0.14	8.87	0.0	0.0	9.0
120.00	10.79	0.14	9.00	0.0	0.0	9.1
123.00	10.25	0.14	9.06	0.0	0.0	9.2
126.00	9.73	0.14	9.13	0.0	0.0	9.3
129.00	9.24	0.14	9.13	0.0	0.0	9.3
132.00	8.78	0.14	9.13	0.0	0.0	9.3
135.00	8.33	0.14	9.13	0.0	0.0	9.3
138.00	7.91	0.14	9.06	0.0	0.0	9.2
141.00	7.52	0.14	9.00	0.0	0.0	9.1
144.00	7.14	0.14	8.93	0.0	0.0	9.1
147.00	6.78	0.14	8.87	0.0	0.0	9.0
150.00	6.44	0.14	8.74	0.0	0.0	8.9
153.00	6.11	0.14	8.61	0.0	0.0	8.8
156.00	5.81	0.14	8.55	0.0	0.0	8.7
159.00	5.51	0.14	8.42	0.0	0.0	8.6
162.00	5.24	0.14	8.23	0.0	0.0	8.4
165.00	4.97	0.14	8.11	0.0	0.0	8.2
168.00	4.72	0.14	7.98	0.0	0.0	8.1
171.00	4.49	0.14	7.86	0.0	0.0	8.0
174.00	4.26	0.13	7.67	0.0	0.0	7.8
177.00	4.05	0.13	7.49	0.0	0.0	7.6
180.00	3.84	0.13	7.37	0.0	0.0	7.5
183.00	3.65	0.13	7.18	0.0	0.0	7.3
186.00	3.46	0.13	7.06	0.0	0.0	7.2
189.00	3.29	0.13	6.89	0.0	0.0	7.0
192.00	3.12	0.13	6.71	0.0	0.0	6.8
195.00	2.97	0.13	6.59	0.0	0.0	6.7
198.00	2.82	0.13	6.42	0.0	0.0	6.5
201.00	2.68	0.13	6.24	0.0	0.0	6.4
204.00	2.54	0.13	6.13	0.0	0.0	6.3
207.00	2.41	0.13	5.96	0.0	0.0	6.1
210.00	2.29	0.13	5.79	0.0	0.0	5.9
213.00	2.18	0.13	5.62	0.0	0.0	5.7
216.00	2.07	0.13	5.51	0.0	0.0	5.6
219.00	1.96	0.12	5.35	0.0	0.0	5.5
222.00	1.86	0.12	5.24	0.0	0.0	5.4
225.00	1.77	0.12	5.08	0.0	0.0	5.2
228.00	1.68	0.12	4.97	0.0	0.0	5.1
231.00	1.60	0.12	4.81	0.0	0.0	4.9

Stormwater routing

T (time min)	Q (cfs)	Storage	Stage	Outflow	Elevation	Diameter 1.75 inch Orifice	1.00 Length (ft) 63.50 Weir	16.00 Top of Box 66.00 Weir	15.00 Emerg Spill 66.80	18.00 Outlet Orifice 62.50
0	0	-	0.00	0.00	62.50					
3.00	0.1	-	0.00	0.00	62.50	0.00	0.00	0.00	0.00	0.00
6.00	0.3	14	0.00	0.00	62.50	0.00	0.00	0.00	0.00	0.00
9.00	0.7	68	0.01	0.00	62.51	0.00	0.00	0.00	0.00	0.85
12.00	1.2	190	0.03	0.00	62.53	0.00	0.00	0.00	0.00	1.47
15.00	1.8	405	0.05	0.00	62.55	0.00	0.00	0.00	0.00	1.90
18.00	2.6	737	0.08	0.01	62.58	0.01	0.00	0.00	0.00	2.41
21.00	3.5	1,207	0.12	0.02	62.62	0.02	0.00	0.00	0.00	2.95
24.00	4.5	1,835	0.16	0.02	62.66	0.02	0.00	0.00	0.00	3.40
27.00	5.6	2,638	0.22	0.03	62.72	0.03	0.00	0.00	0.00	3.99
30.00	6.7	3,632	0.29	0.04	62.79	0.04	0.00	0.00	0.00	4.58
33.00	7.9	4,828	0.36	0.04	62.86	0.04	0.00	0.00	0.00	5.10
36.00	9.1	6,236	0.45	0.05	62.95	0.05	0.00	0.00	0.00	5.70
39.00	10.3	7,860	0.54	0.05	63.04	0.05	0.00	0.00	0.00	6.25
42.00	11.5	9,704	0.65	0.06	63.15	0.06	0.00	0.00	0.00	6.86
45.00	12.7	11,764	0.76	0.07	63.26	0.07	0.00	0.00	0.00	7.41
48.00	13.8	14,038	0.88	0.07	63.38	0.07	0.00	0.00	0.00	7.98
51.00	14.9	16,516	1.00	0.08	63.50	0.08	0.00	0.00	0.00	8.50
54.00	15.9	19,187	1.13	0.22	63.63	0.08	0.14	0.00	0.00	9.04
57.00	16.8	22,012	1.27	0.51	63.77	0.09	0.42	0.00	0.00	9.58
60.00	17.6	24,949	1.40	0.85	63.90	0.09	0.76	0.00	0.00	10.06
63.00	18.3	27,967	1.54	1.29	64.04	0.10	1.19	0.00	0.00	10.55
66.00	18.8	31,028	1.68	1.78	64.18	0.10	1.68	0.00	0.00	11.02
69.00	19.2	34,098	1.82	2.33	64.32	0.11	2.23	0.00	0.00	11.47
72.00	19.5	37,141	1.95	2.89	64.45	0.11	2.78	0.00	0.00	11.88
75.00	19.6	40,131	2.07	3.43	64.57	0.11	3.32	0.00	0.00	12.24
78.00	19.6	43,041	2.20	4.06	64.70	0.12	3.94	0.00	0.00	12.61
81.00	19.4	45,829	2.31	4.62	64.81	0.12	4.50	0.00	0.00	12.93
84.00	19.0	48,482	2.42	5.20	64.92	0.12	5.08	0.00	0.00	13.23
87.00	18.5	50,968	2.53	5.80	65.03	0.13	5.68	0.00	0.00	13.53
90.00	17.9	53,257	2.62	6.31	65.12	0.13	6.19	0.00	0.00	13.77
93.00	17.1	55,342	2.70	6.78	65.20	0.13	6.65	0.00	0.00	13.97
96.00	16.3	57,207	2.78	7.26	65.28	0.13	7.12	0.00	0.00	14.18
99.00	15.3	58,831	2.84	7.62	65.34	0.13	7.49	0.00	0.00	14.33
102.00	14.3	60,216	2.90	7.99	65.40	0.14	7.86	0.00	0.00	14.48
105.00	14.0	61,345	2.94	8.24	65.44	0.14	8.11	0.00	0.00	14.58
108.00	13.3	62,375	2.98	8.50	65.48	0.14	8.36	0.00	0.00	14.68
111.00	12.6	63,233	3.01	8.69	65.51	0.14	8.55	0.00	0.00	14.75
114.00	12.0	63,937	3.04	8.88	65.54	0.14	8.74	0.00	0.00	14.83
117.00	11.4	64,491	3.06	9.01	65.56	0.14	8.87	0.00	0.00	14.88
120.00	10.8	64,915	3.08	9.14	65.58	0.14	9.00	0.00	0.00	14.93
123.00	10.2	65,211	3.09	9.20	65.59	0.14	9.06	0.00	0.00	14.95
126.00	9.7	65,399	3.10	9.27	65.60	0.14	9.13	0.00	0.00	14.97
129.00	9.2	65,482	3.10	9.27	65.60	0.14	9.13	0.00	0.00	14.97
132.00	8.8	65,477	3.10	9.27	65.60	0.14	9.13	0.00	0.00	14.97
135.00	8.3	65,388	3.10	9.27	65.60	0.14	9.13	0.00	0.00	14.97
138.00	7.9	65,219	3.09	9.20	65.59	0.14	9.06	0.00	0.00	14.95
141.00	7.5	64,987	3.08	9.14	65.58	0.14	9.00	0.00	0.00	14.93
144.00	7.1	64,695	3.07	9.07	65.57	0.14	8.93	0.00	0.00	14.90
147.00	6.8	64,347	3.06	9.01	65.56	0.14	8.87	0.00	0.00	14.88
150.00	6.4	63,945	3.04	8.88	65.54	0.14	8.74	0.00	0.00	14.83
153.00	6.1	63,506	3.02	8.75	65.52	0.14	8.61	0.00	0.00	14.78
156.00	5.8	63,031	3.01	8.69	65.51	0.14	8.55	0.00	0.00	14.75
159.00	5.5	62,513	2.99	8.56	65.49	0.14	8.42	0.00	0.00	14.71
162.00	5.2	61,964	2.96	8.37	65.46	0.14	8.23	0.00	0.00	14.63
165.00	5.0	61,401	2.94	8.24	65.44	0.14	8.11	0.00	0.00	14.58
168.00	4.7	60,812	2.92	8.12	65.42	0.14	7.98	0.00	0.00	14.53
171.00	4.5	60,201	2.90	7.99	65.40	0.14	7.86	0.00	0.00	14.48
174.00	4.3	59,570	2.87	7.81	65.37	0.13	7.67	0.00	0.00	14.41
177.00	4.0	58,932	2.84	7.62	65.34	0.13	7.49	0.00	0.00	14.33
180.00	3.8	58,288	2.82	7.50	65.32	0.13	7.37	0.00	0.00	14.28
183.00	3.6	57,630	2.79	7.32	65.29	0.13	7.18	0.00	0.00	14.21
186.00	3.5	56,969	2.77	7.20	65.27	0.13	7.06	0.00	0.00	14.15
189.00	3.3	56,297	2.74	7.02	65.24	0.13	6.89	0.00	0.00	14.08
192.00	3.1	55,627	2.71	6.84	65.21	0.13	6.71	0.00	0.00	14.00
195.00	3.0	54,958	2.69	6.72	65.19	0.13	6.59	0.00	0.00	13.95
198.00	2.8	54,282	2.66	6.55	65.16	0.13	6.42	0.00	0.00	13.87
201.00	2.7	53,612	2.63	6.37	65.13	0.13	6.24	0.00	0.00	13.79
204.00	2.5	52,946	2.61	6.26	65.11	0.13	6.13	0.00	0.00	13.74
207.00	2.4	52,278	2.58	6.09	65.08	0.13	5.96	0.00	0.00	13.66
210.00	2.3	51,617	2.55	5.92	65.05	0.13	5.79	0.00	0.00	13.58
213.00	2.2	50,965	2.52	5.75	65.02	0.13	5.62	0.00	0.00	13.50
216.00	2.1	50,322	2.50	5.64	65.00	0.13	5.51	0.00	0.00	13.45
219.00	2.0	49,680	2.47	5.47	64.97	0.12	5.35	0.00	0.00	13.37
222.00	1.9	49,048	2.45	5.36	64.95	0.12	5.24	0.00	0.00	13.31
225.00	1.8	48,419	2.42	5.20	64.92	0.12	5.08	0.00	0.00	13.23
228.00	1.7	47,801	2.40	5.09	64.90	0.12	4.97	0.00	0.00	13.18
231.00	1.6	47,188	2.37	4.93	64.87	0.12	4.81	0.00	0.00	13.09

Results of routing the 10 Year storm

Use orifice =	**1.75**	**inches**	
Peak outflow =	**9.27**	**cfs**	Less than Predeveloped Flow = 14.36
Peak Stage=	**3.10**	**ft**	
Water Elevation=	**65.60**	**msl**	
Peak Storage =	**65,482**	**cf**	
Design Spillway	**63.50**	**msl**	Temporary Pool Elevation for 1st inch of runoff
Length of weir	**1**	**ft**	
Structure Overflow	**66.00**	**msl**	Top of Outlet Control Structure
Length of weir	**16.00**	**ft**	

Routing Equations for Table Above

Synthetic Hydrograph

$$Qt = \frac{Qp}{2}\left[1-\cos\left(\pi\left(\frac{t}{Tp}\right)\right)\right]$$

$$0 \le t \le 1.25Tp$$

$$Q = 4.34\,Qp\exp\left[-1.30\left(\frac{t}{Tp}\right)\right]$$

$$t > 1.25Tp$$

Routing Equations

$$Storage\,(S_{ij}) = (I_i - Q_i)\Delta t_{ij}$$

Stage/Storage Equation

Stage $Z = \left[\frac{S}{K_s}\right]^{\frac{1}{b}}$

$$K_s = \frac{S_2}{Z_2^b}$$

$$b = \frac{\ln\left(\frac{S_1}{S_2}\right)}{\ln\left(\frac{Z_1}{Z_2}\right)}$$

Outflow

$$Q_{outflow} = \sum(Q_{orif} + Q_{weir} + Q_{spillway} + \cdots)$$

Outflow from Orifice

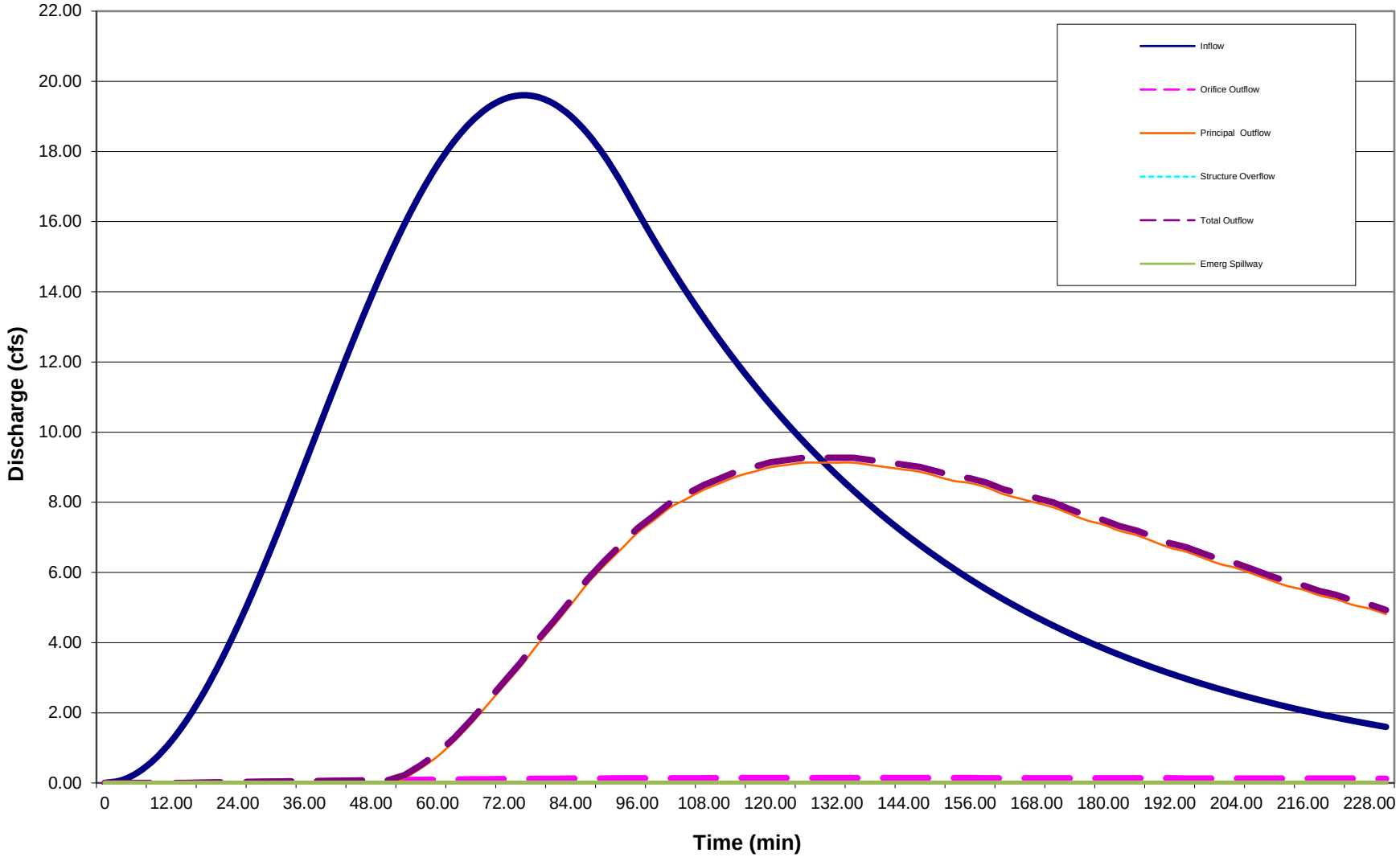
$$Q_{orifice} = C_d A\sqrt{2gh}$$

Outflow from Weir

$$Q_{weir} = C_w L H^{\frac{3}{2}}$$

10 year storm

Routing Hydrograph (10-YR)



107 East Second Street
Greenville, NC 27858
(252) 752-4135
F-0334

STORM WATER DETENTION ROUTING
FOR
Alice Keene, Greenville, NC

25 Year 24-Hour Storm
2/20/2023

Site Conditions Predevelopment

Total watershed area						32.51	acres
Impervious	C=	0.95	CN=	95		1.07	acres
Lawn	C=	0.15	CN=	55		7.18	acres
Pasture	C=	0.45	CN=	60		24.26	acres
SCS Soil Group	Ly, GoA						
Hydraulic Length		Overland	330.00	Channelized		973.00	feet
Vertical Relief		Overland	1.00	Channelized		3.60	feet
25 Year 24 h Rainfall						7.33	inches

Time of Concentration
channel flow

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
	12.67	+	13.49	38.8	minutes
Travel Factor	2.00		1.00		

Composite C = 0.40

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

Rainfall Intensity = $I = \frac{g}{(h+T)}$

R	g	h		
25	**249.2**	**24.8**	3.92	inches per hr

Peak Discharge $Q = CIA$ **50.95** cfs

Site Conditions Post Development

Total watershed area						32.51	acres
Impervious	C=	0.95	CN=	95		3.08	acres
Lawn	C=	0.15	CN=	95		5.36	acres
Pasture	C=	0.45	CN=	60		24.07	acres
SCS Soil Group	Ly, GoA						
Hydraulic Length		Chan Imp	330	Channelized		973	feet
Vertical Relief		Chan Imp	1.0	Channelized		3.6	feet
25 yr rainfall						7.33	inches

Design Hydrograph Formulation

Composite CN 69.1

$$S = \frac{1000}{CN} - 10$$ 4.47

Runoff

$$Q^* = \frac{(P - 0.2S)^2}{P + 0.8S}$$ 3.80 inches

Time of Concentration
channel flow (not overland)

$$t_c = \frac{\left[\frac{L^3}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
	12.67	+	13.49	38.82	minutes
Travel Factor	2.00		1.00		

Composite C = 0.45

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

Rainfall Intensity = $I = \frac{g}{(h+T)}$

R	g	h		
25	**249.2**	**24.8**	3.92	inches per hr

Peak Discharge $Q = CIA$ **57.03 cfs**

Time to peak $T_p = \frac{Vol}{1.39 Q_p}$ 94.2 minutes

Storage Required $S = (Q_p - Q_o)\,T_p$ 34,325 cf
(Above 1st inch of runoff pool)

Allowable release at impoundment (pre-bypass) =	50.95	cfs
Peak rate of inflow at impoundment (pre-bypass) =	57.03	cfs
Allowable release at impoundment(post-bypass)=	**16.64**	cfs
Peak rate of inflow at impoundment (post-bypass) =	**22.72**	cfs

BYPASSED FLOW

	Area(ac)	C	I(in/hr)	
Buffer	0.34	0.95		
Roof	18.75	0.45		$Q_{bypassed}$ **34.31 cfs**
Lawn	0.00	0.15		
Total	19.09	0.46	3.92	

25 year storm

STAGE STORAGE DATA

Elevation	surface area	diff. elev	storage	accum. storage	Elevation	Stage
62.50	16,666				62.50	
		0.50	9,077			
63.00	19,643			9,077	63.00	0.5
		1.00	20,579			
64.00	21,514			29,656	64.00	2
		1.00	22,479			
65.00	23,444			52,135	65.00	2.5
		1.00	24,432			
66.00	25,419			76,566	66.00	3.5
		1.00	26,437			
67.00	27,454			103,003	67.00	4.5
		1.00	28,509			
68.00	29,564			131,512	68.00	5.5

Storage elevation@minimum storage volu **63.50** msl

Storage	Stage	LN(storage)	LN(Stage)	Z Computed Stage
76,566	3.5	11.25	1.25	3.53
103,003	4.5	11.54	1.50	4.50
131,512	5.5	11.79	1.70	5.50

$$b = \frac{\ln\left(\frac{S_2}{S_1}\right)}{\ln\left(\frac{Z_2}{Z_1}\right)}$$ 1.22

$$K_s = \frac{S_2}{Z_2^{\,b}}$$ 16,500.03

$$Z = \left[\frac{S}{K_s}\right]^{1/b}$$ 24.97

63.50 feet msl

Size Outlet Device for Control Structure

invert elevation =	62.50	feet msl
estimated orifice center elev. =	62.57	feet msl
proposed water surface elev. =	63.50	feet msl
Average head (h) =	0.33	feet
discharge (d) =	16.6	cfs
coefficient of discharge =	0.6	

Orifice equation

$$Q = C_d A\sqrt{2gh}$$

	2.76	inches	estimated based on 25yr
SAY	1.75	inches	try based on 1 yr

Inflow Hydrograph

Peak Inflow =	57.03	**22.72**
Time to Peak =	94.2 min	118

Time T (min)	Inflow Q (cfs)	Orifice Outflow Q (cfs)	Principal Outflow Q (cfs)	Structure Overflow Q (cfs)	Emerg Spillway Q (cfs)	Total Outflow Q (cfs)
0	0.00	0.00	0.00	0.0	0.0	0.0
3.00	0.06	0.00	0.00	0.0	0.0	0.0
6.00	0.23	0.00	0.00	0.0	0.0	0.0
9.00	0.51	0.00	0.00	0.0	0.0	0.0
12.00	0.90	0.00	0.00	0.0	0.0	0.0
15.00	1.39	0.00	0.00	0.0	0.0	0.0
18.00	1.98	0.00	0.00	0.0	0.0	0.0
21.00	2.67	0.01	0.00	0.0	0.0	0.0
24.00	3.45	0.02	0.00	0.0	0.0	0.0
27.00	4.30	0.03	0.00	0.0	0.0	0.0
30.00	5.22	0.03	0.00	0.0	0.0	0.0
33.00	6.21	0.04	0.00	0.0	0.0	0.0
36.00	7.25	0.04	0.00	0.0	0.0	0.0
39.00	8.32	0.05	0.00	0.0	0.0	0.0
42.00	9.43	0.05	0.00	0.0	0.0	0.1
45.00	10.56	0.06	0.00	0.0	0.0	0.1
48.00	11.69	0.07	0.00	0.0	0.0	0.1
51.00	12.83	0.07	0.00	0.0	0.0	0.1
54.00	13.94	0.08	0.00	0.0	0.0	0.1
57.00	15.03	0.08	0.07	0.0	0.0	0.1
60.00	16.09	0.09	0.29	0.0	0.0	0.4
63.00	17.10	0.09	0.59	0.0	0.0	0.7
66.00	18.05	0.10	1.00	0.0	0.0	1.1
69.00	18.93	0.10	1.46	0.0	0.0	1.6
72.00	19.74	0.10	1.95	0.0	0.0	2.1
75.00	20.46	0.11	2.52	0.0	0.0	2.6
78.00	21.09	0.11	3.14	0.0	0.0	3.2
81.00	21.63	0.12	3.80	0.0	0.0	3.9
84.00	22.06	0.12	4.45	0.0	0.0	4.6
87.00	22.39	0.12	5.13	0.0	0.0	5.3
90.00	22.61	0.13	5.85	0.0	0.0	6.0
93.00	22.71	0.13	6.53	0.0	0.0	6.7
96.00	22.70	0.13	7.18	0.0	0.0	7.3
99.00	22.57	0.14	7.86	0.0	0.0	8.0
102.00	22.34	0.14	8.55	0.0	0.0	8.7
105.00	21.99	0.14	9.13	0.0	0.0	9.3
108.00	21.54	0.14	9.72	0.0	0.0	9.9
111.00	20.99	0.14	10.26	0.0	0.0	10.4
114.00	20.34	0.15	10.74	0.0	0.0	10.9
117.00	19.60	0.15	11.22	0.0	0.0	11.4
120.00	18.82	0.15	11.65	0.0	0.0	11.8
123.00	18.05	0.15	11.93	0.0	0.0	12.1
126.00	17.32	0.15	12.29	0.7	0.0	13.1
129.00	16.62	0.15	12.43	1.1	0.0	13.7
132.00	15.94	0.15	12.58	1.5	0.0	14.2
135.00	15.30	0.15	12.65	1.8	0.0	14.6
138.00	14.68	0.15	12.72	2.0	0.0	14.9
141.00	14.08	0.15	12.72	2.0	0.0	14.9
144.00	13.51	0.15	12.65	1.8	0.0	14.6
147.00	12.96	0.15	12.65	1.8	0.0	14.6
150.00	12.44	0.15	12.58	1.5	0.0	14.2
153.00	11.93	0.15	12.43	1.1	0.0	13.7
156.00	11.45	0.15	12.36	0.9	0.0	13.4
159.00	10.98	0.15	12.29	0.7	0.0	13.1
162.00	10.54	0.15	12.14	0.4	0.0	12.7
165.00	10.11	0.15	12.07	0.2	0.0	12.5
168.00	9.70	0.15	11.93	0.0	0.0	12.1
171.00	9.31	0.15	11.86	0.0	0.0	12.0
174.00	8.93	0.15	11.72	0.0	0.0	11.9
177.00	8.57	0.15	11.58	0.0	0.0	11.7
180.00	8.22	0.15	11.43	0.0	0.0	11.6
183.00	7.89	0.15	11.22	0.0	0.0	11.4
186.00	7.57	0.15	11.08	0.0	0.0	11.2
189.00	7.26	0.15	10.88	0.0	0.0	11.0
192.00	6.97	0.15	10.74	0.0	0.0	10.9
195.00	6.68	0.14	10.53	0.0	0.0	10.7
198.00	6.41	0.14	10.33	0.0	0.0	10.5
201.00	6.15	0.14	10.19	0.0	0.0	10.3
204.00	5.90	0.14	9.99	0.0	0.0	10.1
207.00	5.66	0.14	9.79	0.0	0.0	9.9
210.00	5.43	0.14	9.59	0.0	0.0	9.7
213.00	5.21	0.14	9.39	0.0	0.0	9.5
216.00	5.00	0.14	9.19	0.0	0.0	9.3
219.00	4.80	0.14	9.00	0.0	0.0	9.1
222.00	4.60	0.14	8.81	0.0	0.0	8.9
225.00	4.42	0.14	8.61	0.0	0.0	8.8
228.00	4.24	0.14	8.42	0.0	0.0	8.6
231.00	4.07	0.14	8.17	0.0	0.0	8.3

Stormwater routing

T (time min)	Q (cfs)	Storage	Stage	Outflow	Elevation	Diameter 1.75 inch Orifice	1.00 Length (ft) 63.50 Weir	16.00 Top of Box 66.00 Weir	15.00 Emerg Spill 66.80	18.00 Outlet Orifice 62.50
0	0	-	0.00	0.00	62.50					
3.00	0.1	-	0.00	0.00	62.50	0.00	0.00	0.00	0.00	0.00
6.00	0.2	10	0.00	0.00	62.50	0.00	0.00	0.00	0.00	0.00
9.00	0.5	51	0.01	0.00	62.51	0.00	0.00	0.00	0.00	0.85
12.00	0.9	142	0.02	0.00	62.52	0.00	0.00	0.00	0.00	1.20
15.00	1.4	304	0.04	0.00	62.54	0.00	0.00	0.00	0.00	1.70
18.00	2.0	554	0.06	0.00	62.56	0.00	0.00	0.00	0.00	2.08
21.00	2.7	911	0.09	0.01	62.59	0.01	0.00	0.00	0.00	2.55
24.00	3.4	1,390	0.13	0.02	62.63	0.02	0.00	0.00	0.00	3.07
27.00	4.3	2,007	0.18	0.03	62.68	0.03	0.00	0.00	0.00	3.61
30.00	5.2	2,776	0.23	0.03	62.73	0.03	0.00	0.00	0.00	4.08
33.00	6.2	3,711	0.29	0.04	62.79	0.04	0.00	0.00	0.00	4.58
36.00	7.2	4,822	0.36	0.04	62.86	0.04	0.00	0.00	0.00	5.10
39.00	8.3	6,118	0.44	0.05	62.94	0.05	0.00	0.00	0.00	5.64
42.00	9.4	7,607	0.53	0.05	63.03	0.05	0.00	0.00	0.00	6.19
45.00	10.6	9,295	0.62	0.06	63.12	0.06	0.00	0.00	0.00	6.70
48.00	11.7	11,185	0.73	0.07	63.23	0.07	0.00	0.00	0.00	7.27
51.00	12.8	13,278	0.84	0.07	63.34	0.07	0.00	0.00	0.00	7.79
54.00	13.9	15,574	0.95	0.08	63.45	0.08	0.00	0.00	0.00	8.29
57.00	15.0	18,070	1.08	0.15	63.58	0.08	0.07	0.00	0.00	8.84
60.00	16.1	20,750	1.21	0.37	63.71	0.09	0.29	0.00	0.00	9.35
63.00	17.1	23,578	1.34	0.69	63.84	0.09	0.59	0.00	0.00	9.84
66.00	18.0	26,533	1.48	1.09	63.98	0.10	1.00	0.00	0.00	10.35
69.00	18.9	29,584	1.62	1.56	64.12	0.10	1.46	0.00	0.00	10.82
72.00	19.7	32,710	1.75	2.05	64.25	0.10	1.95	0.00	0.00	11.25
75.00	20.5	35,894	1.89	2.63	64.39	0.11	2.52	0.00	0.00	11.69
78.00	21.1	39,104	2.03	3.25	64.53	0.11	3.14	0.00	0.00	12.12
81.00	21.6	42,316	2.17	3.91	64.67	0.12	3.80	0.00	0.00	12.53
84.00	22.1	45,505	2.30	4.57	64.80	0.12	4.45	0.00	0.00	12.90
87.00	22.4	48,655	2.43	5.25	64.93	0.12	5.13	0.00	0.00	13.26
90.00	22.6	51,739	2.56	5.97	65.06	0.13	5.85	0.00	0.00	13.61
93.00	22.7	54,733	2.68	6.66	65.18	0.13	6.53	0.00	0.00	13.92
96.00	22.7	57,621	2.79	7.32	65.29	0.13	7.18	0.00	0.00	14.21
99.00	22.6	60,390	2.90	7.99	65.40	0.14	7.86	0.00	0.00	14.48
102.00	22.3	63,015	3.01	8.69	65.51	0.14	8.55	0.00	0.00	14.75
105.00	22.0	65,472	3.10	9.27	65.60	0.14	9.13	0.00	0.00	14.97
108.00	21.5	67,763	3.19	9.86	65.69	0.14	9.72	0.00	0.00	15.19
111.00	21.0	69,865	3.27	10.40	65.77	0.14	10.26	0.00	0.00	15.38
114.00	20.4	71,770	3.34	10.88	65.84	0.15	10.74	0.00	0.00	15.54
117.00	19.6	73,490	3.41	11.37	65.91	0.15	11.22	0.00	0.00	15.70
120.00	18.8	74,974	3.47	11.79	65.97	0.15	11.65	0.00	0.00	15.84
123.00	18.1	76,237	3.51	12.13	66.01	0.15	11.93	0.05	0.00	15.93
126.00	17.3	77,304	3.56	13.14	66.06	0.15	12.29	0.71	0.00	16.05
129.00	16.6	78,056	3.58	13.67	66.08	0.15	12.43	1.09	0.00	16.09
132.00	15.9	78,587	3.60	14.25	66.10	0.15	12.58	1.52	0.00	16.14
135.00	15.3	78,892	3.61	14.55	66.11	0.15	12.65	1.75	0.00	16.16
138.00	14.7	79,027	3.62	14.87	66.12	0.15	12.72	2.00	0.00	16.18
141.00	14.1	78,992	3.62	14.87	66.12	0.15	12.72	2.00	0.00	16.18
144.00	13.5	78,850	3.61	14.55	66.11	0.15	12.65	1.75	0.00	16.16
147.00	13.0	78,663	3.61	14.55	66.11	0.15	12.65	1.75	0.00	16.16
150.00	12.4	78,376	3.60	14.25	66.10	0.15	12.58	1.52	0.00	16.14
153.00	11.9	78,051	3.58	13.67	66.08	0.15	12.43	1.09	0.00	16.09
156.00	11.4	77,738	3.57	13.40	66.07	0.15	12.36	0.89	0.00	16.07
159.00	11.0	77,387	3.56	13.14	66.06	0.15	12.29	0.71	0.00	16.05
162.00	10.5	76,998	3.54	12.68	66.04	0.15	12.14	0.38	0.00	16.00
165.00	10.1	76,613	3.53	12.47	66.03	0.15	12.07	0.25	0.00	15.98
168.00	9.7	76,188	3.51	12.13	66.01	0.15	11.93	0.05	0.00	15.93
171.00	9.3	75,751	3.50	12.01	66.00	0.15	11.86	0.00	0.00	15.91
174.00	8.9	75,265	3.48	11.86	65.98	0.15	11.72	0.00	0.00	15.86
177.00	8.6	74,737	3.46	11.72	65.96	0.15	11.58	0.00	0.00	15.82
180.00	8.2	74,169	3.44	11.58	65.94	0.15	11.43	0.00	0.00	15.77
183.00	7.9	73,563	3.41	11.37	65.91	0.15	11.22	0.00	0.00	15.70
186.00	7.6	72,936	3.39	11.23	65.89	0.15	11.08	0.00	0.00	15.66
189.00	7.3	72,277	3.36	11.02	65.86	0.15	10.88	0.00	0.00	15.59
192.00	7.0	71,599	3.34	10.88	65.84	0.15	10.74	0.00	0.00	15.54
195.00	6.7	70,894	3.31	10.68	65.81	0.14	10.53	0.00	0.00	15.47
198.00	6.4	70,175	3.28	10.47	65.78	0.14	10.33	0.00	0.00	15.40
201.00	6.2	69,444	3.26	10.34	65.76	0.14	10.19	0.00	0.00	15.36
204.00	5.9	68,691	3.23	10.13	65.73	0.14	9.99	0.00	0.00	15.28
207.00	5.7	67,929	3.20	9.93	65.70	0.14	9.79	0.00	0.00	15.21
210.00	5.4	67,161	3.17	9.73	65.67	0.14	9.59	0.00	0.00	15.14
213.00	5.2	66,387	3.14	9.53	65.64	0.14	9.39	0.00	0.00	15.07
216.00	5.0	65,609	3.11	9.33	65.61	0.14	9.19	0.00	0.00	15.00
219.00	4.8	64,829	3.08	9.14	65.58	0.14	9.00	0.00	0.00	14.93
222.00	4.6	64,048	3.05	8.94	65.55	0.14	8.81	0.00	0.00	14.85
225.00	4.4	63,267	3.02	8.75	65.52	0.14	8.61	0.00	0.00	14.78
228.00	4.2	62,487	2.99	8.56	65.49	0.14	8.42	0.00	0.00	14.71
231.00	4.1	61,709	2.95	8.31	65.45	0.14	8.17	0.00	0.00	14.61

Results of routing the 25 Year storm

Use orifice =	**1.75**	**inches**	
Peak outflow =	**14.87**	**cfs**	Predeveloped flow rate 16.64 cfs
Peak Stage=	**3.62**	**ft**	
Water Elevation=	**66.12**	**msl**	
Peak Storage =	**79,027**	**cf**	
Design Spillway	**63.50**	**msl**	Temporary Pool Elevation for 1st inch of runoff
Length of weir	**1**	**ft**	
Structure Overflow	**66.00**	**msl**	Top of Outlet Control Structure
Total length of Spillways	**16.00**	**ft**	

Routing Equations for Table Above

Synthetic Hydrograph

$$Qt = \frac{Qp}{2}\left[1-\cos\left(\pi\left(\frac{t}{Tp}\right)\right)\right]$$

$$0 \le t \le 1.25\,Tp$$

$$Q = 4.34\,Qp\exp\left[-1.30\left(\frac{t}{Tp}\right)\right]$$

$$t > 1.25\,Tp$$

Routing Equations

$$Storage\,(S_{ij}) = (I_i - Q_i)\Delta t_{ij}$$

Stage/Storage Equation

Stage $$Z = \left[\frac{S}{K_s}\right]^{1/b}$$

$$K_s = \frac{S_2}{Z_2^{\,b}}$$

$$b = \frac{\ln\left(\frac{S_2}{S_1}\right)}{\ln\left(\frac{Z_2}{Z_1}\right)}$$

Outflow

$$Q_{outflow} = \sum(Q_{orif} + Q_{weir} + Q_{spillway} + \cdots)$$

Outflow from Orifice

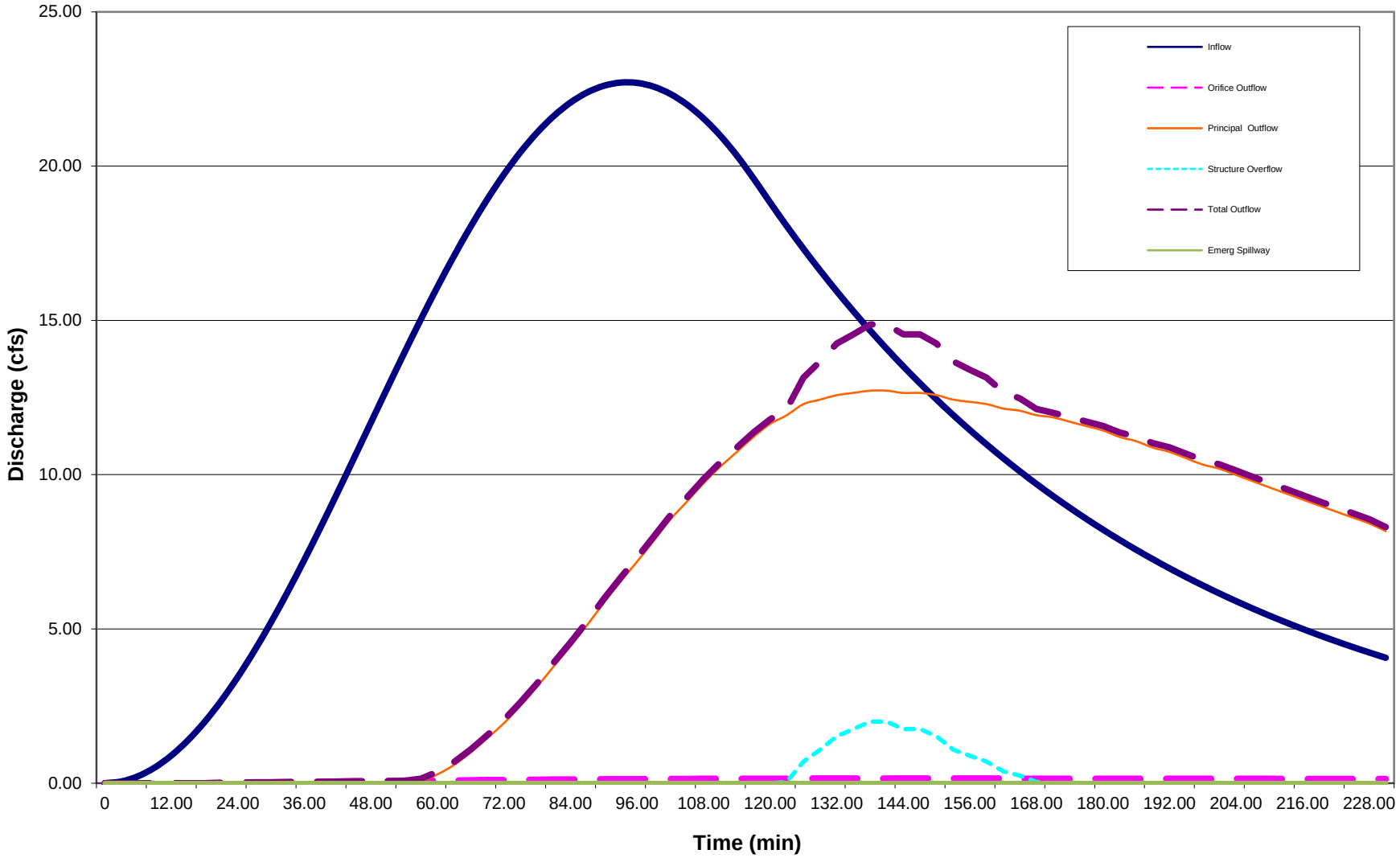
$$Q_{orifice} = C_d A\sqrt{2gh}$$

Outflow from Weir

$$Q_{weir} = C_w L H^{\frac{3}{2}}$$

25 year storm

Routing Hydrograph (25-YR)



107 East Second Street
Greenville, NC 27858
(252) 752-4135
F-0334

STORM WATER DETENTION ROUTING
FOR
Alice Keene, Greenville, NC

100 Year 24-Hour Storm
2/20/2023

Site Conditions Predevelopment

Total watershed area					32.51	acres
Impervious	C=	0.95	CN=	95	1.07	acres
Lawn	C=	0.15	CN=	55	7.18	acres
Pasture	C=	0.45	CN=	60	24.26	acres
SCS Soil Group	Ly, GoA					
Hydraulic Length		Overland	330.00	Channelized	973.00	feet
Vertical Relief		Overland	1.00	Channelized	3.60	feet
100 Year Rainfall					10	inches

Time of Concentration
channel flow

$$t_c = \frac{\left[\frac{L^2}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
	12.67	+	13.49	38.8	minutes
Travel Factor	2.00		1.00		

Composite C= 0.40

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

Rainfall Intensity = $I = \frac{g}{(h+T)}$

R	g	h		
			4.79	inches per hr

Peak Discharge $Q = CIA$

100	**321.3**	**28.3**		
			62.31	cfs

Site Conditions Post Development

Total watershed area					32.51	acres
Impervious	C=	0.95	CN=	95	3.08	acres
Lawn	C=	0.15	CN=	95	5.36	acres
Pasture	C=	0.45	CN=	60	24.07	acres
SCS Soil Group	Ly, GoA					
Hydraulic Length		Chan Imp	330	Channelized	973	feet
Vertical Relief		Chan Imp	1.0	Channelized	3.6	feet
100 yr rainfall					10	inches

Design Hydrograph Formulation

Composite CN 69.1

$$S = \frac{1000}{CN} - 10$$ 4.47

Runoff

$$Q^* = \frac{(P - 0.2S)^2}{P + 0.8S}$$ 6.10 inches

Time of Concentration
channel flow (not overland)

$$t_c = \frac{\left[\frac{L^2}{H}\right]^{0.385}}{128}$$

	Overland		Channelized		
	12.67	+	13.49	38.8	minutes
Travel Factor	2.00		1.00		

Composite C = 0.45

IDF (intensity-duration-frequency) Equation - Developed from NOAA - Precipitation Frequencies

Rainfall Intensity = $I = \frac{g}{(h+T)}$

R	g	h		
			4.79	inches per hr

Peak Discharge $Q = CIA$

100	**321.3**	**28.3**		
			69.73	**cfs**

Time to peak $T_p = \frac{Vol}{1.39 Q_p}$ 123.9 minutes

Storage Required $S = (Q_p - Q_o) T_p$ 55,207 cf
(Above 1st inch of runoff pool)

Allowable release at impoundment (pre-bypass) = 62.31 cfs
Peak rate of inflow at impoundment (pre-bypass) = 69.73 cfs
Allowable release at impoundment(post-bypass)= **20.35** cfs
Peak rate of inflow at impoundment (post-bypass) = **27.78** cfs

BYPASSED FLOW

	Area(ac)	**C**	**I(in/hr)**	
Impervious	0.34	0.95		
Pasture	18.75	0.45		**$Q_{bypassed}$ 41.95 cfs**
Lawn	0	0.15		
Total	19.09	0.46	4.79	

100 year storm

STAGE STORAGE DATA

Elevation	surface area	diff. elev	storage	accum. storage	Elevation	Stage
62.50	16,666				62.50	
		0.50	9,077			
63.00	19,643			9,077	63.00	0.5
		1.00	20,579			
64.00	21,514			29,656	64.00	2
		1.00	22,479			
65.00	23,444			52,135	65.00	2.5
		1.00	24,432			
66.00	25,419			76,566	66.00	3.5
		1.00	26,437			
67.00	27,454			103,003	67.00	4.5
		1.00	28,509			
68.00	29,564			131,512	68.00	5.5

Storage elevation@minimum storage volume **63.50** msl

Storage	Stage	LN(storage)	LN(Stage)	Z Computed Stage
76,566	3.5	11.25	1.25	3.53
103,003	4.5	11.54	1.50	4.50
131,512	5.5	11.79	1.70	5.50

$b = \frac{\ln\left(\frac{S_2}{S_1}\right)}{\ln\left(\frac{Z_2}{Z_1}\right)}$ 1.22

$K_s = \frac{S_2}{Z_2^b}$ 16,500.03

$Z = \left[\frac{S}{K_s}\right]^{1/b}$ 24.97

63.50 feet msl

Size Outlet Device for Control Structure

invert elevation =	62.50	feet msl
estimated orifice center elev. =	62.57	feet msl
proposed water surface elev. =	63.50	feet msl
available head (h) =	0.33	feet
discharge (d) =	20.4	cfs
coefficient of discharge =	0.6	

Orifice equation

$Q = C_d A\sqrt{2gh}$

3.05	inches	est based on 100 yr
1.75	inches	based on 1 yr storm

100 year storm

Inflow Hydrograph

Peak Inflow = 69.73 **27.78** cfs
Time to Peak = 123.9 min 155

Time T (min)	Inflow Q (cfs)	Orifice Outflow Q (cfs)	Principal Outflow Q (cfs)	Structure Overflow Q (cfs)	Emergency Spillway Q (cfs)	Total Outflow Q (cfs)
0	0.00	0.00	0.00	0.0	0.0	0.0
3.00	0.04	0.00	0.00	0.0	0.0	0.0
6.00	0.16	0.00	0.00	0.0	0.0	0.0
9.00	0.36	0.00	0.00	0.0	0.0	0.0
12.00	0.64	0.00	0.00	0.0	0.0	0.0
15.00	0.99	0.00	0.00	0.0	0.0	0.0
18.00	1.42	0.00	0.00	0.0	0.0	0.0
21.00	1.92	0.00	0.00	0.0	0.0	0.0
24.00	2.49	0.01	0.00	0.0	0.0	0.0
27.00	3.13	0.02	0.00	0.0	0.0	0.0
30.00	3.83	0.03	0.00	0.0	0.0	0.0
33.00	4.58	0.03	0.00	0.0	0.0	0.0
36.00	5.39	0.04	0.00	0.0	0.0	0.0
39.00	6.25	0.04	0.00	0.0	0.0	0.0
42.00	7.16	0.05	0.00	0.0	0.0	0.0
45.00	8.10	0.05	0.00	0.0	0.0	0.1
48.00	9.07	0.06	0.00	0.0	0.0	0.1
51.00	10.08	0.06	0.00	0.0	0.0	0.1
54.00	11.10	0.07	0.00	0.0	0.0	0.1
57.00	12.14	0.07	0.00	0.0	0.0	0.1
60.00	13.20	0.08	0.00	0.0	0.0	0.1
63.00	14.25	0.08	0.08	0.0	0.0	0.2
66.00	15.31	0.09	0.29	0.0	0.0	0.4
69.00	16.35	0.09	0.59	0.0	0.0	0.7
72.00	17.38	0.10	0.97	0.0	0.0	1.1
75.00	18.39	0.10	1.39	0.0	0.0	1.5
78.00	19.38	0.10	1.91	0.0	0.0	2.0
81.00	20.33	0.11	2.43	0.0	0.0	2.5
84.00	21.25	0.11	3.05	0.0	0.0	3.2
87.00	22.12	0.12	3.70	0.0	0.0	3.8
90.00	22.95	0.12	4.40	0.0	0.0	4.5
93.00	23.72	0.12	5.08	0.0	0.0	5.2
96.00	24.44	0.13	5.85	0.0	0.0	6.0
99.00	25.10	0.13	6.59	0.0	0.0	6.7
102.00	25.69	0.13	7.43	0.0	0.0	7.6
105.00	26.21	0.14	8.17	0.0	0.0	8.3
108.00	26.66	0.14	9.00	0.0	0.0	9.1
111.00	27.04	0.14	9.79	0.0	0.0	9.9
114.00	27.34	0.14	10.60	0.0	0.0	10.7
117.00	27.57	0.15	11.43	0.0	0.0	11.6
120.00	27.71	0.15	12.14	0.4	0.0	12.7
123.00	27.78	0.15	12.94	2.8	0.0	15.9
126.00	27.76	0.15	13.53	5.3	0.0	19.0
129.00	27.67	0.16	14.06	7.9	0.0	22.1
132.00	27.49	0.16	14.66	11.2	0.0	26.1
135.00	27.24	0.16	15.20	14.5	0.0	29.8
138.00	26.91	0.16	15.74	18.0	0.0	33.9
141.00	26.50	0.16	16.22	21.2	0.0	37.6
144.00	26.02	0.16	16.77	25.2	0.0	42.1
147.00	25.47	0.16	17.25	28.7	0.0	46.1
150.00	24.98	0.16	17.74	32.4	0.0	50.3
153.00	24.21	0.17	18.07	35.0	0.0	53.3
156.00	23.46	0.17	18.48	38.3	0.7	57.6
159.00	22.73	0.17	18.72	40.3	1.2	60.4
162.00	22.02	0.17	18.89	41.7	1.6	62.4
165.00	21.34	0.17	19.06	43.0	2.1	64.4
168.00	20.68	0.17	19.14	43.7	2.4	65.4
171.00	20.04	0.17	19.14	43.7	2.4	65.4
174.00	19.42	0.17	19.14	43.7	2.4	65.4
177.00	18.82	0.17	19.06	43.0	2.1	64.4
180.00	18.23	0.17	19.06	43.0	2.1	64.4
183.00	17.67	0.17	18.89	41.7	1.6	62.4
186.00	17.12	0.17	18.81	41.0	1.4	61.4
189.00	16.59	0.17	18.72	40.3	1.2	60.4
192.00	16.08	0.17	18.56	39.0	0.8	58.5
195.00	15.58	0.17	18.48	38.3	0.7	57.6
198.00	15.09	0.17	18.31	37.0	0.4	55.8
201.00	14.63	0.17	18.15	35.6	0.1	54.1
204.00	14.17	0.17	17.98	34.3	0.0	52.5

Stormwater routing

T (time min)	Q (cfs)	Storage	Stage	Outflow	Elevation	Diameter 1.75 inch Orifice	1.00 Length (ft) 63.50 Weir	16.00 Top of Box 66.00 Weir	15.00 Emerg Spill 66.80	18.00 Outlet Orifice 62.50
0	0	-	0.00	0.00	62.50					
3.00	0.0	-	0.00	0.00	62.50	0.00	0.00	0.00	0.00	0.00
6.00	0.2	7	0.00	0.00	62.50	0.00	0.00	0.00	0.00	0.00
9.00	0.4	36	0.01	0.00	62.51	0.00	0.00	0.00	0.00	0.85
12.00	0.6	101	0.02	0.00	62.52	0.00	0.00	0.00	0.00	1.20
15.00	1.0	216	0.03	0.00	62.53	0.00	0.00	0.00	0.00	1.47
18.00	1.4	394	0.05	0.00	62.55	0.00	0.00	0.00	0.00	1.90
21.00	1.9	650	0.07	0.00	62.57	0.00	0.00	0.00	0.00	2.25
24.00	2.5	996	0.10	0.01	62.60	0.01	0.00	0.00	0.00	2.69
27.00	3.1	1,442	0.14	0.02	62.64	0.02	0.00	0.00	0.00	3.18
30.00	3.8	2,001	0.18	0.03	62.68	0.03	0.00	0.00	0.00	3.61
33.00	4.6	2,685	0.23	0.03	62.73	0.03	0.00	0.00	0.00	4.08
36.00	5.4	3,504	0.28	0.04	62.78	0.04	0.00	0.00	0.00	4.50
39.00	6.3	4,469	0.34	0.04	62.84	0.04	0.00	0.00	0.00	4.96
42.00	7.2	5,586	0.41	0.05	62.91	0.05	0.00	0.00	0.00	5.45
45.00	8.1	6,866	0.49	0.05	62.99	0.05	0.00	0.00	0.00	5.95
48.00	9.1	8,314	0.57	0.06	63.07	0.06	0.00	0.00	0.00	6.42
51.00	10.1	9,937	0.66	0.06	63.16	0.06	0.00	0.00	0.00	6.91
54.00	11.1	11,740	0.76	0.07	63.26	0.07	0.00	0.00	0.00	7.41
57.00	12.1	13,727	0.86	0.07	63.36	0.07	0.00	0.00	0.00	7.89
60.00	13.2	15,900	0.97	0.08	63.47	0.08	0.00	0.00	0.00	8.38
63.00	14.3	18,262	1.09	0.16	63.59	0.08	0.08	0.00	0.00	8.88
66.00	15.3	20,798	1.21	0.37	63.71	0.09	0.29	0.00	0.00	9.35
69.00	16.4	23,486	1.34	0.69	63.84	0.09	0.59	0.00	0.00	9.84
72.00	17.4	26,306	1.47	1.06	63.97	0.10	0.97	0.00	0.00	10.31
75.00	18.4	29,244	1.60	1.49	64.10	0.10	1.39	0.00	0.00	10.76
78.00	19.4	32,286	1.74	2.01	64.24	0.10	1.91	0.00	0.00	11.22
81.00	20.3	35,412	1.87	2.54	64.37	0.11	2.43	0.00	0.00	11.63
84.00	21.2	38,614	2.01	3.16	64.51	0.11	3.05	0.00	0.00	12.06
87.00	22.1	41,871	2.15	3.82	64.65	0.12	3.70	0.00	0.00	12.47
90.00	22.9	45,166	2.29	4.52	64.79	0.12	4.40	0.00	0.00	12.87
93.00	23.7	48,484	2.42	5.20	64.92	0.12	5.08	0.00	0.00	13.23
96.00	24.4	51,819	2.56	5.97	65.06	0.13	5.85	0.00	0.00	13.61
99.00	25.1	55,143	2.69	6.72	65.19	0.13	6.59	0.00	0.00	13.95
102.00	25.7	58,450	2.83	7.56	65.33	0.13	7.43	0.00	0.00	14.31
105.00	26.2	61,713	2.95	8.31	65.45	0.14	8.17	0.00	0.00	14.61
108.00	26.7	64,936	3.08	9.14	65.58	0.14	9.00	0.00	0.00	14.93
111.00	27.0	68,090	3.20	9.93	65.70	0.14	9.79	0.00	0.00	15.21
114.00	27.3	71,170	3.32	10.75	65.82	0.14	10.60	0.00	0.00	15.50
117.00	27.6	74,157	3.44	11.58	65.94	0.15	11.43	0.00	0.00	15.77
120.00	27.7	77,034	3.54	12.68	66.04	0.15	12.14	0.38	0.00	16.00
123.00	27.8	79,740	3.65	15.88	66.15	0.15	12.94	2.79	0.00	16.25
126.00	27.8	81,881	3.73	16.42	66.23	0.15	13.53	5.29	0.00	16.42
129.00	27.7	83,922	3.80	16.58	66.30	0.16	14.06	7.89	0.00	16.58
132.00	27.5	85,918	3.88	16.75	66.38	0.16	14.66	11.24	0.00	16.75
135.00	27.2	87,851	3.95	16.90	66.45	0.16	15.20	14.49	0.00	16.90
138.00	26.9	89,711	4.02	17.05	66.52	0.16	15.74	18.00	0.00	17.05
141.00	27.5	91,485	4.08	17.18	66.58	0.16	16.22	21.20	0.00	17.18
144.00	26.6	93,335	4.15	17.32	66.65	0.16	16.77	25.15	0.00	17.32
147.00	25.8	95,005	4.21	17.45	66.71	0.16	17.25	28.72	0.00	17.45
150.00	25.0	96,504	4.27	17.57	66.77	0.16	17.74	32.43	0.00	17.57
153.00	24.2	97,837	4.31	17.70	66.81	0.17	18.07	34.99	0.05	17.66
156.00	23.5	99,008	4.36	18.42	66.86	0.17	18.48	38.28	0.66	17.76
159.00	22.7	99,915	4.39	19.03	66.89	0.17	18.72	40.30	1.22	17.82
162.00	22.0	100,580	4.41	19.50	66.91	0.17	18.89	41.67	1.64	17.86
165.00	21.3	101,034	4.43	20.01	66.93	0.17	19.06	43.05	2.11	17.90
168.00	20.7	101,274	4.44	20.28	66.94	0.17	19.14	43.75	2.36	17.92
171.00	20.0	101,347	4.44	20.28	66.94	0.17	19.14	43.75	2.36	17.92
174.00	19.4	101,304	4.44	20.28	66.94	0.17	19.14	43.75	2.36	17.92
177.00	18.8	101,149	4.43	20.01	66.93	0.17	19.06	43.05	2.11	17.90
180.00	18.2	100,934	4.43	20.01	66.93	0.17	19.06	43.05	2.11	17.90
183.00	17.7	100,615	4.41	19.50	66.91	0.17	18.89	41.67	1.64	17.86
186.00	17.1	100,285	4.40	19.26	66.90	0.17	18.81	40.98	1.42	17.84
189.00	16.6	99,899	4.39	19.03	66.89	0.17	18.72	40.30	1.22	17.82
192.00	16.1	99,459	4.37	18.61	66.87	0.17	18.56	38.95	0.83	17.78
195.00	15.6	99,003	4.36	18.42	66.86	0.17	18.48	38.28	0.66	17.76
198.00	15.1	98,491	4.34	18.08	66.84	0.17	18.31	36.95	0.36	17.72
201.00	14.6	97,955	4.32	17.80	66.82	0.17	18.15	35.64	0.13	17.68
204.00	14.2	97,383	4.30	17.64	66.80	0.17	17.98	34.35	0.00	17.64

Results of routing the 100 Year storm

Use orifice =	**1.75**	**inches**	
Peak outflow =	**20.28**	**cfs**	Less than post-bypass allowable release of 20.35
Peak Stage=	**4.44**	**ft**	
Water Elevation=	**66.94**	**msl**	
Peak Storage =	**101,347**	**cf**	
Design Spillway	**63.50**	**msl**	Temporary Pool Elevation for 1st inch of runoff
Length of weir	**1**	**ft**	
Structure Overflow	**66.00**	**msl**	Top of Outlet Control Structure
Length of weir	**16.00**	**ft**	

Routing Equations for Table Above

Synthetic Hydrograph

$$Qt = \frac{Qp}{2}\left[1 - \cos\left(\pi\left(\frac{t}{Tp}\right)\right)\right]$$

$0 \le t \le 1.25Tp$

$$Q = 4.34\,Qp \exp\left[-1.30\left(\frac{t}{Tp}\right)\right]$$

$t > 1.25Tp$

Routing Equations

$$Storage\,(S_{ij}) = (I_i - Q_i)\Delta t_{ij}$$

Stage/Storage Equation

Stage

$$Z = \left[\frac{S}{K_s}\right]^{1/b}$$

$$K_s = \frac{S_2}{Z_2{}^b}$$

$$b = \frac{\ln\left(\frac{S_2}{S_1}\right)}{\ln\left(\frac{Z_2}{Z_1}\right)}$$

Outflow

$$Q_{outflow} = \sum(Q_{orif} + Q_{weir} + Q_{spillway} + \cdots)$$

Outflow from Orifice

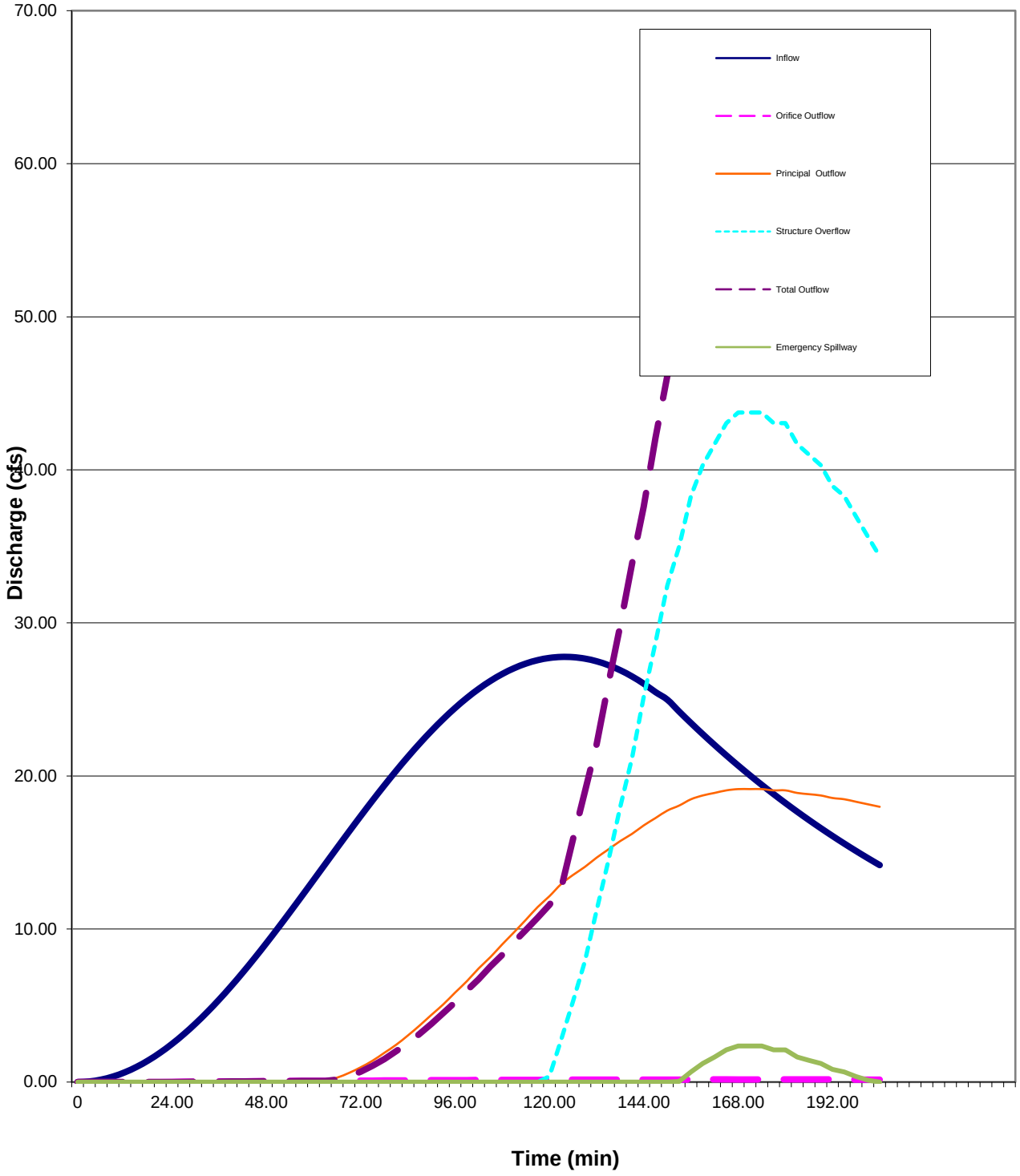
$$Q_{orifice} = C_d A\sqrt{2gh}$$

Outflow from Weir

$$Q_{weir} = C_w L H^{\frac{3}{2}}$$

100 year storm

Routing Hydrograph (100-YR)



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F-0334
107 E. 2nd Street
Greenville, 252-752-41 sjanowski@riversandassociates.com

Table of Rational Runoff Coefficients

C	Description
0.10	Lawn, sandy, flat <2%
0.10	Wooded, deep ground litter
0.15	Lawn, sandy, avg 2-7%
0.17	Lawn, dense soil, flat 2%
0.20	Wooded, sparse ground litter
0.22	Lawn, dense soil, AVG 2-7%
0.25	Park, cemetery
0.35	Unimproved cleared area
0.35	Cultivated Land Sandy
0.40	Residences, 2 dwellings/acre
0.50	Residences, 4 dwellings/acre
0.55	Residences, 6 dwellings/acre
0.55	Cultivated Land Clay and Loam
0.60	Apartments, schools, churches
0.60	Residences, 10 dwellings/acre
0.85	Commercial, generalized
0.70	Washed Stone
0.90	Parking lot
0.90	Roof, flat
0.95	Street, driveway, sidewalk
1.00	Roof, inclined

Pipe Calculations - Alice Keene Greenville, NC.

						Intensity		Pipe Data											
Name	Design Storm Return Period (Years)	Drainage Areas	Area (ac)	C	T_C (min)	I (in/hr)	Q = CIA (cfs)	Type	N	Beginning Invert (ft)	Ending Invert (ft)	L (ft)	% Slope	Size (in)	x	# of Pipes	Velocity (ft/sec)	Q Avail. (cfs)	Flow Type
						10yr													
DI 6 - DI 5	10	6	0.53	0.40	5.00	7.59	1.61	HP	0.012	64.22	63.97	86	0.291	12	x	1	2.65	2.09	Open Channel
DI 5 - DI 4	10	6,5	0.57	0.40	5.54	7.44	1.69	HP	0.012	63.97	63.74	76	0.303	15	x	1	3.13	3.86	Open Channel
DI 4 - DI 3	10	6,5,4	0.91	0.57	5.95	7.34	3.80	HP	0.012	63.74	63.45	98	0.296	15	x	1	3.10	3.82	Open Channel
DI 3 - DI 2	10	6,5,4,3	1.18	0.59	6.47	7.20	4.98	RCP	0.012	63.45	63.17	94	0.298	18	x	1	3.51	6.23	Open Channel
DI 2 - DI 1	10	6,5,4,3,2	1.79	0.57	6.92	7.09	7.20	RCP	0.012	63.17	62.82	116	0.302	24	x	1	4.28	13.50	Open Channel
DI 1 - FES 1	10	7,6,5,4,3,2,1	10.21	0.28	7.37	6.98	19.73	RCP	0.012	62.82	62.50	108	0.296	30	x	1	4.92	24.25	Open Channel
CB - FES 2	10	8	0.63	0.93	5.00	7.59	4.44	RCP	0.012	63.50	62.50	112	0.893	18	x	1	6.08	10.78	Open Channel
FES 3 - DI 1	10	7	7.41	0.18	5.00	7.59	10.20	RCP	0.012	63.50	62.80	97	0.722	24	x	1	6.62	20.87	Open Channel
OCS - FES 4	10						9.27	RCP	0.012	62.50	62.30	79	0.253	24	x	1	3.92	12.36	Open Channel

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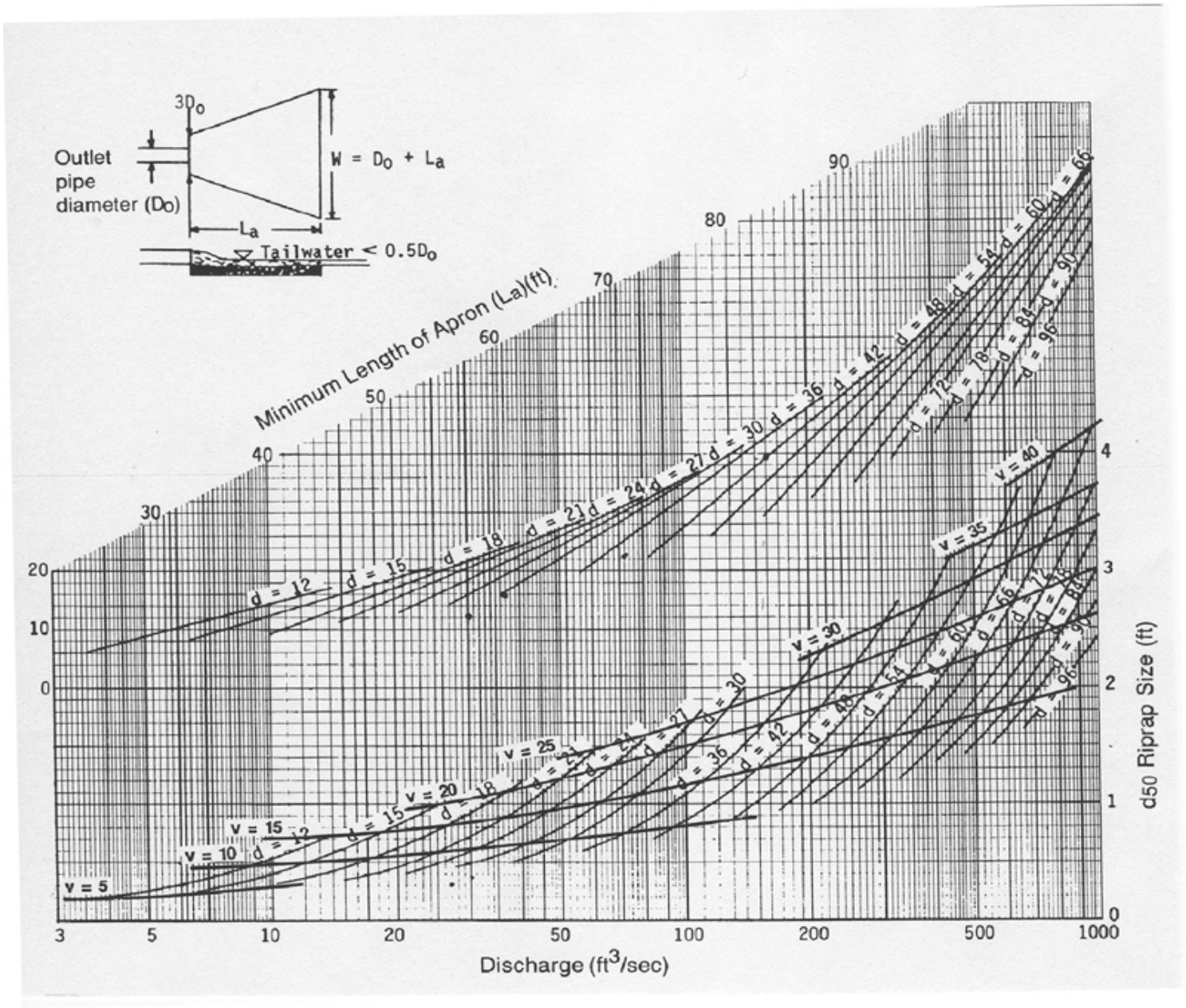
JOB Alice F. Keene
SHEET NO. 1 OF 1
CALCULATED BY DH DATE 3/3/2023
CHECKED BY DATE 3/3/2023
SCALE nts



Given Information

Q_{10} = 19.73 **cfs**
D_o = 30 "
Class 'B' stone unit weight = 110 pcf
Is flow below minimum for Pipe Diameter: YES
If flow is higher, then chart consultation is needed

Calculated Information

Width at entrance = $3D_o$ = 7.5 ft use 8.0 ft
Width at exit ($D_o + 0.4xL_a$) = 4.9 ft use 5.0 ft
Length of Apron (from chart) L = 6 ft
Thickness = 24 " thick Class 'B' stone
Tonnage = 4.29 tons use 5 tons

Apron at FES 1:

Use 8 ft x 5 ft x 6 ft,5 tons.

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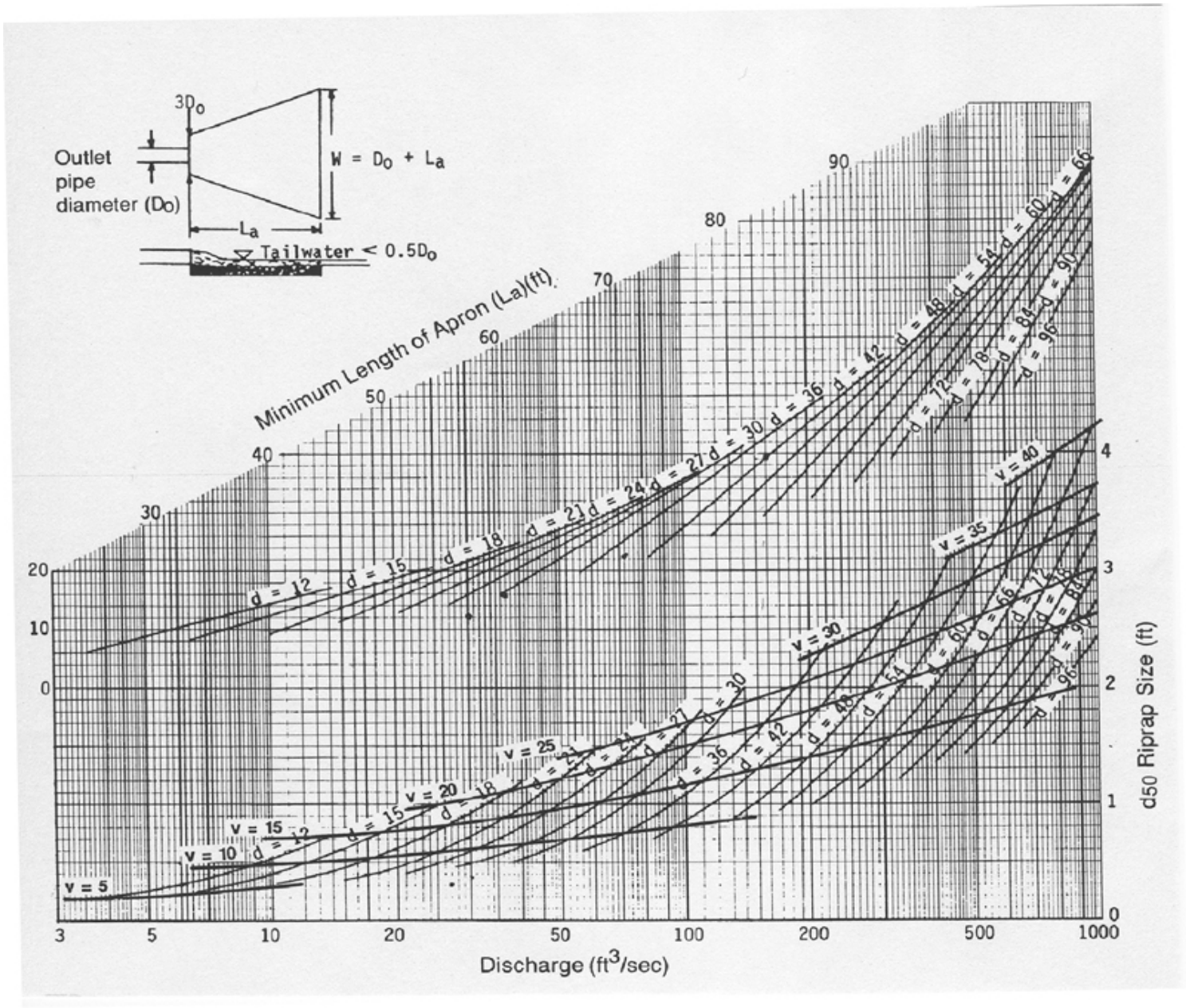
JOB Alice F. Keene
SHEET NO. 2 OF 3
CALCULATED BY DH DATE 3/3/2023
CHECKED BY DATE 3/3/2023
SCALE nts



Given Information

Q_{10} = 4.44 **cfs**
D_o = 18 "
Class 'B' stone unit weight = 110 pcf
Is flow below minimum for Pipe Diameter: YES
If flow is higher, then chart consultation is needed

Calculated Information

Width at entrance = $3D_o$ = 4.5 ft use 5.0 ft
Width at exit ($D_o + 0.4xL_a$) = 3.1 ft use 4.0 ft
Length of Apron (from chart) L = 4 ft
Thickness = 24 " thick Class 'B' stone
Tonnage = 1.98 tons use 2 tons

Apron at FES 2:

Use 5 ft x 4 ft x 4 ft,2 tons.

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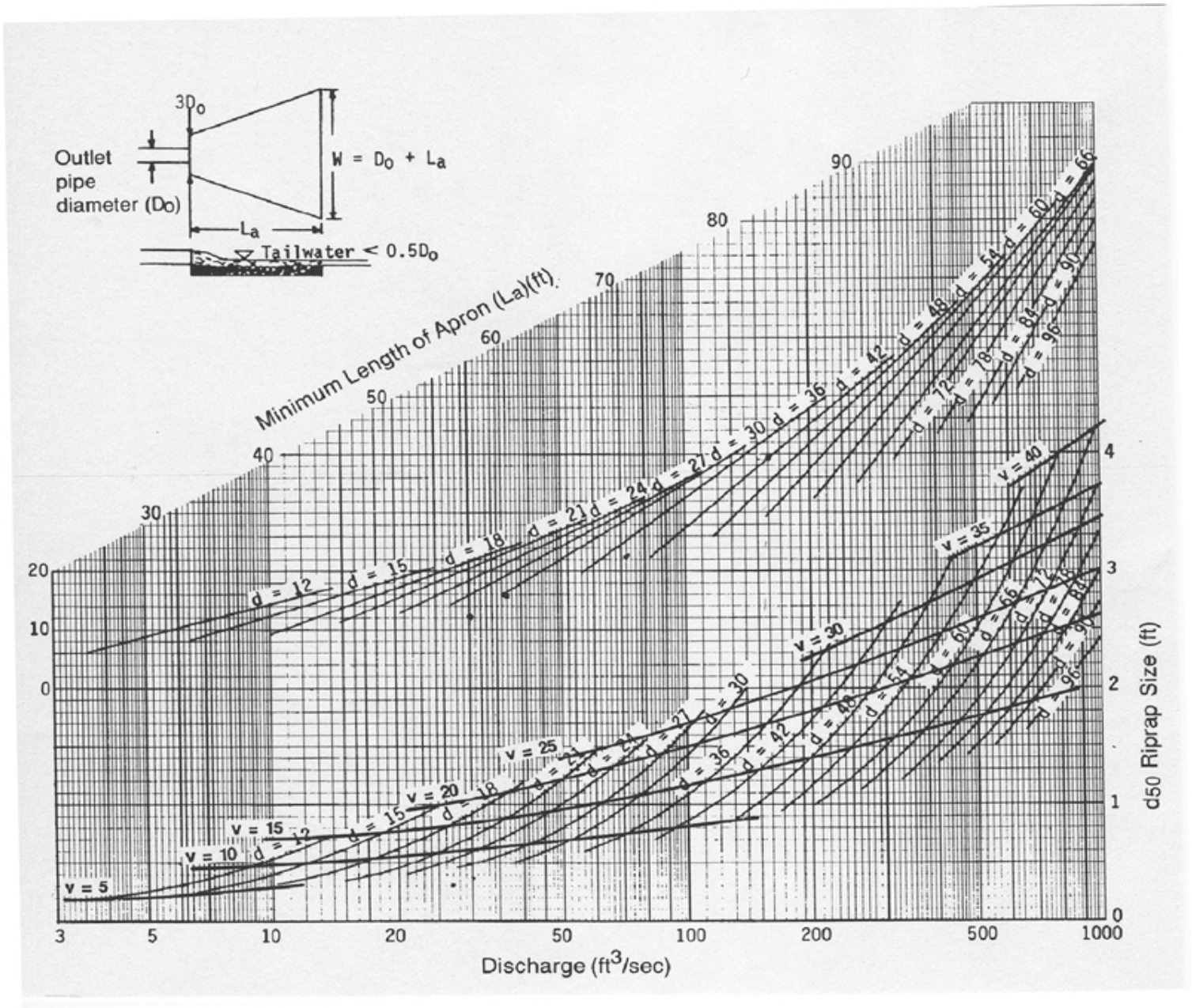
JOB Alice F. Keene
SHEET NO. 3 OF 3
CALCULATED BY DH DATE 3/3/2023
CHECKED BY DATE 3/3/2023
SCALE nts



Given Information

Q_{10} = 9.27 **cfs**
D_o = 24 "
Class 'B' stone unit weight = 110 pcf
Is flow below minimum for Pipe Diameter: YES
If flow is higher, then chart consultation is needed

Calculated Information

Width at entrance = $3D_o$ = 6 ft use 6.0 ft
Width at exit ($D_o + 0.4xL_a$) = 5.2 ft use 6.0 ft
Length of Apron (from chart) L = 8 ft
Thickness = 18 " thick Class 'B' stone
Tonnage = 3.96 tons use 4 tons

Apron at FES ≠ 4

Use 6 ft x 6 ft x 8 ft,4 tons.

DA#1
1.01 ac

DA#2
0.61 ac

DA#3
0.27 ac

DA#4
0.34 ac

DA
0.16 ac

DA#5
0.04 ac

DA#6
0.03 ac

DA#7= 7.41ac

DA#8
0.53 ac

TOTAL DISTURBED AREA = 7.0 Acres

Existing Building FFE=69.67

Proposed New Gymnasium Addition F.F.E=69.67'

Pump House

Wet DetentIonPond
WS 62.50'
Bottom = 59.00'
(SA = 16,685 S.F.)

Forebay Bot.=59.00'

Existing Building FFE=71.90'

COUNTY HOME ROAD (60' R/W - SR 1725)

LIMITS OF CONSTRUCTION

TEMPORARY SILT FENCE

TEMPORARY ROCK SILT FENCE OUTLET

EROSION CONTROL LEGEND

TST #	TEMPORARY SEDIMENT TRAP
	LIMITS OF CONSTRUCTION / DISTURBANCE
	TEMPORARY DIVERSION SWALE
	TEMPORARY ROCK CHECK DAM
	TEMPORARY STORM INLET SEDIMENT TRAP
	TEMPORARY SEDIMENT FENCE
	EXCELSIOR NETTING DITCH LINER
	STONE RIP RAP

LEGEND IS FOR REFERENCE ONLY. SYMBOLS / ABBREVIATIONS SHOWN DO NOT NECESSARILY APPLY TO THIS PROJECT.

NOTE: SEE GRADING & DRAINAGE LEGEND ON C-201 FOR OTHER SYMBOLS AND ABBREVIATIONS

North Carolina 811 www.nc811.org

POST DEVELOPMENT DA MAP

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CIVIL ENGINEERING CONSULTANT:
J. STEPHEN JANKOWSKI P.E.
Rivers & Associates, Inc.
License No. F-0334
107 East Second Street ● Greenville, NC
(252) 414-2000

COMMUNITY CENTER AND GYMNASIUM FOR
Alice F. Keene District Park
4561 County Home Road, Greenville, NC 27858

Project No. 22207
Date: December 1, 2022
Drawing no. C 202

EROSION CONTROL LEGEND

TST #	TEMPORARY SEDIMENT TRAP
	LIMITS OF CONSTRUCTION / DISTURBANCE
	TEMPORARY DIVERSION SWALE
	TEMPORARY ROCK CHECK DAM
	TEMPORARY STORM INLET SEDIMENT TRAP
	TEMPORARY SEDIMENT FENCE
	EXCELSIOR NETTING DITCH LINER
	STONE RIP RAP

LEGEND IS FOR REFERENCE ONLY; SYMBOLS / ABBREVIATIONS SHOWN DO NOT NECESSARILY APPLY TO THIS PROJECT.

NOTE: SEE GRADING & DRAINAGE LEGEND ON C-201 FOR OTHER SYMBOLS AND ABBREVIATIONS

North Carolina 811 www.nc811.org

EACH PERSON CONTRACTOR PERFORMING EXCAVATING OR UNDERGROUND WORK SHALL NOTIFY THE NORTH CAROLINA 811 CENTER AT LEAST THREE (3) BUT NOT MORE THAN FIVE (5) FULL WORKING DAYS BEFORE THE DATE SHALL STARTED BY NOTIFICATION AT LEAST 72 HOURS PRIOR TO EXCAVATION. CONTRACTOR SHALL CONFIRM THAT ALL UTILITIES HAVE BEEN LOCATED AND MARKED. CONTRACTOR SHALL CONTACT ALL UTILITY COMPANY FOR ANY UTILITIES NOT MEMBERS WITH THE 811 SYSTEM. CONTRACTOR SHALL USE ALL CARE NECESSARY WHEN EXCAVATING IN AREAS KNOWN OR SUSPECTED CONTAIN UNDERGROUND UTILITIES. FAILURE TO NOTIFY...

Hite associates
ARCHITECTURE / PLANNING / TECHNOLOGY
2600 Meridian Drive / Greenville, NC 27834 / tel (252) 757-0333

HITE ASSOCIATES, P.A. CORPORATION LICENSE NUMBER C-1618 REGISTERED PROFESSIONAL ENGINEERS GREENVILLE, NC

CIVIL ENGINEERING CONSULTANT:
J. STEPHEN JANKOWSKI P.E.
Rivers & Associates, Inc.
License No. F-0304
107 East Second Street Greenville, NC
(252)-214-3002

COMMUNITY CENTER AND GYMNASIUM FOR
Alice F. Keene District Park
4561 County Home Road, Greenville, NC 27858

Project No. 22207
Date: December 1, 2022
Drawing no. C 202

Pump House
Pioneer Water Tank Model XL 33/50 30,000 Gallon Capacity
Existing Building FFE=69.67'
Proposed New Gymnasium Addition FFE=69.67'
Alternate Plan C-901
TOTAL DISTURBED AREA = 7.0 Acres
Forebay Bot.=59.00'
Wet DetentIonPond WS 62.50' Bottom = 59.00' (SA = 16,685 S.F.)
LIMITS OF CONSTRUCTION
COUNTY HOME ROAD (60' R/W - SR 1725)
Existing Building FFE=71.90'

SWALE 1 DA 0.65 ac
SWALE 2 DA 0.14 ac
SWALE 3 DA 0.16 ac
SWALE 4 DA 0.29 ac
SWALE 5 DA 0.71 ac
SWALE 6 DA 0.19 ac

PROPOSED SWALES DA MAP

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Pitt County, North Carolina

February 28, 2023

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:4,050 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Pitt County, North Carolina
Survey Area Data: Version 20, Sep 14, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 9, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ExA	Exum fine sandy loam, 0 to 1 percent slopes	2.6	7.1%
GoA	Goldsboro sandy loam, 0 to 1 percent slopes	9.0	24.3%
Ly	Lynchburg fine sandy loam, 0 to 2 percent slopes, Atlantic Coast Flatwoods	22.0	59.5%
NrB	Norfolk sandy loam, 1 to 6 percent slopes	3.1	8.5%
OcB	Ocilla loamy fine sand, 0 to 4 percent slopes	0.1	0.2%
Os	Osier loamy sand, loamy substratum (Plummer)	0.1	0.4%
Totals for Area of Interest		**37.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not

mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Pitt County, North Carolina

ExA—Exum fine sandy loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 3tyv
Elevation: 20 to 160 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Exum and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Exum

Setting

Landform: Broad interstream divides on marine terraces, flats on marine terraces
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy and silty marine deposits

Typical profile

Ap - 0 to 8 inches: very fine sandy loam
E - 8 to 12 inches: silt loam
Bt - 12 to 70 inches: clay loam
C - 70 to 100 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

GoA—Goldsboro sandy loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 3tyx
Elevation: 20 to 330 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Goldsboro and similar soils: 90 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Goldsboro

Setting

Landform: Broad interstream divides on marine terraces, flats on marine terraces
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 7 inches: fine sandy loam
E - 7 to 13 inches: fine sandy loam
Bt - 13 to 40 inches: sandy clay loam
Btg - 40 to 80 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Rains, undrained

Percent of map unit: 3 percent

Landform: Broad interstream divides on marine terraces, carolina bays on marine terraces, flats on marine terraces
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Woodington, undrained

Percent of map unit: 2 percent
Landform: Depressions on marine terraces, flats on marine terraces, broad interstream divides on marine terraces
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Ly—Lynchburg fine sandy loam, 0 to 2 percent slopes, Atlantic Coast Flatwoods

Map Unit Setting

National map unit symbol: 2vx8k
Elevation: 0 to 100 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 64 to 70 degrees F
Frost-free period: 200 to 310 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Lynchburg and similar soils: 82 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lynchburg

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 6 inches: fine sandy loam
E - 6 to 13 inches: fine sandy loam
Bt - 13 to 21 inches: sandy clay loam
Btg - 21 to 45 inches: sandy clay loam
BCg - 45 to 63 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Rains, undrained

Percent of map unit: 5 percent
Landform: Broad interstream divides on marine terraces, flats on marine terraces, carolina bays on marine terraces
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Rains, drained

Percent of map unit: 5 percent
Landform: Broad interstream divides on marine terraces, flats on marine terraces, carolina bays on marine terraces
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

NrB—Norfolk sandy loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: 3tz7
Elevation: 20 to 160 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Norfolk and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norfolk

Setting

Landform: Ridges on marine terraces, broad interstream divides on marine terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 9 inches: sandy loam
E - 9 to 15 inches: sandy loam
Bt1 - 15 to 19 inches: sandy clay loam
Bt2 - 19 to 100 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 40 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

OcB—Ocilla loamy fine sand, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: 3tz9
Elevation: 20 to 160 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 200 to 280 days
Farmland classification: Not prime farmland

Map Unit Composition

Ocilla and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ocilla

Setting

Landform: Flats on marine terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy and sandy marine deposits

Typical profile

Ap - 0 to 4 inches: loamy fine sand
E1 - 4 to 15 inches: loamy fine sand
E2 - 15 to 28 inches: loamy fine sand
Bt1 - 28 to 49 inches: sandy loam
Bt2 - 49 to 59 inches: sandy clay loam
Bt3 - 59 to 80 inches: sandy clay loam

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Hydric soil rating: No

Os—Osier loamy sand, loamy substratum (Plummer)

Map Unit Setting

National map unit symbol: 3tzc
Elevation: 80 to 330 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 210 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Plummer, undrained, and similar soils: 40 percent
Osier, undrained, and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plummer, Undrained

Setting

Landform: Depressions, drainageways, flats
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy and sandy marine deposits

Typical profile

A - 0 to 9 inches: loamy sand
Eg - 9 to 50 inches: loamy sand
Btg - 50 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Very rare
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Description of Osier, Undrained

Setting

Landform: Depressions, drainageways, flats
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy fluviomarine deposits

Typical profile

A - 0 to 8 inches: loamy sand
Cg1 - 8 to 48 inches: loamy sand
Cg2 - 48 to 80 inches: coarse sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

GENERAL LANDSCAPE REQUIREMENTS AND ONE YEAR WARRANTY:

Redistribute stockpiled topsoil a minimum of 3" thick layer, to supplement that available for reuse at site.

Provide grown-in turf from seed, sod turf, and landscape plantings (trees, shrubs, flowers), maintain and warranty complete installation for one year following acceptance. Owner shall have final approval of tree and shrubs plantings materials.

All areas of finish grades disturbed or damaged by construction activities shall be completely restored to like new or original condition.

PRE-EMERGENT HERBICIDE TREATMENT:

Prior to permanent seeding, apply herbicide as recommended by the seed supplier, in accordance with published recommendations.

SEEDING PLAN:

PERMANENT SEEDING AFTER APRIL 15 AND BEFORE SEPTEMBER 15:

Seeding Mixture:

1. Centipede, applied at the rate of 10 lbs. Per acre.
2. Common Bermuda, applied at the rate of 100 lbs. Per acre.

PERMANENT SEEDING AFTER SEPTEMBER 15 AND BEFORE APRIL 15:

Seeding Mixture:

1. Centipede, applied at the rate of 10 lbs. Per acre.
2. Common Bermuda (unhulled), applied at the rate of 100 lbs. Per acre.
3. Annual Rye Grass, applied at the rate of 50 lb. Per acre.

SOD:

Provide centipede sod where indicated on Drawings.

SOIL AMENDMENTS

Apply 3000 lb. / acre ground agricultural limestone and 1,000 lb. / acre of 10-10-10 fertilizer.

MULCH

Use jute, excelsior matting, or other effective channel lining material to cover the bottom of channels, ditches, and swales as required to prevent erosion and promote turf establishment. Extend lining above the highest calculated depth of flow. On channel side slopes above this height, and in drainages not requiring temporary lining, apply 4000 lb. / acre grain straw by stapling netting over the top.

All other lawn areas shall be mulched with 2,000 lb. / acre grain straw, stitched into ground with a disc harrow with blades set straight

TURF ESTABLISHMENT, MAINTENANCE, AND SPECIAL RIGHT OF OWNER TO TAKE CORRECTIVE ACTION

Turf establishment and maintenance includes sufficient irrigation and frequent mowing to promote turf grow-in and to prevent the growth and proliferation of weeds. In addition, the contractor shall re-seed, re-fertilize and mulch immediately following erosion or other damage, which is to be expected. Should the Owner determine that the grounds in part or as a whole lack proper maintenance in accordance with this paragraph, the Owner or his designated agent (the Architect or Engineer) may provide written notice to the Contractor to take corrective action. If the Contractor does not respond with corrective action or otherwise in an acceptable manner to the Owner within five (5) calendar days, the Owner may, at his option, undertake such corrective action with his own or other forces, and deduct the full cost from the Contract amount of the Contractor.

PLANTING GENERAL LAWNS:

Where topsoil has been stripped, redistribute a minimum 3” layer of stockpiled topsoil, add specified soil amendments and mix thoroughly into top 4" of soil, tilling surface to a level, fine texture.

Cultivate to a depth of 6" in areas where topsoil has not been stripped, add specified soil amendments and mix thoroughly into top 4" of soil, tilling surface to a level, fine texture.

Grade and roll prepared lawn surface. Water thoroughly but do not create muddy soil condition.

Hydro-seed uniformly in two directions in the quantity recommended by the seed producer. Water thoroughly with fine spray.

Protect seeded areas against erosion by stitching mulch straw with a disc harrow with blades set straight. Immediately after seeding, protect the area against traffic or other use by erecting barricades as required until final acceptance.

Install sodding where indicated on Drawings. Irrigate as necessary for establishment and maintenance.

LANDSCAPE MATERIALS AND PLANTING:

Comply with detailed drawings and the AMERICAN STANDARD FOR NURSERY STOCK, ANSI Z60.1-1990. Plant materials shall be checked upon delivery to site and before planting in accordance with this standard, and any materials that do not meet specifications will be removed from the site. The contractor shall replace any dead or dying plant materials, or those failing to thrive, that are observed, following acceptance of 12 months install by Owner.

FINAL ACCEPTANCE:

Final Inspection and Acceptance: At the end of the turf establishment period, final inspection will be made upon written request at least 10 days prior to the anticipated date. Final acceptance will be based upon a full stand of turf of the species specified.

Turf establishment period shall be defined as minimum three mowing cycles, or as required to produce a stand of turf. Contractor is responsible for irrigation and mowing as required.

Re-planting: In areas which do not have a satisfactory stand of turf or sod, replace sod or replant, mulch, re-fertilize and irrigate within specified planting dates.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Extent of portland cement concrete paving includes concrete sidewalks, curbs and gutters, as shown on Drawings.

Prepared subbase is specified in Section 02200.

Concrete and related materials are specified in Section 03200.

QUALITY ASSURANCE:

Codes and Standards: Comply with NCDOT Regulations if more stringent than herein specified.

SUBMITTALS:

Furnish samples, manufacturer's product data, test reports, and materials' certifications as required in referenced sections for concrete and joint fillers and sealers.

Install sample section of concrete sidewalk for review and approval by Architect. Mockup sample to include full construction features required by Drawings, including expansion joints and sealants, and control joints.

JOB CONDITIONS:

Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2: PRODUCTS

MATERIALS:

Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

Use flexible spring steel forms or laminated boards to form radius bends as required.

Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.

Concrete Materials: Comply with requirements of applicable Division - 3 Sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

Welded Steel Wire Fabric: ASTM A185 Plain Type; in flat sheets; unfinished. Rolled WWF shall not be acceptable for use on this job.

Expansion Joint Materials: Bituminous Fiber, 1/2" thick, complying with NCDOT Spec. Section 928-1 and Section 420-12.

Liquid-Membrane Forming Curing Compound: Complying with ASTM C 309, Type I, Class A unless other type acceptable to Engineer. Moisture loss not more than 0.055 gr. / sq. cm. when applied at 200 sq. ft. / gal.

Detectable Tactile Warning Surfaces: Vitrified polymer composite panels, cast into concrete. Dark color. "Armor-Tile" as manufactured by Engineered Plastics or equivalent. Comply with all ADA and NC Accessibility code requirements.

CONCRETE MIX, DESIGN AND TESTING:

Comply with requirements of applicable Division - 3 Sections for concrete mix design, sampling and testing, and quality control, and as herein specified.

Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (super - plasticizer), air-entraining admixture and water to produce the following properties:

Compressive Strength: 3,000 psi, minimum at 28 days, unless otherwise indicated.
Slump Range: Not greater than 4".
Air Content: 5 % - 8%.

PART 3: EXECUTION

SUBSURFACE PREPARATION:

Remove loose material from compacted subbase surface immediately before placing aggregate base course. No aggregate base course shall be placed until the foundation has been inspected and approved by the Engineer. Proof-rolling may be required depending on condition of subbase.

Place aggregate base course material on prepared subgrade in layers of uniform thickness. Grade the base course evenly to thickness indicated on drawings and compact before placing concrete.

FORM CONSTRUCTION:

Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 2 hours after concrete placement.

Check completed formwork for grade and alignment to following tolerances:

Top of forms not more than 1 / 8" in 10'.
Vertical face on longitudinal axis, not more than 1/4" in 10'.

Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

REINFORCING

Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions, including load bearing pads.

CONCRETE PLACEMENT:

General: Comply with requirements of Division - 3 Sections for mixing and placing concrete, and as herein specified.

Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent discoloration of reinforcing, dowels, and joint devices.

Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

Drop top of curb as shown in details of plans at all radii of intersections, to allow construction of handicapped ramps and sidewalks.

Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades finish, and jointing as specified.

JOINTS:

General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

Exterior Concreted Walks: Provide all concrete walk surfaces with a concrete walk 1/2" tooled expansion joints at 30' centers maximum and sawcut weakened-plane (contraction) joints at 5' centers maximum. Pour sample for Architect approval.

Weakened-Plane (Contraction) Joints: Provide sawcut weakened-plane (contraction) joints, sectioning concrete sidewalks at 5' intervals. Sawcut weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

Sawcut joints at concrete walks as soon as concrete has sufficient strength to prevent spalling of the joint due to the action of the saw. But in no case greater than 4 hours after initial placement of the concrete. Concrete walk sawcut joints shall not be filled with joint filler.

Tooled Joints: Form tooled joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer. Remove tooling marks.

Construction Joints: Place tooled construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such placements terminate at expansion joints.

Construct joints as shown or, if not shown, use standard metal keyway-section forms.

Locate expansion joints at 90' o.c. for each curb and gutter section and 30' o.c. for each sidewalk section unless otherwise indicated, and at beginning and end of all curb and gutter radii. Connections with rigid objects including existing curb and gutter and catch basins.

Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or slip joint filler sections together.

Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

Fillers and Sealants: Comply with manufacturer's requirements for preparation of joints, materials installation, and performance. Place at all curb and gutter template joints, curb-to-walk transition joints, concrete walk expansion joints, tooled concrete walk construction joints. Joint filler not required at 5’ O.C. sawcut weakened-plane contraction joints.

CONCRETE FINISHING:

After striking-off and consolidating concrete, smooth surface by screening and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

After floating, test surface for trueness with a 10' straight edge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

Provide all concrete walk surfaces with a unidirectional fine broom finish. Pour sample for Architect approval.

Broom Finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Engineer.

Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honey combed areas. Remove and replace areas or sections with major defects, as directed by Engineer.

CURING:

Protect and cure finished concrete paving, complying with applicable requirements of Division - 3 Sections. Use membrane-forming curing and sealing compound or approved moist-curing methods.

REPAIRS AND PROTECTIONS:

Repair or replace broken or defective concrete, as directed by Engineer.

Drill test cores where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

Sweep concrete and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

The extent of work under this item includes the placement of aggregate base course and asphalt concrete pavement.

Asphalt concrete paving shall also mean asphalt paving, or bituminous concrete as may be used in other sections of the specifications or drawings.

SUBMITTALS:

Material Certificates: Asphalt Concrete Paving:

Provide two copies of materials certificates signed by the material producer and the Contractor, and notarized, certifying that each material item complies with, or exceeds, specified requirements.

Job Mix Formula: Provide two copies of the proposed job mix formula at least 10 days prior to beginning work. This formula shall be approved by NCDOT for the type of pavement specified. Contractor shall, at his own expense, take whatever measures are necessary in order to obtain said approval prior to beginning work of have a mix design prepared by an approved Testing Lab.

SITE CONDITIONS:

Weather Limitations: Construction shall be conducted in accordance with the weather limitations given in the applicable sections of "Standard Specifications for Roads and Structures" as issued by N. C. Department of Transportation. No asphalt concrete shall be placed when the ambient temperature is less than 40 degrees F (4°C.) in the shade away from artificial heat.

Grade Control: Establish and maintain required lines and elevations as necessary to match existing grades and / or proposed grades on the drawings.

LIQUID ASPHALT PRICE ADJUSTMENT:

Asphalt shall be bid based on the FOB binder price in effect on Bid Date, per ton. Adjustments to the contract will be made + / - in accordance with NCDOT Section 620-5 “Basis of Payment” rules.

PART 2: PRODUCTS

MATERIALS:

General: Use locally available materials and gradations, which exhibit a satisfactory record of previous installations.

Aggregate Base Course: Aggregate meeting the requirements of Section 910-1, Paragraph (a) of "Standard Specifications for Roads and Structures" by NCDOT.

Asphalt Concrete Base Course Type B 25.0 B: Materials meeting the requirements of Section 645 of "Standard Specifications for Road and Structures" as issued by NCDOT.

Asphalt Concrete Intermediate Course Type I 19.0.0 B: Materials meeting the requirements of Section 645 of "Standard Specifications for Road and Structures" as issued by NCDOT.

Asphalt Surface Course, Type S-9.5B: Materials meeting the requirements of Section 645-2 and 3 of "Standard Specifications for Road and Structures" by NCDOT.

Tack Coat: Material meeting the requirements of Section 605-2 of "Standard Specifications for Roads and Structures" as issued by NCDOT. Only on existing asphalt to be overplayed.

Striping: Glidden “Romark” traffic marking paint, or approved equivalent. Apply full 2-coat thickness for all striping and graphics, and symbols. Allow manufacturer’s specified cure time between coats.

All markings in NCDOT right-of-ways to be thermoplastic as approved by NCDOT.

Asphalt Seal Coat: Mineral reinforced asphalt emulsion blended with polymers, 58% to 63% solids, equivalent to Polymer Modified MasterSeal. Apply per manufacturer’s instructions and specifications and in compliance with ASMA Standard Specifications.

PART 3: EXECUTION

GENERAL:

Install the aggregate base course, asphalt surface course, prime coat and tack coat in accordance with the applicable provisions of "Standards Specifications for Roads and Structures" as issued by the North Carolina Department of Transportation.

Provide milling and/or wedging of existing asphalt surfaces at asphalt paving modifications and tie-ins as necessary to meet indicated grades of modified areas.

SUBGRADE:

Shape surface of areas under base course to line, grade and cross-section shown on drawings, with finish surface not more than 1/2" above or below the required subgrade elevation.

Patches in driveways and roadways shall be graded to depth required to match existing pavement or to provide minimum pavement specified.

Maintain a uniform surface on the subgrade until the placement of aggregate base course is complete.

Provide a proof rolling of the compacted subgrade with a heavy roller or loaded dump truck (+25 tons) in the presence of the Engineer. The proof rolling shall be covered by the wheels of the proof roller operating at a speed between 2 and 3 miles per hour.

Any areas that rut or pump excessively shall be allowed to dry or shall be undercut and backfilled with select backfill or coarse aggregate base course as directed by the Engineer.

After undercut and backfill operations are complete, a final proof rolling of the undercut areas will be performed in the presence of the Engineer.

AGGREGATE BASE COURSE:

Place base course material on prepared subgrade in layers of uniform thickness. Subgrade shall be inspected and accepted for placement of base coarse by Engineer as described above. Grade the base course evenly and compact to 100%. The thicknesses indicated on drawings are compacted thickness.

Maintain a uniform surface on the base course until the placement of the asphalt surface course is complete.

Provide a proof rolling of the compacted aggregate base course with a heavy roller or loaded dump truck (+25 tons) in the presence of the Engineer. The proof rolling shall be covered by the wheels of the proof roller operating at a speed between 2 and 3 miles per hour.

Any areas that rut or pump excessively shall be allowed to dry or shall be undercut and subgrade replaced with select backfill or coarse aggregate base course as directed by the Engineer.

After undercut and backfill operations are complete, a final proof rolling of the undercut areas will be performed in the presence of the Engineer, and Owners representative.

TACK COAT:

Tack Coat shall be applied to contact surfaces of previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. All application of tack coat shall be in conformance with Section 605 of the N. C. Highway Specifications for Roads and Structures latest revision.

Tack coat shall be uniformly applied at a rate of 0.02 to 0.05 gallons per square yard. No more tack coat material shall be applied than can be covered with base, binder, or surface course during the following day's operations. No base, binder or surface mixture shall be deposited thereon until the tack coat has sufficiently cured to properly receive paving.

All exposed surfaces, not intended to contact paving, shall be protected sufficiently to prevent tack coat from being tracked or splattered on said surfaces. After the tack coat has been applied, it shall be protected until it has cured for a sufficient length of time to prevent it from being picked up by traffic.

PLACING ASPHALT CONCRETE PAVEMENT:

Place asphalt concrete pavement in as continuous as operation as possible. The Contractor shall spread the materials to uniform density and strike a smooth finish true to cross-section and free from inequalities. Spread mixture at minimum temperature of 225 degrees F. Place each course in the required amounts, so that when compacted, they will conform to the indicated grade, cross section, and thickness. All seams or joints are to be raked smooth prior to rolling.

Provide joints between old and new pavements and between successive days' work for continuous bond between adjoining work. Clean contact surfaces and apply tack coat.

Rolling: Begin rolling when asphalt concrete mixture will bear roller weight without excessive displacement. Repair surface defects with hot asphalt concrete material as rolling progresses. Cut out and patch defective areas and roll to blend with adjacent satisfactory paving. Continue rolling until maximum density is attained and roller marks eliminated.

Protect paving from damage and vehicular traffic until asphalt concrete mixture has cooled and attained its maximum degree of hardness.

FIELD QUALITY CONTROL:

GENERAL:

Test the in-place asphalt concrete courses for compliance with requirements for thickness, compacted density and surface smoothness. Repair or remove and replace unacceptable paving as directed by the Engineer, or Owner.

Thickness: In-place thickness will not be acceptable if exceeding following allowable variation from required thickness:

Course Aggregate Base Course: 1/2", plus or minus.

Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10' straight edge applied parallel with, and at right angles to center line of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:

- Wearing Course Surface: 1/8"
- Check surfaced areas at intervals as directed by the Engineer.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1 - GENERAL

1.1 All materials and installation methods shall be in accordance with these plans and specifications and applicable AWWA Standards and the AUTHORITY HAVING JURISDICTION (AHJ) standards and specifications. The Contractor shall obtain from the Owner certificate of approval for the substitution of any material other than those specified. Excavation & backfilling shall conform to TRENCHING AND BACKFILLING FOR UTILITIES.

1.2 Current specifications of the American Society for Testing Materials (ASTM) and the American National Standards Institute (ANSI) shall apply in all cases where material is covered by an item in these specifications, and all material used under this contract shall conform fully to these current specifications or be removed from the job at the direction of the Owner. Failure of the Owner to condemn material on preliminary inspection shall not be grounds for acceptance if future defects are found.

1.3 Detail or shop drawings of valves and tapping sleeves must be approved by the Engineer prior to installation, or approval of payment for same.

1.4 It shall be the contractor's responsibility to notify the Owner and the AHJ at least 24 hours in advance of beginning any construction work on any portion of this project.

1.5 Preconstruction Conference: Prior to commencing any water extension construction work, the Department Engineer shall be contacted to schedule a preconstruction conference. No construction shall occur until after the preconstruction conference is held.

1.6 Contractor shall be responsible for verifying all elevations, dimensions, locations and sizes of existing facilities in the field prior to construction or ordering materials.

1.7 Pipe installation shall be performed only in the presence of the AHJ’s Representative, except as authorized by the AHJ.

1.8 Backfilling shall be performed only with the approval of a AHJ’s Representative.

1.9 The Contractor shall construct and maintain all detours, crossings and temporary approaches that may be required during construction. Maintenance shall be in accordance with the applicable features of Section 150 of the N.C. Department of Transportation Standard Specifications.

1.10 All PVC water main shall be installed with Detectable marking tape shall be installed in accordance with Section 3. Tape shall be three (3) inches in width with a minimum thickness of 0.5 millimeters (minimum solid center foil thickness of 0.35 millimeters). Color of the tape shall be blue meeting the American Water Works Association color code. Tape shall read: “Caution – Buried Water Line Below”. Tape shall be manufactured by Lineguard, Inc., Pro-Line Safety Products Co., Empire Level Mfg. Corp., or approved equal.

1.11 Property Protection:

1.11.1 Trees, fences, poles and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the Contractor shall be restored by the Contractor to the Owner's satisfaction.

1.11.2 Signs, mailboxes and other items which must be removed to facilitate construction shall be replaced in a condition equal or better than condition prior to removal. Replacement shall occur immediately following backfill of the trench at the location of each item removed.

1.11.3 All existing drainage shall be maintained at all times on the Project. Any drainage swales, ditches, culverts, etc. blocked by construction activities shall be reopened at the end of the day before leaving the job site.

1.12 Encroachment Contracts and Permits:

1.12.1 Prior to actual construction, the Owner shall acquire the necessary encroachments from NCDOT for installations. When working inside the rights-of-way of State system roads for highways, the Contractor shall acquire the necessary permits for his work.

1.12.2 The Contractor shall be responsible for securing all other local and state permits required for the utility construction.

1.12.3 Open cut shall be used for excavation of all water mains unless written permission of the Owner is given, or as specified by the encroachment agreement with the N.C. Department of Transportation.

1.13 Record Drawing: An updated record drawing shall be prepared by the contractor and submitted to the Engineer as a condition of approval for any pay request which includes pay items for water and/or sewer improvements. Record drawings shall be prepared by and bear the seal and signature of a Professional Engineer or Registered Land Surveyor.

1.14 Guarantee: The Contractor shall guarantee all material, equipment, and workmanship for a period of one year after final acceptance by the Owner and the AHJ. Inspection may be made by AHJ within the one-year warranty. The Contractor shall make any and all necessary repairs to the system within this his one-year warranty period at no additional cost to the Owner or the AHJ.

Before the guarantee period shall begin, the record drawings and other relevant information shall be approved and the owner shall receive a letter of acceptance from the AHJ for the water.

PART 2 - MATERIALS

2.1 PVC Water Mains - 4" through 12": All mains 4" through 12" shall be polyvinyl chloride pipe meeting the requirements of the latest edition of AWWA C-900. The pipe shall be rated at 150 psi, and SDR 18 with integral bell and spigot joints. Outside diameter of the pipe shall be the same as cast iron. Joints shall be elastomeric-gasket type designed to accommodate up to 3 degrees of axial deflection without adverse consequences. Pipe shall be furnished in nominal 20 foot lengths

2.2 PVC Water Mains to 3": All water mains to 3" PVC water main shall be Class 200 SDR 21 conforming to ASTM D1784 and ASTM D2241 with "push-on" joints. Fittings shall be Schedule 80 PVC with solvent weld joints. Pipe shall be furnished in nominal twenty-foot (20') lengths. All pipe shall bear the NSF logo.

2.3 Ductile Iron Pipe: Ductile iron pipe for water mains shall be manufactured in conformance with AWWA C151 and shall be cement mortar lined with an asphaltic coating in accordance with AWWA C104. The exterior of the pipe shall be bituminous coated in accordance with AWWA C151. The minimum thickness Class of pipe shall be Class 50. Pipe shall be furnished in nominal 18 to 20 foot lengths. Pipe joints for ductile iron pipe shall be "push-on" unless the additional pipe deflection allowed by mechanical joints is necessary or other considerations dictate the use of mechanical joints. The joints for ductile iron pipe shall conform to AWWA Standard C111 revision (ANSI A21.11).

Polyethylene encasement shall be applied to all underground ductile iron pipe and fitting installations. Material and installation procedures shall be in accordance with ANSI/AWWA C105/A21.5-88.

2.4 Gate Valves: Gate Valves shall conform to requirements of the latest version of AWWA Specification C-509 for resilient seated gate valves. The valve body shall be ASTM A-126 Class B cast iron. All interior valve parts and surfaces shall be of corrosion resistant materials or have an epoxy coating sufficient to prevent corrosion. Such coating shall be recognized by the AWWA for potable water use. Exterior valve parts and surfaces shall be epoxy coated or have the Standard AWWA coating. The valves shall open counterclockwise and have non-rising stem operation with 2-inch square operating nuts. The maximum number of turns required to fully open or close the valve shall equal three times the pipe diameter plus two. The stem shall be of corrosion resistant material and have "O" ring seals. Valve shall provide zero leakage at a working pressure of 200 psi in either direction of line flow. Valves shall have flange connections conforming to ANSI B16.1. Class 125 or mechanical joints conforming to AWWA C-111. Valves shall be manufactured by Clow, American Flow Control, or Mueller.

2.5 Ball Valves (2"): Ball valves for two-inch mains and services shall be bronze body with tee head. The turn required to travel from fully closed to fully open position shall be 90 degrees. Ball valves shall be Hayes 4300, A.Y. McDonald 6101W, Ford B11-777, Mueller B-20283or approved equal.

2.6 Valve Boxes

Valves 2” through 10” - Valve boxes shall be of cast iron suitable for H-20 loading. The manufacturer’s name and part number shall be cast into each component of the box. The

box shall be of the telescoping (slip) type consisting of a base section, center extensions as necessary, and a top section with a cover marked "WATER". Sections shall be selected and installed such that a minimum of four inches (4") of future adjustment (upward and downward) is possible without section removal or replacement and without the use of adapters. Valve boxes and extensions shall be either of the following:

- Charlotte Pipe and Foundry: UTL-274 (valve boxes) and UTL-281 (extensions).

- Tyler Pipe: 6855 Series (valve boxes and extensions). Lid shall be 5-1/4" Drop Lid having a minimum of 1-1/2" deep skirt.

- East Jordan Iron Works Global Cast: G-8472 Slip-Type Valve Box Series

Valve boxes shall be installed in accordance with the Standard Details.

2.6.1 Valves 12" and Larger – Valve box shall consist of an East Jordan Iron Works – 157801 frame and cover with a valve box bottom and extensions, as needed in accordance with Section 7.3.4.1. Installation shall be in accordance with the Standard Details.

2.7 Fittings: Tees, elbows and other fittings for PVC SDR 21, PVC C-900 pipe and ductile iron pipe shall be of ductile iron. Standard dimension fittings or compact fittings may be used in accordance with the requirements of this Section. The interior of all fittings shall be cement mortar lined with an asphaltic coating in accordance with AWWA Standard C-104 (ANSI 21.4). The exterior of all fittings shall have a one (1) mil bituminous coating in accordance with AWWA Standards C-110 (ANSI A21.10).

Compact fittings shall be ductile iron with either push-on or mechanical joints in accordance with ANSI/AWWA C153/A21.53-84. Cement lining and asphaltic coating shall be provided in accordance with ANSI/AWWA C104/A21.4.

Standard dimension fittings for PVC SDR 21, PVC C-900 pipe and ductile iron pipe shall be of ductile iron with either "push-on" joints or mechanical joints. The fittings shall comply with all requirements of AWWA Standard C-110 (ANSI A21.10). Shall be designed for a minimum working pressure of 150 psi plus 100-psi surge pressure.

2.8 Restraint Devices

2.8.1 Restraint devices for use on PVC SDR 21, ductile iron and C-900 PVC "push-on" joints shall be constructed of high strength ductile iron, ASTM A536, Grade 65-45-12 and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, full circle contact and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be of high strength, low alloy material in accordance with ANSI/AWWA C111/A21.11, latest revision thereof. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Restraining devices shall be Uni-Flange Block Buster Series 1390-C, Star Pipe Products Allgrip series 3600 and Pipe Restrainers Series 1200S, or approved equal.

2.8.2 Restraint devices for use on mechanical joint to PVC SDR 21 and C-900 PVC, shall be constructed of high strength ductile iron, conforming to the requirements of ASTM A536, Grade 65-45-12, and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, full circle contact and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be of high strength low alloy material in accordance with ANSI/AWWA C111/A21.11, latest revision thereof. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Restraining devices shall be Uni-Flange Series 1500, Star Pipe Products, Allgrip Series 3600, Romac Industries, Inc GripRing or approved equal.

2.8.3 Restraint devices for use on mechanical joint ductile iron, shall be constructed of high strength ductile iron, conforming to the requirements of ASTM A536, Grade 65-45-12, and shall incorporate machined serrations on the inside diameter to provide positive restraint, exact fit, full circle contact and support of the pipe in an even and uniform manner. Bolts and connecting hardware shall be of high strength low alloy material in accordance with ANSI/AWWA C111/A21.11, latest revision thereof. All devices shall have a safety factor of no less than 2:1 at the full rated pressure of the pipe on which it is installed. They shall be UL listed and Factory Mutual approved. Restraining devices shall be Uni-Flange Series 1300-C, Star Pipe Products, Allgrip Series 3600, Romac Industries, Inc. GripRing or approved equal.

2.8.4 Locked hydrant tees and fittings for fire hydrants shall meet the requirements of AWWA Standard C-111 (ANSI A21-11). Locked tees shall be as manufactured by American Cast Iron Pipe Company, Clow, U.S. Pipe, or approved equal.

2.8.5 Bolted Couplings for PVC SDR 21 and PVC C-900 pipe and ductile iron pipe shall be constructed of a center sleeve and end rings of ductile iron in accordance with ASTM A536. Bolts and nuts shall be of high strength, low alloy steel per ASTM A242 and AWWA C-111. Center sleeve and end rings shall have a paint finish coat. Couplings shall be Ford Style FC1, Romac 501 Series, Smith Blair 441, or JCM 201.

2.9 Fire Hydrants: Hydrants shall be in accordance with AWWA Standard C502, latest revision thereof, suitable for an operating pressure of not less than 150 pounds per square inch and shall have a traffic breakable feature (safety flange and stem coupling), dry top, sealed lubrication reservoir and a main valve which is held closed with pressure. The hydrant body shall be cast iron with "O" ring seals and bronze threads on the seat ring and drain ring, and shall have two (2) 2 1/2-inch nozzles with caps having National Standard threads and one (1) 5-inch nozzle with a factory fitted Storz connection and cap. The hydrant main valve shall be a minimum of 5-1/4 inches in diameter. All continuously wetted hydrant parts and surfaces shall be of corrosion resistant materials or be epoxy coated with epoxy recognized by AWWA for potable water use. The epoxy coating shall be of a color other than black (unless the word "epoxy" is stenciled on the base) to permit distinction between standard and epoxy coatings to be made easily. Hydrants shall be American Darling B-84-B, Mueller A-423 or Clow Medalion.

The inlet shoe for fire hydrant shall have a six-inch (6") inside diameter and shall be cast or ductile iron with mechanical joint fittings in accordance with AWWA Standard C110.

2.10 Tapping Sleeves - Tapping sleeves shall be all stainless steel body and flange with a full circumferential gasket, or ductile iron body, mechanical joint designed to accommodate a minimum operating pressure of 150 pounds per square inch. All tapping sleeves shall be pressure tested prior to tapping the main. Stainless steel tapping sleeves shall be Ford Model FAST, JCM Model 432, Mueller Model H304 or Romac Model SST. Ductile iron body, mechanical joint sleeves shall meet the requirements of Section 7.2.3 of this Manual.

2.11 Tapping Valves - Tapping valves shall conform to the requirements of the latest revision of AWWA Specification C-509 for resilient- seated gate valves. The valve body shall be ASTM A-126 Class B cast iron. All internal valve parts and surfaces shall be of corrosion resistant materials or have an epoxy coating sufficient to prevent corrosion. Such coating shall be recognized by the AWWA for potable water use. Exterior valve parts and surfaces shall be epoxy coated or have the Standard AWWA coating. The valves shall open counterclockwise and have non-rising stem operation with a two-inch square operating nut. The maximum number of turns required to fully open or close the valve shall equal three times the pipe diameter plus two.

The stem shall be of corrosion resistant material and have 0-ring seals. Valves shall provide zero leakage at a working pressure of 200 psi in either direction of line flow. Valves shall have a flange connection conforming to ANSI B16.1 Class 125 and a mechanical joint conforming to AWWA C-111. Valves shall be manufactured by Mueller, Clow or American Flow Control. Tapping valves shall be installed and pressure tested prior to tapping the water line.

2.12 Steel Encasement Pipe: Steel encasement pipe shall be spiral welded or smooth wall seamless, consisting of grade "B" steel with a minimum yield strength of 35,000 psi and manufactured in accordance with ASTM A139 and A283. The pipe thickness shall be in accordance with the requirements of the right-of-way owner, but in no case less than that shown in the following table. The ends shall be beveled and prepared for field welding at the circumferential joints.

MINIMUM WALL THICKNESS FOR STEEL ENCASEMENT PIPE

NOMINAL DIAMETER IN INCHES	MINIMUM THICKNESS IN INCHES
4- 12 3/4	0.188
14	0.219
16-18	0.250
20	0.281
22	0.312
24	0.344
26	0.375
28-30	0.406
32	0.438
34-36	0.469
38-42	0.500

The encasement pipe shall be uncoated inside and out unless required otherwise by the right-of-way owner or the AHJ.

Encasement pipe and joints shall be of leak proof construction, capable of withstanding design loading. The inside diameter of the encasement pipe shall be at least 2 inches greater than the largest outside diameter of the carrier pipe, joints or couplings, for carrier pipe less than 6 inches in diameter; and at least 4 inches greater for carrier pipe 6 inches and larger in diameter. It shall, in all cases, be great enough to allow the carrier pipe to be removed subsequently without disturbing the casing pipe or roadbed. Engineer to verify clearance between carrier pipe and encasement pipe.

2.11 Backflow Prevention: Control assemblies such as reduced pressure principal assemblies, double check valve assemblies and double detector check valve assemblies shall be limited to those approved by the Bertie Co. Regional Water System and the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California. RPZ or RPDA shall be Watts 909, Wilkins 375, or Febco 860 or approved equal.

PART 3 - CONSTRUCTION METHODS

3.1 GENERAL: Installation of the water main shall be in conformance with the latest AWWA Standards and the specific recommendations of the pipe manufacturer. Before any installation is begun, the contractor shall notify NC One Call, at least 48 hours prior to commencing construction in order that existing utilities in the area may be flagged or staked. The contractor shall be responsible for damage to any existing overhead and underground utility systems.

3.2 HANDLING AND STORING MATERIALS:

3.2.1 The Contractor shall be responsible for the shipping and storing of all water main materials. Any material which is damaged or defective shall be replaced by the Contractor at his own expense.

3.2.2 The loading and unloading of all pipe, valves, hydrants, manholes and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.

The Contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, Contractor must have the written consent from the property owner.

3.2.3 All materials once on the job site shall be stored in accordance with the manufacturer's recommendations. All PVC water pipe shall be protected from the sun's ultra violet rays if stored on the job site longer than 20 days. The type of protective cover for all plastic pipe material shall be approved by the Owner prior to use.

3.2.4 All valves and hydrants shall be stored so that they are protected from freezing. All pipe shall be kept free of dirt and other debris. Any damage relating to the coating of the various materials for water mains shall be repaired in a manner approved by the Owner.

3.2.5 The Contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The Contractor shall be responsible for the storage of

materials in a safe and workmanlike manner to prevent injuries, during and after working hours, until project completion.

3.3 PIPE INSTALLATION:

3.3.1 Trenching and Backfilling: shall conform to "Technical Specifications for Trenching and Backfilling of Utilities". Trenches shall be free of water during pipe installation. Trench excavation shall require the provisions of vertical curve chords which will not exceed the permissible deflection of the pipe. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each joint of pipe on undisturbed soil at every point along its entire length. The placement of No. 57 crushed stone shall be placed in the bottom of the trenches when unstable material is encountered. Such unstable material shall be removed to the depth required by the AHJ and replaced with No. 57 stone such that the pipe will be adequately supported throughout its entire length. Excavation below the planned pipe invert elevation shall be refilled with No. 57 crushed stone.

3.3.2 PVC and ductile iron pipe shall be installed in accordance with the procedures of AWWA C900 and C600 respectively and with the manufacturer's recommendations. Minimum cover over top of the pipe shall be 36".

3.3.3 Pipe fittings shall be installed as shown on the drawings or where necessary so as to not exceed the allowable joint deflection of AWWA C600. All fittings shall be measured and referenced on the Contractor's record drawings.

3.3.4 All PVC water main shall be installed with three inch (3") wide metallic detectable tape. The tape shall be clearly marked "Water" and shall be centered over the main, installed twelve inches (12") below finished grade. Any breaks in the tape shall be repaired in accordance with the manufacturer’s recommendations.

3.3.5 1" Service Tubing: shall be installed with sufficient slack to prevent tension on the line. A maximum of three splices (couplings) per service shall be allowed. Tubing shall have a minimum cover of twenty-four inches (24"). See the standard details. If the service tubing is damaged during construction such that its flow capacity or its life expectancy is adversely affected, the damaged portion shall be replaced. It shall be installed with a minimum of six inches (6”) of vertical separation from an existing or proposed storm drain.

3.3.6 1 1/2" and 2" services: shall be installed in accordance with the Standard Details. The installation of the Class 200 PVC service pipe shall be in strict conformance with the requirements for mains, except that the service pipe shall have a minimum cover of 24".

3.4 CUTTING OF PIPE: Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Owner's Representative, cutting shall be done with a suitable mechanical cutter.

3.5 ADJACENT FACILITIES:

3.5.1 Sewer Lines: Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a

sewer except where the bottom of the water pipe will be at least 18 inches above the top of the sewer pipe. Where water lines are less than 18 inches above the sewer lines, or cross under sewer lines, the water and sewer pipe for a distance of at least 10 feet each side of the crossing shall be made of ductile iron pressure pipe. The section of water main pipe shall be centered at the crossing

3.5.2 Water lines shall not be laid in the same trench with sewer lines, gas lines, or electric wiring.

3.6 JOINT DEFLECTION: Deflection will be in accordance with the pipe manufacturers recommendations.

3.7 JOINTING

3.7.1 PVC and Ductile Iron Pipe: Push-on type joints shall be installed in accordance with pipe manufacturer's recommendations.

3.7.2 Connections between different types of pipe and accessories shall be made with transition fittings approved by the Owner's representative and the AHJ.

3.8 SERVICE LATERALS: Service Laterals shall conform to the standard details. Meter will be provided by the Owner/Contractor unless otherwise negotiated with the Bertie Co. Regional Water System.

3.9 SETTING OF FIRE HYDRANTS, VALVES, VALVE BOXES AND METER BOXES:

3.9.1 Fire Hydrants shall be located and installed as shown on the drawings and details. Each hydrant shall be connected to the main with a 6-inch branch line having at least three feet of cover. Hydrants shall be set plumb with pumper nozzle facing the roadway and with the center of lowest outlet not less than 18 inches above the finished surrounding grade, and not more than 24 inches above the finished surrounding grade. The hydrant shall be set in a bed of washed rock which shall surround the barrel at least 12 inches in all directions.

3.9.2 Valves and Valve Boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on valve. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Valve boxes outside of pavement shall have a concrete block 2 feet square by 6 inches thick poured around it, or precast concrete collar set flush with the existing grade.

3.9.3 Hydrants and Valves after delivery shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. The hydrant or valve shall be fully opened and fully closed to insure that all parts are in working condition.

3.9.4 Meter boxes and brick for one-inch (1”) services shall be provided by the Contractor as shown on the Standard Details. Meter boxes installed for multi-family developments and ganged together shall be marked with the unit number being served. Markings shall be permanently painted on the inside of the frame section and highly visible and shall be in sequential order.

3.10 JOINT RESTRAINT: Plugs, caps tees and bends either vertically or horizontally, on all water lines and fire hydrants shall be provided with joint restraint. Joint restraint will be provided by concrete thrust blocks. In lieu of concrete thrust blocking, piping systems 12 inches and smaller in diameter may be restrained through the use of restrained joint pipe or approved joint restraint devices meeting the material specifications in section 2. The minimum length of piping to be restrained shall be as set forth in the table below.

*Restrained Length (ft.)

Pipe Size (in.)	4	6	8	10	12
Pipe Cover (ft.)					
3.0	16	24	31	38	46
4.0	15	23	30	37	43
5.0	14	22	29	36	42

* Above values are the lengths of restrained pipe required on each side of fitting. Above values are for 45 horizontal bend. For other horizontal bends multiply above by the following coefficients: 90 - 2.4; 22 1/2 - 0.48; 11 1/4 - 0.24; dead end - 2.4.

The use of joint restraint devices on vertical bends and on piping systems larger than 12 inches in diameter shall not be utilized unless approved by the Bertie Co. Regional Water System.

The use of combined thrust restraint systems employing concrete blocking and joint restraint devices, based on each system being designed to resist a percentage of the resultant thrust force, shall not be permitted. The use of combined systems based on each system being designed to resist all of the resultant thrust force are permitted

3.10.1 Concrete Thrust Blocking: Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair.

3.11 All boring and jacking installations shall be accomplished with the use of encasement pipe which as a minimum meets the specifications set forth in Section 7.9 of the Manual. The carrier pipe shall be DIP with “push-on” joints in conformance with the requirements of Section 7.2 of this Manual. The ends of the encasement pipe shall be as shown in the Standard Details.

3.12 TESTING OF WATER SYSTEM EXTENSIONS

3.12.1 Test Sequence: The following test sequence shall be used unless otherwise approved by the AHJ.

A. Perform pretest inspection.
B. Clean the main.
C. Perform the hydrostatic tests.
D. Apply the proper dosage of chlorine.
E. Allow chlorine solution to remain in the water main a minimum of 24 hours.
F. Assist the AHJ in taking bacteriological samples.

3.12.2 Pretest Inspection: Prior to commencement of hydrostatic testing and chlorination, the AHJ shall be contacted to request scheduling of inspection and testing. A AHJ's Representative shall visually inspect the installation prior to testing to insure that all fire hydrants, valves and other appurtenances are properly located, operable, and installed at the proper grade. All defects disclosed by the inspection shall be corrected prior to testing.

3.12.3 Cost of Tests: The cost of testing the mains, including all temporary connections, shall be included in the unit price bid for pipe.

3.13 HYDROSTATIC TESTS

3.13.1 General: Where any section of a water line is provided with concrete thrust blocking for fittings, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking unless otherwise approved. The method proposed for disposal of wastewater from hydrostatic tests and disinfection shall be submitted to the Owner's Representative prior to performing hydrostatic tests.

3.13.2 Tests: Unless otherwise permitted, pressure and leakage testing shall be performed between each main line valve in accordance with AWWA C600. The AHJ will, except when certain circumstances dictate otherwise, permit the lengths of test sections to be a maximum of 1500 feet in subdivisions or other areas where the new main has closely spaced valves. Testing shall be done only in the presence of a AHJ's Representative. Testing shall be performed using a suitable pump and an accurate gauge graduated in 1.0 psi increments. The section of the main to be tested shall be subjected to a test pressure of 150 psi for a period of two (2) hours. The leakage of the test section shall be accurately determined and compared to the schedule shown below. All visible leaks shall be repaired regardless of the amount of leakage.

ALLOWABLE LEAKAGE

PIPE SIZE (inches)	(Gallons per hour per 1000 feet of pipe)
2	0.16
4	0.33
6	0.50
8	0.66
10	0.83
12	0.99
14	1.29
16	1.47
18	1.66
20	1.84
24	2.21
30	2.76
36	3.31

If the leakage is greater than the allowable leakage as given by the above table, the Contractor shall replace any defective materials and perform all necessary work to insure that the installation is acceptable and a retest shall be performed subsequent to any repair work performed. Remedial repair work and retesting shall be repeated until

the leakage occurring during the test period is less than or equal to the allowable leakage.

3.14 CHLORINATION

3.14.1 All water supply mains shall be disinfected by the Contractor. No extra payment will be provided as this work is considered to be an element of other work units. The disinfection process shall be in conformance with the standards of the N.C. Division of Health Services.

3.14.2 Chlorination shall be performed only in the presence of a AHJ's Representative and shall be performed only after the line is complete and has tested satisfactorily for leakage.

3.14.3 Pipe subjected to contaminating materials shall be treated as directed by the AHJ or Engineer; should such treatment fail to cleanse the pipe, replacement shall be required. The Owner shall bear no portion of any cost sustained by Contractor in meeting this specification.

3.14.4 Chlorination of a completed line shall be carried out after completing the pressure test and in the following manner.

3.14.4.1 Chlorination taps will be made within five (5) pipe diameters of the water main control valve at the upstream end of the line and at all extremities of the line.

3.14.4.2 A solution of water containing high test hypochlorite (70%) available chlorine or chlorine gas solution shall be introduced into the line by regulated pumping at the control-valve tap. The solution shall be of such a concentration that the line shall have a uniform concentration of 50 ppm total chlorine immediately after chlorination. The chart below shows the required quantity of 70% HTH compound to be contained in solution in each 1000 foot section of line to produce the desired concentration of 50 ppm. The chlorination solution shall be introduced to the main at a constant rate while regulating the flow of water through the main being chlorinated such that the required concentration of chlorine is achieved throughout

Pipe Size	Pounds High Test Hypochlorite (70%) Per 1000 Feet of Line
6"	1.76
8"	3.12
10"	4.84
12"	7.00
14"	9.52

3.14.4.3 The HTH solution shall be circulated in the main by opening the control valve and systematically manipulating hydrants and taps at the line extremities. The HTH solution must be pumped in at a constant rate for each discharge rate in order that a uniform concentration will be produced in the mains. All valves within the section of main being chlorinated shall be operated once during the contact period.

3.14.4.4 Services shall be chlorinated at the same time and by the same method utilized

for the main.

3.14.4.5 The chlorine solution shall remain in lines for no less than 24 hours, unless otherwise directed by the AHJ.

3.14.4.6 Extreme care shall be taken to prevent contamination of existing water mains during the test period. If, in the opinion of the AHJ, an existing main in contaminated, the section of main subjected to the possible contamination shall be flushed and chlorinated in accordance with the requirements for new mains. The Owner shall bear no portion of any cost sustained by Contractor in meeting this specification.

3.14.4.7 The AHJ will advise the Contractor when a suitable period of time has elapsed for chlorine contact. The main shall be flushed thereafter in the presence and under the direction of the AHJ's Representative. The flushing of the main shall be considered complete when the chlorine concentration with the main is less than or equal to the lesser of the following values:

3.14.4.7.1 One (1) part per million (ppm) free chlorine.

3.14.4.7.2 The free chlorine concentration within the existing main to which the extension has been connected.

3.14.5 The Contractor shall be responsible for insuring that high-strength chlorine solution is contained on-site and not allowed to make its way to any watercourse, stream, creek, lake, or other body of water.

3.15 BACTERIOLOGICAL TESTING

3.15.1 After completion of chlorination and flushing, the Contractor shall assist the AHJ as necessary in obtaining sufficient bacteriological samples for complete testing. Bacteria samples must be tested by a State-approved laboratory. A list of approved laboratories is located on the Public Water Supply website at: http://www.ncwater.org/pws/Compliance/electronic_reporting.html .

3.15.1 The AHJ shall determine the location of samples and the number of samples necessary to provide a test group which is representative of the section of main being tested.

3.15.2 A failure of any sample of a test group shall constitute failure of the entire test group from which the sample was taken. Such failure shall require two (2) successive passing test groups to substantiate that the main has been satisfactorily chlorinated. The Contractor, may at his option, rechlorinate and retest the section of water main upon failure of the test group.

3.15.3 If two (2) successive bacteriological test groups fail, the section of main from which the group is taken shall be rechlorinated and retested until the main is shown to be properly chlorinated in accordance with Paragraph 3.14.

3.16 Cleaning of the Main

3.16.1 General: Mains shall be cleaned only in the presence of a AHJ representative. No valves or hydrants owned by the AHJ shall be operated without the express permission of the AHJ.

3.16.2 Cleaning of Water Mains Smaller Than 4" in Diameter: Mains shall be cleaned by flushing. Flushing velocity shall be adequate to remove all debris and other undesirable material and a minimum of 2-1/2 feet per second.

3.16.3 Cleaning of water Mains 4" and Larger in Diameter: Mains shall be cleaned only in the presence of a AHJ representative. No valves or hydrants owned by the AHJ shall be operated without the express permission of the AHJ. Cleaning shall be accomplished by passing through the pipe a polyethylene pig ("pig") of the appropriate size and density (as manufactured by Poly-Pig or approved equal). Pig(s) shall be furnished by the Contractor. The procedure shall be as follows:

a. The Contractor shall prepare the main for the installation and removal of pig(s) as required:
   i. In general, this will consist of furnishing all equipment, material, and labor to satisfactorily install and remove the pig(s).
   ii. Prior to beginning construction, Contractor shall submit a "pigging" plan to the Department Engineer for approval. No water main shall be installed prior to approval of the plan.
   iii. Where expulsion of the pig is required through a dead end main, the Contractor shall prevent the backflow of purged water into the main after expulsion of the pig. For pipe 12" or less in diameter, purged water can be prevented from re-entering into the pipe by the temporary installation of pipe and fittings as required to provide a riser with an above ground discharge. On larger pipe, additional excavation of the trench may serve the same purpose.
   iv. After expulsion of the pig, completion of flushing, and at the direction of the AHJ, the Contractor shall complete work at openings by plugging, blocking, backfilling and completion of all appurtenant work necessary to secure the system.

b. Under supervision of the Inspector, pig(s) shall be propelled via water pressure through the main(s) from point of insertion to point of expulsion. Where mains are in the form of a loop, the Contractor shall "pig" the complete system.

c. As an alternative to "pigging", dead end pipes of less than 100 feet in length which are difficult to "pig" may be cleaned by flushing. Flushing shall be accomplished in the same manner as that required for pipes less than 4 inches in diameter.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.1 The construction required herein shall include all appurtenant structures. Wye branches and service lines shall be installed as shown or as located by the owner's representative. Excavation and backfilling shall conform to Sections 02200 EARTHWORK, 02210 TRENCHING AND BACKFILLING FOR UTILITIES and DRAWINGS. Work covered by this section will not be accepted until backfilling and testing connected with work has been completed satisfactorily.

1.2 Current specifications of the American Society for Testing Materials (ASTM) and the American National Standards Institute (ANSI) shall apply in all cases where material is covered by an item in these specifications, and all material used under this contract shall conform fully to these current specifications or be removed from the job at the direction of the Owner. Failure of the Owner to condemn material on preliminary inspection shall not be grounds for acceptance if future defects are found.

1.3 Contractor shall be responsible for verifying all elevations, dimensions, locations and sizes of existing facilities in the field prior to construction or ordering materials.

1.4 The Contractor shall construct and maintain all detours, crossings and temporary approaches that may be required during construction. Maintenance shall be in accordance with the applicable features of Section 150 of the N.C. Standard Specifications for Roads and Structures.

1.5 Property Protection:

1.5.1 Trees, fences, poles and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the Contractor shall be restored by the Contractor to the owner's satisfaction.

1.5.2 Signs, mailboxes and other items which must be removed to facilitate construction shall be replaced in a condition equal or better than condition prior to removal. Replacement shall occur immediately following backfill of the trench at the location of each item removed.

1.5.3 All existing drainage shall be maintained at all times on the Project. Any drainage swales, ditches, culverts, etc. blocked by construction activities shall be reopened at the end of the day before leaving the job site.

1.6 Encroachment Contracts and Permits:

1.6.1 Prior to actual construction, the Owner shall acquire the necessary encroachments from NCDOT for installations. When working inside the rights-of-way of State system roads for highways, the Contractor shall acquire the necessary permits for his work.

1.6.2 The Contractor shall be responsible for securing all other local and state permits required for the utility construction.

1.6.3 Open cut shall be used for excavation of all sewer mains unless written permission of the Owner is given, or as specified by the encroachment agreement with the N.C. Department of Transportation.

PART 2: MATERIALS

2.1 DUCTILE IRON PIPE: All ductile iron pipe shall be manufactured in compliance with ANSI Standard A21.51. The interior of the pipe shall be cement-mortar lined in accordance with ANSI A21.4. The exterior of the pipe shall have a one (1) ml bituminous coating in accordance with ANSI 21.51. The thickness class for ductile iron pipe shall be Class 50 unless required otherwise by the Commission. Pipe shall be in nominal 18-20 foot laying lengths. The pipe joints for ductile iron pipe shall be lipush-on" manufactured in accordance with ANSI 21.11.Polyethylene encasement shall be applied to all underground ductile iron pipe installations. Materials and installation procedures shall be in accordance with ANSI/AWWA ClO5/A21.5.88.

2.2 SEWER SERVICE PIPE: Sewer service pipe shall be schedule 40 PVC - Drain, waste and vent (DWV) pipe in accordance with ASTM D2665 and ASTM D1785.

2.3 Polyvinyl Chloride (PVC) Pipe 8"-15". PVC pipe shall conform to the requirements of ASTM D3034 (SDR35). Joints and fabricated fittings shall be elastomeric (gasket) joints and shall be assembled in accordance with the pipe manufacturer's recommendations and Specification D3212. Gaskets shall meet the requirements of ASTM F477. Minimum cell class shall be 12454B. PVC pipe shall be supplied in 13.0 foot lengths.

2.4 PVC Composite Pipe. PVC composite pipe shall conform to the requirements of ASTM D2680, Standard Specification for Poly (Vinyl Chloride). Joints and fabricated fittings shall be elastomeric (gasket), joints and shall be assembled in accordance with the manufacturer's recommendations. Minimum cell class shall be 12454B. The pipe shall be similar in all respects to Armco Truss Pipe as manufactured by Contech Construction Products, Inc. PVC composite pipe shall be supplied in 12.5 foot lengths.

2.5 Service Fittings

2.6 Services from ductile iron pipe less than 18" in diameter shall be provided by means of ductile iron wyes meeting the requirements for water main fittings. Services from ductile iron pipe 18" in diameter and larger shall be provided by wyes

2.6.1 Service fittings for use on PVC composite pipe shall be PVC standard gasketed wyes manufactured or approved by the pipe manufacturer and shall conform to the requirements of ASTM D2680.

2.6.2 Service fittings for use on PVC (SDR 35) pipe shall be a standard gasketed wyes manufactured or approved by the pipe manufacturer and shall conform to the requirements of ASTM D3034.

2.7 PRECAST REINFORCED CONCRETE MANHOLES. Manholes shall be precast and have monolithic bottom sections. Manholes with a depth greater than 6 feet shall have eccentric cones, manholes with a depth of 6 feet or less shall have either an eccentric or concentric cone. Manholes shall conform to latest ASTM C-478 specifications. Top slabs when used, shall be satisfactory for H-20 highway loading. Joints shall be watertight and conform to either the latest ASTM C-443 specifications for "O" ring joints Sewer 3 or the latest ASTM C-478 specifications for section joints designed for cold applied sealing compound. Sealing compound shall be CPS-210 as manufactured by Concrete Products Supply Company, or CS 102 as manufactured by Concrete Sealants. Points of exit and entry for all pipe including services shall be provided with flexible manhole sleeves and all stainless steel take up clamps in accordance with ASTM C-923. Points of entry for mains or services which are added after fabrication of the manhole shall be provided by coring and installation flexible sleeve. All pipes shall extend through the manhole a

minimum of 2 inches. Manholes with preformed invert channels and benches may be utilized. Points of pipe exit and entry shall conform with the above paragraph. Manholes that are field tested shall be done in accordance with the Standard Details. All Manholes shall be set on crushed aggregate of at least 1 ft. depth. All pinholes shall be filled with non-shrink grout. Tie into existing Manhole must be made by machine coring.

2.7.1 MANHOLE FRAMES AND COVERS. Manhole rings and covers shall be manufactured in the USA of Class 30, gray cast iron conforming to the requirements of ASTM-A48 (latest revision thereof). The manufacturer's name and part number shall be cast into each component and the words "Sanitary Sewer" shall be cast into the cover. Pick holes shall be the non-penetrating type. Bearing surfaces of both ring and cover shall be machined to insure proper fit and to prevent rattling. Non watertight units shall be either MH-RCR-2001 by Dewey Bothers, V-1384 by Vulcan Foundry, or USF 669 ring and KL cover by US Foundry. Watertight units shall be either MH-RCR-3000W by Dewey Brothers or USF 579 ring and DC-SSG cover by US Foundry. When required to be lockable, covers shall contain a locking device comprised of a stainless steel pentagon head bolt locking device which functions in the manner of a quarter turn fastener. All castings shall meet industry standards in regard to appearance and tolerances for dimensions and weight. Castings do not have to be painted.

2.7.2 MANHOLE STEPS. Manhole steps shall be constructed of 1/2" grade 60 steel bars with a plastic coating and shall meet federal specification RR- F-621C. Maximum vertical step spacing shall be sixteen inches (16") on center.

2.8 MASONRY: Masonry construction shall conform to N.C. Department of Transportation Standard Specifications and latest revision Section 940. Mortar joints shall be thoroughly filled and the thickness shall not be more than three-eights (3/8) of an inch.

2.9 REINFORCED CONCRETE. Reinforced concrete used in construction of piers, manholes and other structures shall conform to the applicable sections of the N.C. Department of Transportation Standard Specifications, revised January 1, 1990. Concrete used in the structures shall be Class A, 3, 000-pound test in accordance with Section 900. Reinforcing steel shall conform to ASTM A-615, Grade 60 unless otherwise specified and shall conform to N.C. Department of Transportation Standard Specifications Section 425.

2.10 STONE BEDDING. Stone used for bedding of sewer mains, manholes and concrete piers shall be granite crushed stone (NCDOT Size No. 57) as per Section 905 of N.C. Department of Transportation Standard Specifications as revised January 1, 1990 and in accordance with Section 02210, TRENCHING AND BACKFILLING FOR UTILITIES.

2.11 TRANSITION COUPLINGS. The preferred transition connection between different sewer line materials shall be a standard manhole installation. Pipe material changes between manholes may be permitted provided that there is not a substantial difference in inside diameters, a smooth uniform flow line is maintained, and a watertight rubber sleeve, mechanical coupler conforming to ASTM C-425 is used to make the transition. All metal hardware shall be stainless steel. Transition sleeves shall be manufactured by Fernco or Indiana Steel.

2.12 CLEAN-OUTS: Shall be constructed of pipe and fittings which also meet the ASTM requirement for Schedule 40 PVC-DWV pipe. Cleanout caps shall be Charlotte 110 or Jones BP134CSK flush cap except cleanouts in paved locations shall be constructed of cast iron and have a brass plug. Cleanouts located in traffic or paved areas may be constructed of PVC except for the upper two feet of the riser which shall be constructed of cast iron soil pipe and have a brass cap.

2.13.1 STEEL ENCASEMENT PIPE: Steel encasement pipe shall be spiral welded or smooth wall seamless, consisting of grade "B" steel with a minimum yield strength of 35,000 psi and

manufactured in accordance with ASTM A139 and A283. The pipe thickness shall be in accordance with the requirements of the right-of-way owner, but in no case less than that shown in the following table. The ends shall be beveled and prepared for field welding at the circumferential joints.

2.13.2 METALLIC LOCATOR TAPE: Provide continuous metallic locator tape above all pipe installation as per Drawings.

MINIMUM WALL THICKNESS FOR STEEL ENCASEMENT PIPE

NOMINAL DIAMETER IN INCHES	MINIMUM THICKNESS IN INCHES:
4 - 12-3/4	0.188
14	0.219
16- 18	0.250
20	0.281
22	0.312
24	0.344
26	0.375
28- 30	0.406
32	0.438
34- 36	0.469
38- 42	0.500

The encasement pipe shall be uncoated inside and out.

Encasement pipe and joints shall be of leakproof construction, capable of withstanding design loading. The inside diameter of the encasement pipe shall be at least 2 inches greater than the largest outside diameter of the carrier pipe, joints or couplings, for carrier pipe less than 6 inches in diameter; and at least 4 inches greater for carrier pipe 6 inches and larger in diameter. It shall, in all cases, be great enough to allow the carrier pipe to be removed subsequently without disturbing the casing pipe or roadbed.

2.14 FORCE MAIN PIPE AND OF APPURTENANCES: Steel

2.14.1 Sewer force main pipe shall be a minimum of Class 200 PVC pipe or Class 50 ductile iron pipe.

2.14.2 PVC shall be Class 200 C-900 conforming to ASTM D1784 and ASTM D2241 (latest revisions). Fittings for PVC force main shall be ductile iron meetings the requirements of ANSI A21.10 and shall be designed for a minimum working pressure of 150 psi plus 100 psi surge pressure. The interior of all fittings shall be cement-mortar lined in accordance with ANSI 21.4 and the exterior of the fittings shall be bituminous coated in accordance with ANSI 21.51.

2.14.3 Ductile iron force main and fittings shall meet the requirements for ductile iron water main set forth in Section 02713.

2.14.4 Directional Bored Force Mains:

2.14.5 High Density Polyethylene (HDPE) Force Main: shall conform to AWWA C9906 and shall have a wall thickness and pressure rating equivalent to C-900 Class 200 PVC pipe. Pipe shall be DISCOPIPE or approved equal.

PART 3: CONSTRUCTION METHODS

3.1 GENERAL: Pipe shall be installed in accordance with specifications and recommendations by the Manufacturer. Before any installation is begun, the Contractor shall notify NC One Call at least 48 hours prior to commencing construction in order that existing utilities in the area may be flagged or staked. The Contractor shall be responsible for damage to any existing overhead and underground utility system.

3.2 HANDLING.AND STORING MATERIALS:

3.2.1 The Contractor shall be responsible for the shipping and storing of all sanitary sewer materials. Any material which is damaged or defective shall be replaced by the Contractor at his own expense.

3.2.2 The loading and unloading of all pipe, manholes and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.

The Contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, Contractor must have the written consent from the property owner.

3.2.3 All materials once on the job site shall be stored in accordance with the manufacturer's recommendations.

3. 2. 4 The Contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The Contractor shall be responsible for the storage of materials in a safe and workmanlike manner to prevent injuries, during and after working hours, until project completion.

3.3 PIPE INSTALLATION:

3.3.1 PIPE INSTALLATION: Flexible thermoplastic sewer pipe shall be installed in accordance with ASTM D2321- 83a, except as modified by these specifications and the specific recommendations of the pipe manufacturer.

3.3.2 CUTTING OF PIPE: Pipe cutting, where permitted, shall be done in accordance with the written recommendations of the pipe manufacturer. Only factory cut ends shall be used for solvent weld joints.

3.3.3 TRENCHING: Trenches shall be excavated in straight lines and uniformly sloped between manholes or junction structures. The trench shall be excavated a minimum of six inches (6”) below the pipe bottom in order to receive the required 6” foundation bedding of No. 57 crushed stone. Bed and haunch pipe in accordance with requirements set forth in Section 02210, TRENCHING AND BACKFILLING FOR UTILITIES, and Drawings.

3.3.4 FOUNDATION STONE: The Contract Documents shall provide for the construction of a Foundation bedding of No. 57 crushed stone in the bottom of trenches. Reference Drawings and Section 02210 TRENCHING AND BACKFILLING FOR UTILITIES.

When unstable trench bottom material is encountered, such unstable material shall be removed to the depth required by the Owner’s testing firm representative and replaced with No.57 stone such that the pipe will be adequately supported throughout the entire length. Excavation below the planned pipe invert elevation as shown on the Approved Plans shall be refilled with No. 57 crushed stone.

3.3.5 DIRECTIONAL BORING: Direction boring / drilling installation shall be accomplished where required on the Plans or in the Special Provisions to minimize disturbance of existing surface improvements. The Contractor shall submit boring / drilling pit locations to the Owner before beginning construction. The drilling equipment shall be capable of installing continuous runs of pipe without intermediate pits, a minimum distance of 200 feet. The guidance system shall be capable of installing pipe within 1-1/2 inch of the plan vertical dimensions and 2-inches of the plan horizontal dimensions. The Contractor shall be required to remove and reinstall pipes, which vary in depth and alignment from these tolerances. Pull back forces shall not exceed the allowable pulling forces for the pipe being installed. Drilling fluid shall be a mixture of water and bentonite clay. Disposal of excess fluid and spoils shall be the responsibility of the Contractor.

3.3.6 BORING AND JACKING: All boring and jacking installation shall be accomplished with the use of encasement pipe which at a minimum meets these specifications. Install steel pipe encasements by boring and or jacking or by pushing the casing pipe through a bored hole. Ensure that the encasement is installed true to line and grade.

The boring machine shall be designed to bore and push or jack the casing on a controlled grade and line in a continuous operation. The boring auger shall not be of a greater diameter than the outside diameter of the casing.

Bore progressively ahead of the advancing pipe while spoil is removed by the auger back through the pipe.

Butt-weld each new section of the encasement pipe to the section previously jacked into place as the boring operation continues.

Protect ends of encasement in an acceptable manner to prevent the entrance of foreign materials or debris.

If voids are encountered or occur outside the encasement pipe, grout holes shall be installed in the top section of the encasement pipe and the voids filled with 1:3 portland cement grout at sufficient pressure to prevent settlement in the roadway.

In the event an obstruction is encountered during the boring and jacking operation, notify the ENGINEER of the obstruction and obtain written authorization from the ENGINEER prior to proceeding with the premature termination of that boring.

When premature termination of a boring is authorized, the auger is to be withdrawn and the excess pipe is to be cut off, capped, and filled with 1:3 portland cement grout at sufficient pressure to fill all voids before moving to another boring site.

Ensure that encasement pipe is installed at the alignment and grade shown on the drawings. Report, in writing, any deviation in the alignment and grade from that shown on the drawings.

Joint carrier pipe in accordance with manufacturer’s specifications.

Carefully secure pipe supports to each joint of carrier pipe. Supports shall be placed at each end of the casing, at each pipe bell for DIP, and tat intervals not greater than 4 feet for PVC or ABS pipe. For gravity sewer the supports shall be constructed to maintain the proper slope of the line even when the casing alignment deviates from the slope shown on the drawings.

Carefully push carrier pipe through encasement ensuring that the assembly is not damaged.

Ensure that the carrier pipe is installed at the alignment and grade shown on the drawings.

3.4 ADJACENT FACILITIES

3.4.1 WATER LINES: Unless otherwise shown on the drawings, the sewer shall not be located closer than 10 feet to a water line, except where the bottom of the water line is greater than 18 inches above the top of the sewer pipe. Where the vertical separation is less than 18 inches, or where the sewer line crosses above the water line, both the water line and sewer line shall be constructed of ductile iron pipe, for a distance of 10' in each direction from the crossing. The section of water line pipe shall be centered at the crossing.

3.5: BACKFILL: Backfill in accordance with Section 02210 TRENCHING AND BACKFILLING FOR UTILITIES. Provide continuous metallic locator tape above all pipe installations as per Drawings.

3.6 SERVICE CONNECTION: Service Connections shall be installed at locations shown on the drawings, or as designated by the owner's representative and be at right angles to the gravity sewer.

3.6.1 Service Connections shall consist of a wye branch, fittings, clean-out, and 411 pipe, unless otherwise shown or directed.

3.6.2 Service Laterals shall include a clean-out located at the right-of-way limit five feet (5') down stream of the water meter, unless otherwise noted on the plans.

3.7 MANHOLES:

3.7.1 GENERAL: Manholes shall be constructed of precast concrete rings with cast iron frames and covers, and in accordance with the drawings. The manhole inverts shall be constructed with a width and height equal to that of the effluent pipe and shall be so brushed and troweled that a minimum energy loss occurs in the manhole due to invert roughness. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. Manholes shall be provided with steps of acceptable design not less than 10 inches in width, built into and securely anchored in the walls. Steps shall be spaced uniformly approximately 16 inches.

3.7.2 JOINTING AND PLASTERING: Installation of water tight joints between precast rings shall conform to either ASTM C443 standard for "o" ring joints, or the ASTM C478 standard for section joints designed for cold applied sealing compound in accordance with recommendations of the manufacturer. The sealing compound shall be CPS-210 as manufactured by Concrete Products Supply Company or CS102 as manufactured by Concrete Sealants.

3.8 TESTING:

3.8.1 GENERAL: The Contractor shall be responsible for providing all pumps, gages, instruments, test equipment and personnel required for testing operations. The Contractor shall also be responsible for cleaning and pre-testing the sewer system extension prior to notifying the Engineer and arranging for final inspections and tests.

All defects in the pipeline and appurtenances shall be remedied by the Contractor at no additional cost to the Owner.

The Contractor shall be required by the Contract Documents to clean and pretest the sewer system extension prior to notifying the Engineer and arranging for final inspections and test.

The Engineer shall be contacted prior to testing to schedule the test time such that the Engineer representative may be present. The Owners representative shall be present during all testing.

3.8.2 TESTING SEQUENCE: The following test sequence shall be used unless otherwise approved by the Owner:

1. Perform a visual inspection
2. Correct defects revealed by visual inspection
3. Perform leakage testing
4. Make any necessary repairs
5. Make the necessary retests

3.8.3 VISUAL INSPECTION: The sewer shall be inspected from every manhole by use of mirrors, television cameras or other devices. The lines shall appear circular in cross section with no noticeable deflection. Lines which do not meet specified tolerances or which have structural defects shall be replaced to meet the requirements of the Engineer prior to leakage testing.

3.8.4 LEAKAGE TESTING: All segments of completed line, including services, shall be tested for leakage by low pressure air test. Testing shall be performed in the presence of the Engineer or his representative.

A. The Contractor shall remedy all visible leaks in pipes, manholes, and appurtenances.

B. Low Pressure Air Test: Tests for leakage for individual line segments shall be made by low pressure air test. Test shall conform to the requirements as follows:

1. All air testing and retesting results shall be recorded on copies of the Air Data Sheets enclosed herein and submitted to the Engineer for approval.
2. Air leakage testing of installed system shall be performed with continuous monitoring gauge no less than 4 inches in diameter with minimum divisions of 0.10 psi and an accuracy of plus or minus 0.04psi. All air used shall pass through a single, above ground control panel visible to the Project Representative during the testing.
3. Determine the ground water elevation and determine the average ground water head above the section of line being tested. Adjust the following test pressures by adding 0.43 psig per foot of ground water head above the pipe invert.
4. Pressurize the system to 4.0 psig (greater than average ground water pressure). Throttle the air supply to maintain that constant pressure for at least 2 minutes. The air pressure supply shall then be disconnected from the system or shut off. Do not exceed 9.0 psig in the system.

5. As a safety precaution, no one shall be allowed in a manhole after the air pressure is increased in the sewer line. If the Resident Inspector suspects that the test plug may be leaking, the pressure first shall be relieved before any adjustments are made to eliminate air leakage at the plug. The Contractor may precoat the plug with a soap solution to check the plugs for leakage.

6. Observe the continuous monitoring gauge while decreasing the pressure to no less than 3.5 psig (greater than ground water pressure). At a reading of 3.5 psig (adjusted) or any convenient observed pressure reading between 3.5 and 4.0 psig (adjusted), timing shall commence with a stop watch or other timing device that is at least 99.8 percent accurate.

   Measure the time interval for pressure to drop 1.0 psig.

7. If the time, shown in the following Table I for the designated line size and length, elapses before the air pressure drops 1.0 psig; the section undergoing test may be discontinued once the prescribed time has elapsed even though the 1.0 psig drop has not occurred. Record all readings.

8. If the pressure drops 1.0 psig before the appropriate time shown in the Table I has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test. Record all readings.

9. If lateral sewers are included in the test section, their lengths may be ignored for computing and required text times. The test will be slightly more severe. In the event a test section having a total surface area less than 625 square feet, fails to pass the air test when lateral sewers have been ignored, the test time shall be recomputed to include all lateral sewers using the following formula:

   Where T = Shortest allowable time, in seconds for the air pressure to drop 1.0 psig: K = 0.000419 (D1L1 + D2L2 + ... + DnLn), but not less than 2.0"; Q = 0.0015 cu.ft./min./sq.ft. of internal surface) Dl, D2,..., Dn = Nominal diameters of the different size being tested. Ll, L2,..., Ln = Respective lengths of the different size pipes being tested.

   If the recomputed test time is short enough to allow the section to pass, the section undergoing test shall have passed.

10. If the sections fail the air test, the Contractor shall determine at his own expense, the source, or sources of leakage, and shall repair or replace all defective materials and workmanship.

11. No sealant shall be used in the newly installed sewers to correct the leaks without prior approval of the Engineer.

12. The extent of the type of repair which may be allowed shall be subject to the approval of the Engineer.

13. The repaired pipe installation shall be retested and required to meet the requirements of this test.

C. Infiltration or Exfiltration Test: for leakage shall not be accepted without prior written approval of the Engineer. For these methods to be considered, the Contractor shall state in writing reasons for this consideration.

Should water exfiltration or infiltration testing be allowed, the maximum leakage rate shall be 50 gallons per inch of pipe diameter per mile of pipe per 234 hours; test ground water depths must be 4 feet minimum; all liquid measurements must be made with a Pomon-O-Weir or equal device. V-notch where measurements shall not be allowed.

3.8.5 DEFLECTION TESTING FOR PVC (SDR 35): If PVC (SDR 35) sewer pipe is utilized, deflection testing shall be required with a rigid device (mandrel) sized to pass 5% or less deflection (or deformation) of the pipe.

Deflection test 100% of the total footage of solid wall PVC pipe. Deflection test is not required on PVC Truss Pipe or Ductile Iron Pipe.

The mandrel device shall be cylindrical in shape and constructed with nine or ten evenly spaced arms or prongs. Mandrels with less than nine arms will not be approved for use. The dimensions of the mandrel shall be as listed in the table below:

Note: The diameter of the mandrel shall carry a tolerance of plus or minus 0.01 inch.

Nominal Diameter	**Contact Length**	**Mandrel Diameter ASTM 3034 SDR 35**	**Mandrel Diameter ASTM D2680**
8”	8”	7.28”	7.36”
10”	10”	9.08”	9.26"
12”	12”	10.79”	11.16"
15”	12”	13.20"	14.01"

Allowance for piping wall thickness tolerances or ovality (from heat, shipping, poor production, etc.) shall be deducted from the "D” dimension but shall not be counted in as a part of the 5% or lesser deflection allowance.

The mandrel shall be hand pulled by the Contractor through all sewer lines in the presence of the Engineer or his Representative. Any sections of the sewer not passing the mandrel shall be uncovered and the Contractor shall reround or replace the sewer to the satisfaction of the Engineer. These repaired sections shall be retested.

The inspection shall be conducted no earlier than 30 days after reaching final trench backfill grade, provided in the opinion of the Engineer that sufficient water densification or rainfall has occurred to thoroughly settle the soil throughout the entire trench depth. If this cannot be achieved in the time after installation prior to the project completion date, then the mandrel size shall be increased to measure 1/3 less of a deflection allowance.

Contact length shall be measured between points of contact of the mandrel arm. This length shall not be less than that shown in the table above.

The mandrel may not be used until approved by the Engineer. Proving rings provided by contractor shall be used to assist in this. Drawings of the mandrel with complete dimensions shall be furnished by the Contractor to the Engineer for each diameter and specification of pipe.

The mandrel device shall be as manufactured by H and H Fabricating of Fairfield, Ohio or Wortco, Inc. of Franklin Ohio; and shall be approved by the Engineer."

3.8.6 MANHOLE TESTING: Each manhole shall be tested for leakage immediately after assembly and prior to backfilling. The test method shall be the vacuum test.

A. All lift holes shall be plugged with non-shrink grout.

B. All pipes entering the manhole shall be plugged.

C. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendation.

D. A vacuum of ten inches (10") of mercury shall be drawn and the vacuum shut off. With the valves closed, the time shall be measured for the vacuum to drop to nine inches (9") . The manhole shall pass if the time is greater than sixty (60) seconds for forty-eight inches (48") diameter, seventy-five (75) seconds for sixty inch (60"), and ninety (90) seconds for seventy-two inch (72") diameter manholes.

E. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

3.8.7 FORCE MAIN TESTING: Shall be in accordance with paragraph 3.12 of Section 02713 Water Mains. It is the Contractor's responsibility to install taps for pressure testing in adequate locations to identify any leaks and pass hydrostatic test.

END OF SECTION

RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this section.

PART 1 - GENERAL

RELATED WORK SPECIFIED ELSEWHERE:

Section 02200 Earthwork

DESCRIPTION OF WORK:

The extent of storm sewer collection system work and materials required are shown on drawings.

Storm Sewer collection system may include, in complete assemblies, but is not limited to, all of the following:

Dual Wall HDPE Pipe
Storm sewer pipe, RCP and PVC.
PVC Plastic Structures for Underground Drainage Piping System.
Trench Drains
Rip Rap.
Catch basins / Manholes

QUALITY ASSURANCE:

CODE AND STANDARDS: Comply with applicable requirements of NCDOT.

SUBMITTALS:

Shop Drawings, Storm Sewer System: Submit shop drawings for the system, including details of underground structures, metal accessories, fittings, and connections, and any variations from those details shown on the drawings.

MATERIAL CERTIFICATES: Provide material certificates signed by the material manufacturer and Contractor for all pipe manhole, catch basins, frames and grates indicating each complies with specifications.

PART 2 - PRODUCTS

CONDUIT MATERIALS:

Dual Wall HDPE Pipe: Corrugated, smooth interior, high-density polyethylene (HDPE) pipe, with ASTM D3212 water-tight reinforced integral bell & gasketed spigot jointing. Pipe and fittings shall comply with AASHTO M252 Type S, AASHTO M294 Type S, ASTM F2306.

Polyvinyl Chloride (PVC) Pipe: PVC pipe shall conform to the requirements of ASTM D3034 (SDR35). Joints and fabricated fittings shall be glued hub joints and shall be assembled in accordance with the pipe manufacturer's recommendations and Specification D3212. Minimum cell class shall be 12454B. PVC pipe shall be supplied in 13.0 foot lengths.

Reinforced Concreted Pipe (RCP):

RCP shall be of tongue and groove construction in accordance with ASTM C-76, Class III. All pipe shall be stamped by supplier - "R. C.". Joint material shall be ConSeal CS-102 Butyl Rubber Sealant gasket, or ConSeal CS-202 Butyl Rubber Sealant gasket conforming to ASTM C 990, and Federal Specification SS-S-210.

TRENCH DRAINS:

Provide vehicle traffic grade Trench Drains where indicated. Provide polymer concrete products equal to ACO Drain K100S complete with heavy duty longitudinal stainless steel gratings locked down with quick locking bolt and bar type lockings as manufactured by ACO Polymer Products.

Provide general purpose grade Trench Drains designed for use in concrete slab applications where indicated. Provide fiberglass channel products equal to ACO Drain FG100 complete with Load Class B, ADA rated, perforated longitudinal stainless steel gratings, locked down with quick locking bolt and bar type lockings as manufactured by ACO Polymer Products.

PVC DRAIN BASINS and INLINE DRAINS:

Provide vehicle traffic grade Drain Basins and Inline Drains where indicated shall be PVC with heavy duty ductile iron grates. Products equal to Nyloplast by Advanced Drainage Systems.

CONCRETE MANHOLES:

General: Manholes and Catchbasins shall be precast concrete where indicated. Manholes not of a conventional size may be of concrete block or brick.

Precast Concrete Manholes: Shall comply with ASTM C-478, sized as indicated, with an eccentric cone, precast top, precast bottom and O-Ring joint conforming to ASTM C 493, or RAM-NEK Preformed Plastic Gasket.
Interior diameter of precast manholes shall be based upon pipe size as follows unless otherwise indicated:

Pipe Size	Interior Diameter
Less than 24"	4'
24" - 30"	5'
Larger than 30"	6'

FLOATING AERATOR FOUNTAIN

Surface Floating Aerator Fountain: Where indicated provide UL certified/listed 2HP Model 200 Gemini Aerating Fountain, as manufactured by Otterbine Barebo, Inc., floating, surface spray aerator with a trumpet shaped spray pattern. Fountain shall introduce oxygen into the water column for water quality management, controlling algae, aquatic weeds, and foul odors. Pumping rate and spray pattern dimensions shall be as recommended by manufacturer.

Provide complete assembly, including pumping capacities as required, full flotation float, impeller, motor, motor housing, electrical connectors, underwater power cable, cable quick disconnects, and power control center. All fasteners shall be stainless steel. Provide manufacturer’s five-year warranty.

Provide a controls panel in a NEMA rated waterproof cabinet, complete assembly.

Installation shall be completed in accordance with manufacturer's specifications and manufacturer's written installation instructions. All electrical installation shall comply with local Building Codes and the current NEC.

MASONRY MATERIALS:

Concrete Masonry Units (Manhole Block): ASTM C 139.

Manhole Drop Inlet and Catch Basin Brick: ASTM C 32, Grade MS.

Concrete Brick: ASTM C 55, Grade NI.

Masonry Mortar: ASTM C 270, Type M, approximately 1:1 / 4:2 Portland Cement, lime, sand.

Concrete Block: ASTM C 90, Grade NI.

For minor amounts of mortar, packaged materials complying with ASTM C 387, Type M, will be acceptable.

Plasticizing Agent: Omicron or equal. Use in accordance with manufacturer's instructions.

ACCESSORIES:

General: All metal accessories for manholes, catch basins and drop inlets shall be gray cast iron, ASTM A 48, Class 30B. Frames, grates and covers shall be factory coated with an asphalt base paint. Install metal accessories as shown on the drawings.

Rip Rap: Rip rap shall be accomplished in accordance with Section 868 of the N. C. State Highway Specifications for Roads and Structures. Rip rap shall be located and be of the class shown on plans.

Filter Cloth: Filter cloth shall be composed of strong rot proof synthetic fibers formed into a fabric shall be free of any treatment or coating which might significantly alter its physical properties after installation. The filter cloth shall have a puncture strength to withstand a minimum force of 100 lbs., in accordance with ASTM D 751. Filter cloth as manufactured by Monsanto, Carthage Mills, Inc., or approved equal will be acceptable.

Downspout Transition Boots: Downspout transition boot fitting for each downspout shall be a PVC Sewer Solvent Weld Downspout Adaptor, sized for 4'x4" downspout transition to the underground leader pipe size indicated. Provide an SDR 35 fitting, meeting ASTM D-2729, and ASTM D-3034 requirements, utilizing solvent welded connection to SDR 35 PVC pipe leaders. As manufactured or distributed by Ferguson, Genova, NDS or equivalent.

Flexible Downspout Transition Boots: Downspout pipe or roof drain leader pipe transition boot fittings for each existing downspout shall be a flexible elastomeric PVC Sewer Downspout Adaptor, sized for existing downspout pipe transition to the new underground leader pipe size indicated. Provide a flexible PVC fitting, meeting ASTM D-2729, and ASTM D-3034 requirements, utilizing 300 series stainless steel pipe clamp connections to new underground pipe leaders. As manufactured or distributed by Ferguson, Genova, NDS or equivalent.

Field examine existing downspout or roof drain leader pipes to determine exact pipe and fitting sizes, and provide the couplings, reducers, connectors, or elbows to suit the condition required for complete transitions.

PART 3 - EXECUTION

INSPECTION:

Contractor must examine the areas and conditions under which storm sewer system work is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

INSTALLATION OF CONDUIT (PIPE):

General:

Perform excavation, trenching, bedding, haunching and backfilling as specified in appropriate Division 2 Sections. Conduct backfill operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed.

Pipe bedding, haunching and backfilling layers shall be in accordance with requirements set forth on Drawings, and in Section 02210, TRENCHING AND BACKFILLING FOR UTILITIES.

Inspect conduit before installation to detect any apparent defects. Mark defective materials with white paint and promptly remove from the site.

Particular care shall be taken to prevent damage to pipe and fitting linings and coatings. Pipe shall be protected during handling against impact shocks and free fall.

Lay conduit beginning at the low point of a system, true to the grades and alignment indicated with unbroken continuity of invert. The line and invert grade of each pipe shall be checked from top line carried on batter boards not over 24' apart or by a laser and target.

Cross above or below other pipe a minimum of 6" unless otherwise directed by the Engineer.

Place bell ends of conduit or the groove end of concrete facing upstream.

Bell holes shall be excavated for each joint to assure bedding supports the barrel of the pipe and to facilitate making a perfect joint. Preparatory to making pipe joints, all surfaces of the portion of the pipe to be jointed or of the factory-made jointing materials shall be clean and dry.

Install gaskets in accordance with manufacturer's recommendations for the use of lubricants, cements, and other special installation requirements.

The Contract Documents shall provide for the construction of a 6” Foundation Bedding of No. 57 crushed stone pipe bedding in the bottom of trenches. Reference Drawings and Section 02210 TRENCHING AND BACKFILLING FOR UTILITIES.

When unstable trench bottom material is encountered, such unstable material shall be removed to the depth required by the Owner’s testing firm representative and replaced with No.57 stone such that the pipe will be adequately supported throughout the entire length. Excavation below the planned pipe invert elevation as shown on the Approved Plans shall be refilled with No. 57 crushed stone.

Reinforced Concrete Pipe (RCP): Install in accordance with applicable provisions of the American Concrete Pipe Association "Concrete Pipe Field Manual", unless otherwise indicated.

PVC PIPE INSTALLATION:

Flexible thermoplastic sewer pipe shall be installed in accordance with ASTM D2321- 83a, except as modified by these specifications and the specific recommendations of the pipe manufacturer.

Pipe cutting, where permitted, shall be done in accordance with the written recommendations of the pipe manufacturer. Only factory cut ends shall be used for solvent weld joints.

Trenches shall be excavated in straight lines and uniformly sloped between manholes or junction structures. The trench shall be excavated a minimum of six inches (6") below the pipe bottom in order to receive the required bedding of Class I No. 57 crushed stone. Pipe bedding, haunching and backfilling shall be in accordance with requirements set forth in Section 02210, TRENCHING AND BACKFILLING FOR UTILITIES.

Cleaning Conduit: Clear the interior of conduit of dirt and other superfluous material as the work progresses.

Place plugs in the ends of uncompleted conduit at the end of the day or whenever work stops.

Flush lines between manholes as required to remove collected debris.

Interior Inspection: Inspect conduit to determine whether line displacement or other damage has occurred.

A light held in a manhole shall show a full circle of light when viewed from the adjoining end of the line.

Make inspections after lines between manholes, or manhole locations, have been installed and approximately two feet of backfill is in place and at completion of the project.

If the inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, take whatever steps are necessary to correct such defects to the satisfaction of the Engineer.

Connection to Existing Structures: Pipe connections to existing structures shall be made in such manner that the finished work will conform as nearly as practicable to the essential applicable requirements specified for new structures, including all necessary concrete work, cutting, and shaping.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

CHAIN LINK FENCING AND GATES:

Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

Product Data: Submit manufacturer's technical product data, and installation instructions for metal fencing, fabric, gates and accessories.

Submit manufacturer's technical product data, installation instructions, and samples of wind screening product.

Dimensions indicated for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

Galvanized Steel Fencing and Fabric:

Allied Tube and Conduit Corp.

American Fence Corp.

Anchor Fence, Inc.

Galvanized Steel Fencing:

Fabric: No. 9 ga. (0.148") finished size steel wires, 2" mesh, with top selvages knuckled for fabric 60" high and under, and both top and bottom selvages twisted and barbed for fabric over 60" high. Tennis court mesh to be 9 ga. X 1 ¾" mesh.

Furnish one piece fabric widths for fencing up to 12' high.

Fabric finish, galvanized, ASTM A 392, Class I, with not less than 1.2 oz. zinc per sq. ft. of surface.

Framework: Galvanized steel, ASTM A 120 or ASTM A 123, with not less than 1.8 oz. zinc per sq. ft. of surface.

Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.

Framing and Accessories:

End, Corner, and Pull Posts: Minimum sizes and weights as follows:

- Up to 6' fabric height, 2.375" od steel pipe, 3.65 lbs. per lin. ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.
- Over 6' fabric height, 2.875" od steel pipe, 5.79 lbs. per lin. ft., or 3.5" roll-formed sections, 4.85 lbs. per lin. ft.

Line Posts: Space 10' o.c. maximum, unless otherwise indicated, of following minimum sizes and weights.

- Up to 6' fabric height, 1.90" od steel pipe, 2.70 lbs. per lin. ft. or 1.875" x 1.625" C sections, 2.28 lbs. per lin. ft.

- Over 6' to 8' fabric height, 2.375" od steel pipe, 3.65 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 2.64" lbs. per lin. ft.

- Over 8' fabric height, 2.875" od steel pipe, 5.79 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 3.26 lbs. per lin. ft.

Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double installation, for nominal gate widths as follows:

	Leaf Width	Gate Post	lbs. / lin. ft.
•	Up to 6’	3.5" x 3.5" roll-formed section or 2.875” od pipe	4.85 5.79
•	Over 6' to 13'	4.000" od pipe	9.11
•	Over 13' to 18'	6.625" od pipe	18.97
•	Over 18'	8.625" od pipe	28.55

Top Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.

1.66" od pipe, 2.27 lbs. per ft. or 1.625" x 1.25" roll-formed sections, 1.35 lbs. per ft.

Tension Wire: 7-gage, coated coil spring wire, metal and finish to match fabric.

Locate at bottom of fabric.

Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.

Post Tops: Provide weathertight closure cap with loop to receive tension wire or top rail; one cap for each post.

Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.

Stretcher Bar Bands: Space not over 15" o.c., to secure stretcher bars to end, corner, pull, and gate posts.

Gates: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal of breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8' apart unless otherwise indicated.

Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate frame at not more than 15" o.c.

Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

Where barbed wire is indicated above gates, extend end members of gate frames 1'-0" above top member. Provide necessary clips to receive and secure 3 strands of wire.

Swing Gates: Fabricate perimeter frames of minimum 1.90" od pipe.
Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

- Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180° gate opening. Provide 1-1/2 pair of hinges for each leak over 6' nominal height.

- Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar.

Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.

Gate Egress and Security Hardware: Where indicated on Drawings, provide weather resistant Surface Mount Exit Bar Kit, equal to D-6040-S by Hoover. Assembly shall include: exit bar device, 24” adjustable mounting plate, adjustable receiver bracket, lock box with solid brass keyed cylinder and two keys for 5-pin Schlage keyway, stainless steel anchors and fasteners. Silver powder coated finish.

Sliding Gates: Provide manufacturer's standard heavy-duty inverted channel track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, hardware, and accessories as required.

Wire Ties: For tying fabric to line posts, use wire ties spaced 12" o.c. For tying fabric to rails and braces, use wire ties spaced 24" o.c. For tying fabric to tension wires, use hog rings spaced 24" o.c.

Manufacturer's standard procedure will be accepted if of equal strength and durability.

Concrete: Provide concrete consisting of portland cement, ASTM C 150, aggregates ASTM C 33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2500 psi using at least 4 sacks of cement per cu. yd., 1" minimum size aggregate, maximum 3" slump, and 2% to 4% entrained air.

Excavation: If not shown on drawings, excavate holes to minimum depth and diameter as recommended by fence manufacturer.

Installation: Install in accordance with ASTM F 567 and written installation instructions of fencing manufacturer to provide secure, aligned installation.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast—in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.2 RELATED SECTIONS

A. Section 03200 — Concrete Reinforcement.

B. Section 03300 — Cast-in-Place Concrete.

1.3 REFERENCES

A. ACI 301 — Structural Concrete for Buildings.

B. ACI 318 — Building Code Requirements for Reinforced Concrete.

C. PS 1 — Construction and Industrial Plywood.

1.4 DESIGN REQUIREMENTS

A. Design and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and 318.

B. Maintain one copy of each document on site.

1.6 REGULATORY REQUIREMENTS

A. Conform to ACI 301 and ACI 318 code for design, fabrication, erection and removal of formwork.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site to prevent damage.

B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.8 COORDINATION

A. Coordinate this Section with other Sections of work which require attachment of components to formwork.

B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

PART 2: PRODUCTS

2.1 WOOD FORM MATERIALS

A. Plywood: Douglas Fir; solid one side, tight faced undamaged sheets with clean, true edges.

2.2 MANUFACTURERS — PREFABRICATED FORMS

A. Symons or equal.

2.3 PREFABRICATED FORMS

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

B. Steel Tubular Column Type: Round, steel material, minimum 16 gage, surface treated with release agent, of sizes required.

2.4 FORMWORK ACCESSORIES

A. Form Ties: Snap—off type, galvanized metal, cone type, with waterproofing washer.

B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture.

C. Dovetail Anchor Slot: Galvanized steel, 22 gage, foam filled.

D. Flashing Reglets: Galvanized steel, 22 gage, longest possible lengths, with alignment splines for joints, foam filled,

E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

F. Waterstops: Hydrophyllic type as manufactured by American Colloid or approved equal.

PART 3: EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil, mud, and debris prior to placing concrete.

3.3 ERECTION — FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.

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

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members which are not indicated on Drawings.

F. Provide chamfer strips on exposed external corners.

3.4 APPLICATION — FORM RELEASE AGENT

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

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

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

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

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

D. Position recessed reglets for brick veneer masonry anchors to spacing and intervals noted on drawings or specified in Section 04200.

E. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Install waterstops in accordance with manufacturer’s instruction continuous without displacing reinforcement.

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

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

3.6 FORM CLEANING

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

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

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

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

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.8 FIELD QUALITY CONTROL

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

3.9 FORM REMOVAL

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

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

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

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall include furnishing all labor and materials required to provide all cast-in-place concrete scheduled on Drawings and as specified in this Section.

Related Work Specified Elsewhere:

Concrete Formwork (Section 03100)
Concrete Reinforcement (Section 03300)

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Industry Standards Index in Division 1.

LEED NC, U. S. Green Building Council

DELIVERY AND PROTECTION OF MATERIALS:

Store cement in weather tight structure with floor at least 12 inches off ground, and accessible for inspection in original packages.

Store fine and coarse aggregate separately. Segregate sizes and avoid getting dirt and foreign materials in concrete.

Deliver ready-mixed concrete in compliance with requirements set forth in ASTM C 94.

Provide documentation of LEED credits requirements for use of local regional materials.

SEVERE-WEATHER PROVISIONS:

Cold-Weather Concreting: (In accordance with ACI 306 and as follows):

Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. Do not use frozen materials, or materials containing ice.

All concrete materials and all reinforcement, forms, fillers, and around which concrete is in contact shall be free from frost.

Whenever temperature of surrounding air is below 40 degrees F., all concrete shall have temperature between 70 degrees and 80 degrees F. Provide adequate means for maintaining temperature not less than 70 degrees F. for three days, or 50 degrees F. for five days, or for as much more time as is necessary to insure curing of concrete.

Use no salt or other chemicals to prevent freezing.

Housing, covering, or other protection used in connection with curing shall remain in place, intact, at least 24 hours after artificial heat is discontinued.

Hot Weather Concreting: (In accordance with ACI 305 and as follows):

Provide adequate methods of lowering temperature of concrete ingredients so that temperature of concrete when placed does not exceed 90 degrees F.

When weather is such as to raise concrete temperature, as placed, consistently above 80 degrees F., use approved retarder.

Sprinkle all subgrade and forms with water before placing concrete. Remove all excess water before placing concrete.

Start curing as soon as practicable to prevent evaporation of water and keep forms wet. Protect flat work from dry wind, direct sun, and high temperatures.

PART 2: PRODUCTS

CEMENT:

Cement shall be standard portland cement of United States manufacture, conforming to ASTM C 150, Type I or Type III. Only one brand of commercial portland cement shall be used. Each bag shall weigh approximately 94 pounds and contain one cubic foot.

CONCRETE AGGREGATES:

Fine Aggregate: Washed sand having clean, hard, durable, uncoated grains, free from harmful substances conforming to ASTM C 33.

Coarse Aggregate for standard-weight concrete: crushed stone, gravel, or other approved inert material having clean, hard, durable uncoated particles conforming to ASTM C 33. Maximum size, in accordance with ACI 318.

Lightweight Coarse Aggregate shall conform to ASTM C 330. Lightweight aggregate shall be expanded shale or slate. Maximum size of aggregate shall be of 3/4".

WATER:

Clean and free from harmful amounts of acids, alkalies, or organic materials. No water shall be added at the site unlss delivered, documented, and approved by the batch plant and testing agency.

VAPOR BARRIER:

Vapor barrier under floor slabs on earth shall be puncture resistant polyethylene sheet not less than 15 mils thick, with permeance of less than 0.01 perms per ASTM F 1249 or ASTM E 96, and in compliance with ASTM E 1745 Class A and ACI 302. Accessories would include seam tape and vapor proofing mastic with permeance less than 0.03 perms. Provide pipe boots constructed from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer’s instructions.

EXPANSION JOINT MATERIALS:

Expansion joint material shall be asphalt-impregnated fiber strips, 1/2" thick, unless otherwise shown or noted: Flexcell by Celotex Corporation, Sealtight by W. R. Meadows, Inc., Joint Filler by Serviced Products Corporation, or approved equal.

ADMIXTURES:

Water Reducing Admixture: ASTM C 494, Type A, and contain no chloride ions.

Air Entraining Admixture: ASTM C 60 for slabs permanently exposed to weather. No air entraining admixture is to be used for concrete not exposed to weather. Air content is to be confirmed by lab tests for both air entrained and non-air entrained mixes.

CLASS OF CONCRETE:

f'c minimum 4000 psi, maximum 150 pcf (regular weight) for exposed exterior concrete.
f'c minimum 3000 psi, maximum 150 pcf (regular weight).
f'c minimum 3000 psi, maximum 120 pcf (light weight-for use in elevated slabs).
f'c minimum 3000 psi, maximum 150 pcf (regular weight pea gravel) high slump mix for concrete masonry fill.

MIX DESIGNS:

Contractor shall select a testing laboratory acceptable to Architect to verify mixes of all classes of concrete.

Contractor shall submit samples in adequate quantities for each mix verification, of all concrete materials to be used on project to designated testing laboratory.

Laboratory shall be engaged by and paid by the contractor out of the material testing allowance.

Submit four (4) copies of all mix design, aggregate test results, and compression test results to Architect prior to use on the job.

PLANT MIXING:

Proportioning Concrete:

Stresses for design of this structure are based on specified minimum 28-day compressive strength of concrete. Proportions shall be in compliance with approved design mix for each class of concrete.

Batching:

Ready-mixed concrete shall be mixed and delivered in accordance with requirements of ASTM C 94.

Producer shall furnish delivery ticket with each load of concrete delivered under this Specification. Delivery ticket shall show clearly class and strength of concrete, size of coarse aggregate, slump ordered, and date and time of departure from batching plant.

1. Stresses for design of this structure are based on specified minimum 28-day compressive strength of concrete. Proportions shall be in compliance with approved design mix for each class of concrete.

2. Regular weight 3000 psi or 4000 psi concrete shall be proportioned for a slump of 4” + or - 1”.

3. Lightweight 3000 psi concrete shall be proportioned for a slump of 6” + or - 1”.

4. Fine aggregate 3000 psi concrete masonry grout shall be proportioned for a slump of 10" + or - 2".

5. All concrete shall be proportioned for a maximum water to cement ratio 0.5.

6. Concrete not permanently exposed to weather such as concrete for foundations, interior slabs on grade, concrete unit masonry grout, and elevated slabs on composite metal deck shall not have air added by entrainment admixtures. This requirement shall be verified by the testing laboratory.

7. Concrete to be permanently exposed to weather shall have air added by entrainment admixtures. Air content shall be 5% + or – 1%. This requirement shall be verified by the testing laboratory.

CONVEYING EQUIPMENT:

Carts or buggies transporting concrete more than 50 feet shall be equipped with pneumatic tires.

Equipment for chuting or conveying concrete shall be of sufficient size to insure continuous flow of concrete at delivery and without separation of materials.

PART 3: EXECUTION

EVALUATION OF COMPRESSION TESTS:

Evaluation of results of tests for ultimate-strength design concrete shall be according to ACI 318.

Neither results of laboratory verification tests nor any provision in Contract Documents shall relieve Contractor of obligation to furnish concrete of class and strength specified.

INSPECTION OF WORK BEFORE PLACING:

Inspect work to receive concrete for deficiencies which would prevent proper execution of finished work. Do not proceed with placing until such deficiencies are corrected.

Do not place concrete on earth until fill or excavation has been prepared as set forth under applicable sections of specifications for that work as verified by the testing lab.

Before any concrete is placed in form, all pipes or sleeves, openings, or embedded items shall be in place and shall receive all tests specified for them.

Remove all grease, oil, mud or other foreign matter from forms and have reinforcing steel in proper condition and position before placement of concrete. Dowels shall be in place and tied off prior to placing concrete.

Remove hardened, or partially hardened, concrete on forms or reinforcement before placing concrete.

CONVEYING:

Convey concrete from mixer to placement by methods which will prevent separation or loss of material. No water shall be added at the site to aid placement of concrete. Concrete too stiff to be properly placed shall be rejected and removed from the site and legally disposed of at no additional cost to the owner.

Runway supports shall not bear upon reinforcing steel or fresh concrete.

If pump(s) are used for conveying concrete, there shall be no aluminum in contact with the concrete, either in pump or in conveying pipes.

Clean conveying equipment thoroughly before run of concrete at frequent intervals.

CONSTRUCTION AND EXPANSION JOINTS:

Construction Joints: Early in construction program, contractor shall review with Architect construction joints he proposes to use, not indicated on the Drawings. Contractor shall not use any construction joints not approved by Architect.

Expansion Joints: Install as indicated.

PLACING:

Deposit concrete as nearly as practicable in its final position to avoid rehandling. Do not deposit concrete on work partially hardened or contaminated by foreign material. Do not use retempered concrete. In no case use concrete when elapsed time, after addition of water and cement to batch, exceeds one hour.

Concrete shall not be dropped more than four feet. For dropping greater distances use metal chutes or tremie pipes.

Once concreting is started carry on as continuous operation until placing of section is completed. Finish top surface to true plane. When construction joints are necessary, they shall be made in accordance with article above. Do not allow cold joints to occur within pours.

Compact all concrete thoroughly by suitable means during placing, and work thoroughly around reinforcement, embedded fixtures, and into corners of forms. When vibrator is used, apply directly to concrete. Do not over vibrate.

PROTECTION

During curing period protect concrete from damaging mechanical disturbances, particularly load stresses, heavy stock, and excessive vibration. Protect all finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain, running water, hot sun, or windy conditions. Do not load self supporting structures in such a way as to overstress concrete.

Coordinate with protection requirements of Section 03362 – Polished Concrete Floor Finishes.

TESTING:

Conduct strength tests of concrete in accordance with following procedures:

Secure composite samples in accordance with "Method of Sampling Fresh Concrete"
(ASTM C 172).

Mold and cure five specimens from each sample in accordance with "Method of Making and Curing Concrete Compression and Flexure Specimens in the Field" (ASTM C 31). Five specimen comprise one test.

Test Two Specimens at 7 days (ASTM C 39). Test two specimens at 28 days in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C 39). Test evaluation shall be conducted in accordance with provisions of ACI 318. Keep one Specimen in reserve.

Make one strength test for each 100 cu. yds. or fraction thereof for each mix design of concrete placed in any one day, except that in no case shall given mix design be represented by less than five tests.

Testing Laboratory shall be selected and paid by the Contractor out of the material testing allowance.

Report all test results to Architect, Structural Engineer, and Contractor on same day that tests are made.

Testing laboratory shall make and handle all test cylinders.

NON-CONFORMING MATERIAL

Any tested concrete material that fails to meet design strength at 28 days shall be removed and repoured. Substandard concrete may be allowed to remain if certified structurally adequate by a qualified independent engineer and approved by the Owner and Architect, however, the cost of the substandard material shall be deducted from the contract sum.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work shall consist of providing specified finishes to all cast-in-place concrete shown on drawings.

RELATED WORK:

Coordinate with requirements and work specified in Specification Section 03362 - Polished Concrete Floor Finishes.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Industry Standards Index in Division 1.

SUBMITTALS:

Submit (in duplicate) Manufacturer's printed instructions for application of curing compounds and floor hardeners.

Coordinate with submittal requirements in Section 03362 – Polished Concrete Floor Finishes.

PART 2: PRODUCTS

FINE AGGREGATE: ASTM C 33, fine aggregate. Natural sand
PORTLAND CEMENT: ASTM C 150, Type 1, gray.

WATER:

Potable, and free of chemicals affecting set of cement.

CURING COMPOUND AND SEALER:

Transparent, resinous sealer, in volatile, conforming to ASTM C 309.

Coordinate with products specified in Section 03362 – Polished Concrete Floor Finishes.

LIQUID CHEMICAL FLOOR HARDENER:

Colorless, aqueous solution containing blend of magnesium fluosilicate and zinc fluosilicate with wetting agent, containing not less than 2 lbs. fluosilicates per gallon. Compound shall be approved by Architect in writing.

Coordinate with products specified in Section 03362 – Polished Concrete Floor Finishes.

ABRASIVE AGGREGATE:

Ceramically bonded aluminum oxide grains 1/8" to 1/32" size. Material shall be delivered to the site in the manufacturer's original container. Submit sample and manufacturer's descriptive date for approval.

JOINT SEALANTS:

Apply interior and exterior joint sealant products required by drawings at locations indicated on drawings.

PROTECTION:

Coordinate with protection requirements specified in Section 03362 – Polished Concrete Floor Finishes.

PART 3: EXECUTION

PATCHING CONCRETE:

Concrete which is not formed as shown on Drawings, or is out of alignment or level, or shows defective surface, or shows defects which reduce structural strength of member or members, shall be considered as not conforming to intent of these specifications and shall be removed from job by Contractor at his expense, unless Architect grants permission to patch effective area. Permission to patch any such area shall not be considered a waiver of Architect's right to require complete removal of defective work if patching does not, in his opinion, satisfactorily restore quality and appearance of surface, or if patching does not restore structural strength of member or members.

After removing forms, inspect all concrete surfaces. Patch any pour joints, voids, honeycomb, stone pockets, or other defective areas permitted by Architect to be patched, and all tie holes. Where necessary, chip away defective areas to depth of not less than 1", with edges perpendicular to surface. Wet area to be patched and space at least 6" wide entirely surrounding it to prevent absorption of water from patching mortar. Brush grout of equal parts portland cement and sand (with sufficient water to produce brushing consistency) into surface, followed immediately by patching mortar. Patching mortar shall be made of same material (and of approximately same proportions) as used for concrete except that coarse aggregate shall be omitted. Mortar shall not be richer than 1 part cement to 3 parts sand. Amount of mixing water shall be as little as is consistent with requirements of handling and placing. Mortar shall be retempered without addition of water by allowing it to stand for period of one hour, during which time it shall be mixed occasionally with trowel to prevent setting.

Compact mortar thoroughly into place and screwed off to leave patch slightly higher than surrounding surface. Leave patch undisturbed for period of 1 to 2 hours to permit initial shrinkage before beginning final finishing. Finish patch in manner to match adjoining surface. On exposed surface where unlined forms have been used, obtain final finish by striking off surface with straight-edge spanning patch, held parallel to direction of form marks. All patches shall be used in accordance with curing requirements for surface in which patch occurs. Keep patch moist for not less than 3 days after installation.

Tie-holes left by withdrawal of rods, or holes, left by removal of ends of ties shall be filled solidly with mortar after first being wet thoroughly. Any excess mortar at surface of wall shall be struck off flush with cloth.

FLATNESS AND LEVELNESS:

Comply with ACI Standard No. 117 and provide floors with a flatness of F25 and a levelness of F20. Use laser guided equipment to set all forms. Use laser guided highway screed to achieve specified levelness and flatness. Use of BULLFLOATS is prohibited.

Areas of Integrally Colored and Dye Stained Polished Concrete Floor Finishes: Comply with ACI Standard No. 117 and provide floors with a flatness of minimum F50 and a minimum levelness of F30.

Use laser guided equipment to set all forms. Use laser guided highway screed to achieve specified levelness and flatness. Use of BULLFLOATS is prohibited.

TESTING:

Floors shall be tested for levelness and flatness by an independent testing agency, using a “Dipstick Floor Profiler”. Floors that do not meet specification will be removed and re-constructed.

MONOLITHIC CEMENT FINISH:

Apply steel trowel finish to surface of concrete roof and floor slabs as follows:

- For all floors where, in Finish Schedule, resilient flooring or carpet covering is called for.
- For all roof slab areas (for future use as floor).
- For all other concrete floors, stairs, platforms, or slabs where, in Finish Schedule, or shown on Drawings, exposed concrete finish is called for, unless otherwise noted.

Screed floor slabs to an even surface by use of straight-edge and screeding strips accurately to proper grade. Float concrete with laser guided highway screed in manner which will compact and produce surface free from depressions or unevenness. Floors shall be level and flat within tolerances and guidelines specified, except where drains occur (in which cases floors shall be pitched to drains). Steel trowel concrete after concrete has hardened sufficiently to prevent fine materials from working to top, and only after all water sheen has disappeared. Drying of surface moisture before troweling shall proceed naturally, and shall not be hastened by dusting on of dry sand or cement. Perform final troweling after concrete has hardened so that no mortar accumulates on trowel and ringing sound is produced as trowel is drawn over surface.

Coordinate with requirements and work specified in Specification Section 03362 - Polished Concrete Floor Finishes.

Exterior Concreted Areas:

Provide all (walks and vertical surfaces) surfaces with a unidirectional fine broom finish, with concrete walk 1/2" tooled expansion joints at 30' centers maximum and sawcut joints at 5' centers maximum. Pour sample for Architect approval.

CURING:

General Requirements for Curing:

Prevent surfaces of concrete from drying out until required curing time has elapsed. Start curing procedures immediately following initial set of concrete.

Surfaces to Receive Finishes Set in Portland Cement Setting Beds:

Cover with non-staining, reinforced kraft paper. Lap kraft paper, and keep weighted down to prevent evaporation. Do not use membrane curing compound on these surfaces.

FLOOR HARDENER:

Apply to floor surfaces to be exposed in accordance with Manufacturer's printed instructions, and at a rate of not less than 100 sq. ft. per gallon. Apply uniform coating to avoid mottled appearance.

GLOSS URETHANE FLOOR SEALER FOR EQUIPMENT PLATFORMS, BOILER ROOMS, MECHANICAL ROOMS, ELECTRICAL ROOMS, CUSTODIAL ROOMS: (Apply whether scheduled or not; typical)

After all areas are final cleaned, to include removal of all stains and exposed reinforcing fibers, apply gray gloss urethane to floor surfaces to be exposed (no floor finishes except sealer) in accordance with Manufacturer's printed instructions, and at a rate of not less than manufacture's application rate instructions and to achieve a permanent high gloss sheen. Apply uniform coating to avoid mottled appearance. Coordinate with Section 09900 requirements.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.2 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements For Reinforced Concrete.

C. ACI SP-66 - American Concrete Institute - Detailing Manual.

D. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.

E. ANSI/ASTM A184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

F. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

G. ANSI/ASTM A496 - Deformed Steel Wire Fabric for Concrete Reinforcement.

H. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

I. ANSI/AWS D1.4 - Structural Welding Code for Reinforcing Steel.

J. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

K. ASTM A616 - Rail Steel Deformed and Plain Bars for Concrete Reinforcement.

L. ASTM A617 - Axle Steel Deformed and Plain Bars for Concrete Reinforcement.

M. ASTM A704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.

N. ASTM A706 - Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

O. ASTM A767 - Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.

P. ASTM A775 - Epoxy-Coated Reinforcing Steel Bars.

Q. ASTM D3963 - Epoxy-Coated Reinforcing Steel.

R. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete and Shotcrete

S. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.

T. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.

U. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.

V. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1.3 SUBMITTALS

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

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

C. Submit in writing any request for deviation form the design drawings and specifications.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice, ACI 301, ACI SP-66, ACI 318, ANSI/ASTM A184.

B. Submit certified copies of mill test report of reinforcement materials analysis.

1.5 COORDINATION

A. Coordinate with placement of formwork, formed openings and other Work.

PART 2: PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, unfinished.

B. Welded Steel Wire Fabric: ASTM A185 Plain Type; in flat sheets; unfinished. Rolled WWF shall not be acceptable for use on this job.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

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

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Stainless steel type; size and shape as required.

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice ACI SP-66, ACI 318 ANSI/ASTM A184.

B. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Indicate location of splices on shop drawings for approval by the Architect/Engineer.

PART 3: EXECUTION

3.1 HANDLING AND STORAGE

A. Provide proper equipment for safe off loading and handling of material.

B. Provide proper clean level storage area with proper skids to keep material clear of mud and water.

C. Keep material free from mud and other deleterious materials that will reduce bond and do not place any reinforcing bars that are bent, twisted, broken, pitted, or otherwise unsuitable for use on the project as determined by the architect.

D. All necessary field bending and straightening shall be accomplished without heating the material.

E. Cutting torch shall be used only for cut off of material but not for bending. All heat bent material will be rejected by the inspector and shall be promptly removed and replaced at no additional cost. Do not weld reinforcing bars.

3.2 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position. WWF laying on the metal deck and being manually pulled up into the fresh concrete during concrete placement operations shall not be acceptable.

B. Do not displace or damage vapor barriers. Damaged vapor barrier shall be removed and replaced at the direction of the Architect.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing as indicated on drawings.

E. Provide proper and adequate supports at maximum 3 ft x 3 ft spacing each way for support of wwf in the designated position. Tie off wwf sheets so that placement of the fresh concrete will not cause the wwf to be displaced. Pulling up of the wwf sheets into freshly placed concrete will not be an acceptable means of placing the wwf.

3.3 FIELD QUALITY CONTROL

A. Field inspection will be performed by the Architect.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION:

Work Included: The work required under this Section includes furnishing all labor, equipment, materials, and services necessary to complete the brick and masonry block work indicated on the Drawings, or specified herein.

QUALITY ASSURANCE:

Qualifications of Workmen: The masonry work shall be accomplished by experienced masons under the direct supervision of a journey man mason.

Codes and Standards: In addition to complying with all pertinent codes and regulations, material and workmanship shall comply with standards of the National Concrete Masonry Association and the Structural Clay Products Institute.

SUBMITTALS:

Samples: Within thirty (30) days after award of Contract, and before any brick or unit masonry materials are delivered to the job site, submit samples as required of the proposed brick and concrete masonry units to the Architect for his approval.

Certification: Prior to delivery of concrete unit masonry to the job site, deliver to the Architect a letter from the manufacturer of the concrete masonry units certifying that all such concrete masonry units delivered to the job site are in strict conformance with the provisions of this Section of these Specifications.

Sample Panels: Before the masonry work is started, approved sample panels approximately 5 feet long by 4 feet high and of the proper thickness shall be constructed at the job site, reviewed and approved by the Architect. One face shall show the workmanship, coursing, bond, mortar joint thickness, tooling of joints, and range of brick color and texture, all to be as specified or selected by the Architect/Engineer. Sample panel shall duplicate the wall assembly construction with the thru-wall flashing system. The finished work shall match the approved sample panel. Mock up to be maintained throughout construction for workmanship reference.

PRODUCT HANDLING:

Protection: Use all means necessary to protect brick and concrete masonry materials before, during, and after installation and to protect the installed work and materials of all other trades. Cover masonry blocks and brick to prevent excessive moisture absorption.

Portland Cement, lime, and/or pre-packaged mortar mixes shall be delivered to the site and stored in unbroken bags or other approved containers. These materials shall be stored in dry, weather tight sheds or enclosures with elevated floors, which will prevent the inclusion of foreign materials and damage by water or dampness. Masonry sand shall be delivered and stored in a manner to prevent inclusion of foreign material. Brick shall be delivered and stored on the job site on platforms or timbers, clear of the ground. Brick which are chipped, cracked, broken, or marred in other manner shall not be used where exposed to view.

PART 2: PRODUCTS

CONCRETE MASONRY UNITS:

General: All concrete masonry units shall be of sizes shown on Drawings, two-cell type, in gray or neutral color, and conforming with ASTM C-90 Standard Specification for Load Bearing Concrete Masonry Units. Provide units with bullnosed exterior corners at all exposed areas.

Standard Grey CMU:

Size: As indicated in the drawings

Color: Standard Color and Texture.

Minimum Net Area Average Compressive Strength: Average of three units 2000 PSI, no individual unit less than 1800 PSI.

Maximum Absorption: Absorption is less than 18 lbs/CF.

Weight Classification: Units shall be lightweight, blended with expanded shale, clay or slate, produced by the rotary kiln process and shall comply with ASTM C331 and ASTM C33 and shall be graded to assure consistent texture.

All units shall be free of organic impurities that will cause rusting, staining, or pop outs and shall contain no combustible material. All lightweight material to be manufactured by rotary kiln process. The use of coal burning power plants residue aggregate (bottom ash) or similar waste products will not be allowed.

The producer of the lightweight concrete masonry units shall furnish a letter of certification stating that all lightweight aggregate used In the manufacturer of the units was expanded shale, clay or slate produced by the rotary kiln process, Big River industries or approved equal conforming to ASTM C331 and ASTM C33.

Acceptable Manufacturers:
Adams Products Company - Oldcastle, Johnson Concrete Company or approved equal. Manufacturer other than approved listed shall provide submittal samples and received written approval by the Architect prior to bid.

Manufacturer other than approved listed shall provide submittal samples and received written approval by the Architect prior to bid.

BRICK:

Common brick to be utility size, nominal 4 ” x 4” x 12”, and shall conform to ASTM C-62, grade MW, use below grade and where not exposed.

Face brick shall be through body wire-cut, for all exposed brick, unless otherwise noted. Provide all brick types, sizes, shapes, colors, special shapes, tax, delivery freight, and Contractor discounts and rebates.

DARK Brick is Taylor 316 Pink Wirecut, utility size, nominal 4” x 4” x 12”, shall conform to ASTM C-69, grade SW.

LIGHT Brick is Taylor Cream Wirecut, utility size, nominal 4” x 4” x 12”, shall conform to ASTM C-69, grade SW.

WHITE Brick to be utility size, nominal 4” x 4” x 12”, selected by the Architect, purchased with a brick allowance of $1786 per thousand brick.

Mock-up panel approval required.

MORTAR:

General: Cementitious materials and aggregates shall be handled and stored in such a manner as to prevent deterioration or intrusion of foreign materials. Each material shall be of like brand; all sand shall be supplied from a single source; sand color to be approved by Architect.

Cement: Shall be Portland Cement, Type I or II, meeting Standard Specifications for Portland Cement (ASTM C-150).

Sand: Shall be clean, washed, and meet the requirements of Standard Specification for Aggregate or Masonry Mortar (ASTM C-144-76), with the gradation to satisfy paragraph 3, Grading, and with the omission of subparagraph 3.4.

Hydrated Lime: Shall meet the requirements of the Standard Specification for Hydrated Lime for Masonry Purposes (ASTM C-207), Type S.

Hydraulic Hydrated Lime: Shall meet the requirements of the Standard Specification for Hydraulic Hydrated Lime for Structural Purposes (ASTM C-141).

Color: Mortars shall be tinted to match each of multiple brick colors.

Water: Shall be potable.

Admixture-workability and air entraining admixtures may be utilized and shall conform to ASTM C-260.

Water Repellent Additive: Add integral water repellant mortar additive to the polished face CMU veneer mortar as recommended by the additive manufacturer’s recommended dosage.

Portland Cement: ASTM C-10, or Fed. Spec. SS-C-192, Type I, II, or III.

Aggregates: ASTM C-144, aggregate for masonry mortar.

Water: Shall be clean and free of deleterious amounts of acids, alkalies, or organic materials.

Plasticizing Agent: Shall be OMICRON by Master Builders, "Hydrocide Powder", by Sonneborn Bldg. Products, Inc., Subsidiary of DeSoto, Inc., "Hydrolox 400" by Chem-Masters Corp., or approved equal, and used in accordance with mfgrs. instructions.

Anti-Freeze Compounds: No anti-freeze liquid, salt, accelerating admixture for masonry mortar or other substance shall be in the mortar to lower the freezing point of the mixing water or accelerate the set of the cement.

Prepackaged Mortar Mixes: Prepackaged mortar mixes may be used with the prior approval of the Architect. The mortar mix shall be in accordance with the following specifications.

Type S Mortar Mix: The mortar mix shall have a compressive strength of 1800 psi minimum at 28 days when tested in accordance with ASTM C-270.

The mortar mix shall contain Portland Cement, hydrated lime, plasticizing admixtures, and/or hydraulic hydrated lime. Mortar mixes which contain other materials, including ground limestone ground slag or other cementitious and non-cementitious materials, are not acceptable.

Bag Label: Each bag of mortar mix shall have a printed label thereon which shall show the contents. Contents shall be described by the percent by volume of Portland Cement (ASTM C-150).

Hydrated Lime (ASTM C-207), Hydraulic Hydrated Lime (ASTM C-141), and Admixtures (ASTM C-260).

Instructions for mixing the mortar mix shall be clearly printed on the container. These instructions shall be by volumetric measurement and shall be limited to the method of mixing in proper proportions of washed sand to 1 bag of the prepackaged mortar mix with water to produce a flow of the proper consistency.

The mortar mix shall be composed only of Portland Cement, Hydrated lime and/or Hydraulic Hydrated Lime and workability admixtures within the following limits:

a. Maximum of 65% Portland Cement.

b. Minimum of 33% Hydrated Lime and/or Hydraulic Hydrated Lime.

c. Maximum of 2% Admixtures.

Air Content: The air content of the pre-packaged mortar mix shall be limited to 16% maximum when tested in accordance with ASTM C-91, Paragraphs l8 through 22.

Autoclave Expansion: Autoclave expansion of the mortar mix shall not exceed 1.0% when determined in accordance with ASTM Method C-151.

On-The-Job Mortar Mix:

Type S. Mortar shall have a compressive strength of 1800 psi minimum at 28 days. The mortar shall be proportioned within the following volumetric limits:

a. 1 part Portland Cement

b. 1/2 part Hydrated Lime

c. Not less than 2 1/4 and not more than 3 times the sum of the volumes of cement and lime used of washed sand measured in a damp, loose condition.

d. Plasticized per instructions of the mfgr., the quantity of which is not to exceed 2% by volume of the cement and lime combination.

Measurement and Mixing:

The method of measuring materials shall be by volume and shall be such that the specified proportions of the mortar materials can be controlled and accurately maintained. A measuring device to make consistent volume measurements shall be used throughout the project. Measurement of washed sand by shovel shall not be permitted.

Mortar Mixer shall be a paddle-type mechanical mixer. It shall be of such design and size to accommodate the mix without overloading, and be adequately powered to vigorously mix the ingredients.

The mortar mixer shall be charged in this order: Add approximately one-half the water required, one-half the washed sand, the cement and lime or prepackaged mortar mix), the remaining amount of washed sand, and then sufficient water to bring the mix to desired consistency. Mortar shall be mixed for a minimum of five minutes after all materials have been charged into the mixer with all batches being mixed to the same consistency.

Mortars that have stiffened because of evaporation of water from the mortar may be retempered by adding water as frequently as needed to restore the required consistency. Mortars shall be used and placed in their final position within 2 hours after mixing. When the temperature is over 80 degrees F., the mortar shall be used within 1 1/2 hours after mixing. Mortar not used within these time periods shall be discarded.

HORIZONTAL JOINT REINFORCEMENT STEEL:

Standards: All components shall be hot-dip galvanized to ASTM A 153 after fabrication.

Joint Reinforcement for CMU/Brick Veneer Cavity Wall: Truss type in CMU backup wall with hook and key eye; steel wire, hot dip galvanized to ASTM A 153 after fabrication, cold drawn steel wire conforming to ASTM A82, 3/16 inch side rods with No.9 diagonal ties. Backup wall reinforcing shall be units no more than two (2) inches smaller in width than the wall thickness and shall be of deformed rods 3/16" side rods and 9 gage diagonal cross rods all galvanized. Veneer anchored with 3/16" keys and hooks, keys are 4-point flush-welded to backup wall rods. Total unit width shall be no more than two (2) inches smaller in width than the total wall thickness. Hooks shall be extended into veneer wythe 1" from exterior face. Provide Hohmann & Barnard LOX-ALL Adjusto-Flex-Mesh #AF-H Truss, Wire-Bond Series 700 adjustable tab, Dur-O-Eye by Dayton Superior or approved equivalent products.

Interior CMU wall reinforcing shall be Truss Type, as mfgd. by AA Wire Products Co., "DUR-O-WALL", Hohmann & Barnard "LOX-ALL", or other approved equal products. Provide prefabricated corners and intersections. Manufactured in accordance with Uniform Building Code Standard UBC 21-10, ASTM A951, ASTM A580 – Type 304, ACI 530/ASCE 5/TMS402 Building Code Requirements for Masonry Structures.

Reinforcing shall be units no more than two (2) inches smaller in width than the wall thickness and shall be of deformed rods 3/16" side rods and 9 gage diagonal cross rods all galvanized.

Provide prefabricated Tees and Corners at all wall intersections.

Interior block partitions shall be reinforced similar to exterior walls.

Spacing: Reinforcing for exterior and interior walls shall be 16" o.c. vertically beginning at the finish floor line and provide line of reinforcing one block course and one below all window heads and sills. Extend 16" beyond jambs on each side.

Lap all splices one full panel of reinforcing unit.

WALL TIES TO STRUCTURAL STEEL:

All exterior and interior masonry walls shall be tied to contiguous steel columns and beams with two-piece adjustable tie units such as, Hohmann and Barnard 359 Weld-On Ties; ¼" diameter x 8" long hot dip-galvanized bent wire, or equivalent column and beam anchors by Wire-Bond or Heckman, with Hohmann and Barnard VBT-Vee Byna-Tie 3/16" diameter hot-dip galvanized triangular wire ties or approved equal by Wire-Bond or Heckman.

Space wall ties to columns and beams at 16" o.c. maximum. Tie anchors shall be welded to structural steel with 4 fillet welds 1/8" x 3/4".

WALL TIES TO LIGHT GAGE METAL WALL STUDS

All exterior masonry veneer with metal stud back up shall be tied to metal studs with two piece adjustable tie units such as Heckman 12 gage 315-D, Hohmann and Barnard 12 gage DW-10HS, or 12 gage Wire-Bond Type III anchors with 3/16 diameter triangular wire ties or approved equal.

Space wall ties so that no tie is required to tie more than 2 2/3 square feet of masonry veneer or 24" oc maximum. Tie anchors shall be attached to metal studs with 2 - #12 self drilling self tapping screws.

FLASHING SYSTEM:

Thru-Wall Flashing system: 40 mil thick EPDM rubber membrane, containing no asphalt, equivalent to Sandell EPDM Rubber Thru-wall Flashing with Carlisle SecurTape splicing tape, and continuous pre-formed stainless steel drip edge. Install in compliance manufacturer's instructions.

Thru-wall flashing shall be completely secured into masonry joints or surface fully adhered throughout all wall assemblies, with all lap joints 100% sealed, in a complete continuous waterproof installation. Provide all necessary accessory components for a complete assembly; to include required roll-on primers, spray adhesives, pressure sensitive adhesive tape, termination bars, etc. wherever necessary.

Locations: Wall flashing system shall be installed over all masonry opening heads and sills, over all lintels in exterior walls, at all weephole locations, continuous around columns, and elsewhere indicated on Drawings.

Build a mock-up installation into the masonry sample panel for review and approval by Architect.

Required Thru-Wall Flashing Accessories:

Carlisle SecurTape Splicing Tape: 3" wide x 100' long roll, double-sided, synthetic cured rubber EPDM adhesive tape, .030" thick. Features a clear poly release film. Apply to cleaned EPDM flashing lap seams and adhere tightly with roller. Primers and spray adhesives shall be applied to surfaces to receive adhesive tape.

Sando-Seal lap sealant: Apply to all exposed edges at surface applied conditions, eliminating any voids, pockets or depressions where moisture would accumulate.

Sandell's S-600 Primer: Manufacturer's special primer formulated to prepare surfaces for adhering flashing to surfaces with pressure sensitive adhesive tape.

Sandell's Self-Adhering End Dams: preformed rubberized asphalt with adhesive surface and release layer film. Install above and beneath all wall openings, all longitudinal ends of flashing, lintel ends, at column abutments, near building expansion joints, and all cavity wall conditions whenever flashing interruptions occur.

Sandell's Self-Adhering Corners: preformed rubberized asphalt with adhesive surface and release layer film. Install at exterior and interior corner conditions. Flashing membrane shall overlap pre-formed corners, adhere and form a continuous waterproof seal.

Pre-Formed Stainless Steel Drip Edge: Provide a continuous pre-formed stainless steel drip edge at all flashings. 28 gauge, dull finish Type 304 stainless steel, ASTM A-167. Minimum 1 5/8" wide with a 3/8" bent safety drip edge. Flashing membrane shall lap and adhere onto drip edge for a continuous waterproof assembly. Flashing membrane shall be terminated at ½" from face of finished wall surface.

Weeps: Plastic weep inserts shall be Cell Vent Weep-Hole Ventilator by DUR-O-WALL or equivalent. 3/8" thick x full head joint height equivalent to actual brick size height, color clear. Install at all wall flashing locations with weepholes indicated on Drawings.

PART 3: EXECUTION

SURFACE CONDITIONS:

Inspection:

Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

Verify that concrete unit masonry may be completed in accordance with all pertinent codes and regulations, referenced standards, and the original design.

Discrepancies: In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been completely resolved.

COORDINATION:

Carefully coordinate with all other trades to insure proper and adequate interface of the work of other trades with the work of this Section.

INSTALLATION OF MASONRY:

GENERAL: Lay up all walls in running bond, plumb, level, and true to the lines and dimensions indicated on the Drawings. Maintain uniform head and bed joint of 3/8" vertically and horizontally. Masonry Contractor shall use sled runner jointing tool wherever possible to maintain consistency.

Do not use chipped or broken units. If any such units are discovered in the finished wall, the Architect may require their immediate removal and replacement with new units at no additional cost to the Owner.

Bullnose CMU shall be begin at floor line, with first unit above floor at a bullnose corner being a bullnose unit, not a square corner unit.

Wetting of Brick: All brick shall be thoroughly wetted as necessary to reduce the rate of absorption of water a time of laying to not more than 0.7 of an ounce (20 grams per minute) per brick when placed on its flat side in 1/4" of water for one minute.

Brick Laying Technique:

All joints between brick shall be completely filled with mortar. Brick shall be laid in a full, lightly furrowed bed of mortar with the head joints completely filled by placing sufficient mortar on the end of the brick so that when the brick is shoved into place, the head joint will be filled. Buttering of face edge and then slushing will not be permitted. All joints, both interior and exterior shall be cut flush.

Disturbed Units: Where brick are disturbed or must be moved after the mortar has begun to lose its moisture, the brick and all adjacent mortar shall be removed and reset completely.

Tooling: Exterior and Interior brick joints shall be tooled to a uniform concave joint (unless otherwise noted) using a metal tool designed for that purpose, head joints first and then the bed joints. Interior CMU joints shall be tooled to a uniform concave joint. All joints shall be tooled at approximately the same degree of moisture content and firmness to achieve a uniform color and texture.

Where indicated provide raked tooled joints.

POINTING OF MASONRY:

At the completion of the masonry work, all holes in the exposed masonry shall be pointed. Defective joints shall be cut out and tuckpointed solidly with mortar. Pointing and tuckpointing shall be done with a pre-hydrated mortar. The mortar mix shall be controlled so that after curing of the mortar, no difference in texture or color exists with that of adjacent masonry. Where indicated, provide tuckpointing of existing masonry.

COLD WEATHER:

No bricklaying shall be performed unless the temperature of the surrounding air is 40 degrees F. and rising. The use of "anti-freeze" or accelerating admixtures is not permitted. Provide temporary protection of completed portions of masonry to insure a minimum 48 hours curing at a minimum 40 degrees F.

MASONRY OPENINGS:

The General Contractor and/or his masonry subcontractor shall be responsible for coordinating and building into all walls, the required openings necessary to permit the passage of duct work and piping by the mechanical contractors. These required openings shall be located and constructed as the work progresses. Knocking out large openings after work has been constructed will not be permitted. Structural lintels shall be furnished and installed by the General Contractor.

MASONRY CLEANING:

While laying the brick, good workmanship and job housekeeping practices shall be used so as to minimize the need for cleaning the brick. Protect the base of the wall from mud splashes and mortar droppings, protect the wall by setting scaffolds so that mortar is not deflected onto the wall, and at the end of each work day set the scaffolding boards so that they do not deflect rainfall onto newly laid masonry.

The bricklaying technique shall be such that mortar does not run down the face of the wall, or smear the mortar onto the brick face.

After the joints are tooled, cut off mortar tailings with the trowel and brush excess mortar burrs and dust from the face of brick. Do not bag or sack the wall, but use a bricklayer's brush made with medium soft hair.

Remove all large mortar particles with a hardwood scraper.

If after using the above outlined techniques, additional cleaning of the walls is found necessary, allow the walls to cure one month prior to and at the time the cleaning solution is applied.

Clean the wall only with an approved cleaning solution applied as recommended by the manufacturer. The solution shall be applied with a brush starting at the top of the wall. The use of any proprietary cleaning agents shall first be approved in writing by the manufacturer of the masonry being cleaned and the Architect. The concentration, method of application of the cleaning solution, and method of scraping shall be as outlined on the container by the manufacturer.

High pressure water and sandblasting shall not be used for cleaning.

Immediately after cleaning a small area, the wall shall be rinsed thoroughly with quantities of water.

Protect adjacent surfaces and materials during brick cleaning operations.

After the walls are cleaned, take necessary precautions to insure that other contractors and subcontractors do not damage or soil the walls. Mud protection around the base of walls shall be left in place until the final grading work is done.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.1 SECTION INCLUDES

A. Concrete masonry units.

B. Reinforcement, anchorage, and accessories.

1.2 REFERENCES

A. ACI 530-99 - Building Code Requirements for Masonry Structures.

B. ACI 530.1-99 - Specifications For Masonry Structures.

C. ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement.

D. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.

E. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.

F. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

G. ASTM C55 - Concrete Building Brick.

H. ASTM C90 - Load-Bearing Concrete Masonry Units.

I. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

J. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Hot Weather Masonry Construction.

K. UL - Fire Resistance Directory.

1.3 SUBMITTALS

A. Shop Drawings: Indicate bars sizes, spacings, locations, reinforcement quantities, bending and cutting schedules, supporting and spacing devices for reinforcement, accessories.

B. Product Data: Provide data for masonry units and fabricated wire reinforcement and accessories.

C. Design Data: Indicate required mortar strength, masonry unit assembly strength in all planes, supportive test data.

D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years experience.

B. Installer: Company specializing in installing the Products specified in this section with minimum five years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products in workmanlike manner to avoid damage to units.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F 48 hours prior to, during, and 48 hours after completion of masonry work.

B. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

C. Maintain materials and surrounding air temperature to maximum 90 degrees F 48 hours prior to, during, and 48 hours after completion of masonry work.

D. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

PART 2: PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Hollow Load Bearing Block Units (CMU): ASTM C90, Type I - Moisture Controlled blended light weight with individual unit net area compressive strength of 1900 psi.

B. Solid Load-Bearing Block Units (CMU): ASTM C90, Type I - Moisture Controlled blended light weight with individual unit net area compressive strength of 1900 psi.

C. Concrete Brick Units: ASTM C55, Type I - Moisture Controlled blended light weight of same Grade, Type, and Weight as block units with individual unit net area compressive strength of 1900 psi.

D. Size and Shape: Nominal modular size. Provide special units for 90 and 45 degree corners, bond beams, lintels, and bullnosed corners.

2.2 REINFORCEMENT AND ANCHORAGE

A. Single and Double Wythe Joint Reinforcement: Truss type; steel wire, hot dip galvanized to ASTM A 153 after fabrication, cold drawn steel wire conforming to ASTM A82, 3/16 inch side rods with No.9 diagonal ties. Reinforcing shall be units no more than two (2) inches smaller in width than the wall thickness and shall be of deformed rods 3/16” side rods and 9 gage diagonal cross rods all hot dipped galvanized.

B. Joint Reinforcement for CMU/Brick Veneer Cavity Wall: Truss type in CMU backup wall; steel wire, hot dip galvanized to ASTM A 153 after fabrication, cold drawn steel wire conforming to ASTM A82, 3/16 inch side rods with No.9 diagonal ties. Backup wall reinforcing shall be units no more than two (2) inches smaller in width than the wall

thickness and shall be of deformed rods 3/16” side rods and 9 gage diagonal cross rods all galvanized. Veneer anchored with 3/16” keys and hooks, keys are 4-point flush-welded to backup wall rods. Total unit width shall be no more than two (2) inches smaller in width than the total wall thickness. Hooks shall be extended into veneer 1” from exterior face. Provide Hohmann & Barnard Adjusto-Flex-Mesh #AF-H Truss or equivalent.

C. Provide prefabricated Tees and Corners at all wall intersections.

D. Interior block partitions shall be reinforced similar to exterior backup walls.

E. Spacing: Reinforcing for exterior and interior walls shall be 16" o.c. vertically beginning at the finish floor line and provide line of reinforcing one block course and one below all window heads and sills. Extend 16" beyond jambs on each side.

F. Lap all splices one full panel of reinforcing unit.

2.3 WALL TIES TO STRUCTURAL STEEL:

A. All exterior and interior masonry walls shall be tied to contiguous steel columns and beams with two-piece adjustable tie units such as, Hohmann and Barnard 359 Weld-On Ties; ¼” diameter x 8” long hot dip-galvanized bent wire, or equivalent column and beam anchors by Wire-Bond or Heckman, with Hohmann and Barnard VBT-Vee Byna-Tie 3/16” diameter hot-dip galvanized triangular wire ties or approved equal by Wire-Bond or Heckman. Refer to Drawings General Notes.

B. Space wall ties to columns and beams at 16” oc maximum. Tie anchors may be welded to structural steel with 4 fillet welds 1/8” x 3/4”.

C. Reinforcing Steel: ASTM A615, 60 ksi yield grade, deformed] billet bars, uncoated finish.

D. Strap Anchors: As indicated on the drawings.

2.4 MORTAR AND GROUT

A. Mortar: Type "S".

B. Grout: Ready Mix 3000 psi pea gravel concrete as specified in Section 03300.

2.5 ACCESSORIES

A. Preformed Control Joints: Neoprene as noted on the drawings.

B. Joint Filler: Closed cell type as noted on the drawings.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.6 LINTELS

A. Bond beam type and steel lintels as noted on the drawings. Provide steel dowels to top flanges of steel beam lintels as noted on drawings. Provide dowels in bottom flanges of beams beyond the masonry openings as noted on the drawings.

2.6 EMBEDDED BEAMS

A. Provide dowels in top and bottom flanges of beams embedded in masonry walls as noted on the drawings.

PART 3: EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify items provided by other sections of work are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other Sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running.

2. Coursing: One unit and one mortar joint to equal 8 inches.

3. Mortar Joints: Concave.

3.4 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.

D. Remove excess mortar as Work progresses.

E. Interlock intersections and external corners unless otherwise noted on the drawings.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Cut mortar joints flush where wall tile is scheduled, cement parging is required, resilient base is scheduled, or bitumen damp proofing is applied.

I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated on drawings.

3.5 REINFORCEMENT AND ANCHORAGE

A. Install horizontal joint reinforcement 16 inches oc.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 32 inches each side of opening.

C. Place joint reinforcement continuous in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum one full panel.

E. Support and secure reinforcing vertical bars from displacement with wire rod positioners as noted on the drawings. Maintain bars position within 1/2 inch of indicated position.

F. Embed anchors attached to structural steel members. Embed anchorages in every second block joint.

3.6 LINTELS

A. Install reinforced bond beam unit masonry lintels over openings where steel lintels are not scheduled.

B. Do not splice reinforcing bars in lintels.

C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of indicated position.

D. Place and consolidate grout fill without displacing reinforcing.

E. Allow masonry lintels to attain specified strength before removing temporary supports.

F. Maintain minimum 8 inch bearing on solid masonry or steel on each side of opening.

G. Refer to drawings for placement of control joints at ends of lintels.

3.7 GROUTED COMPONENTS

A. Reinforce 8” wide bond beams with 1 - #5 top bar and, and 1 - #5 bottom bar 1 inch clear from bottom web. Reinforce 12” wide bond beams with 2 - #5 top bars and, and 2 - #5 bottom bars 1 inch clear from bottom web.

B. Reinforce interior walls with #5 vertical bars spaced at 48" oc unless otherwise noted on the drawings. Place bars in maximum 6'-8" lifts. Lap splices 32", unless otherwise noted on the drawings.

C. Reinforce exterior walls with #6 vertical bars spaced at 24" oc unless otherwise noted on the drawings. Place bars in maximum 6'-8" lifts. Lap splices 36", unless otherwise noted on the drawings.

D. Place vertical bars in center of wythe.

E. Lap splices in horizontal bars minimum 40 bar diameters. Stagger splices in adjacent bars. Dowel horizontal bars through HSS Steel column as noted on the drawings.

F. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

G. Place and consolidate grout fill in 80” maximum lifts in cores containing bars without

displacing reinforcing. Use water reducing plasticizers as required to maintain proper slump for grouting cells 100% solid.

H. At lintel bearing locations, fill masonry cores with grout for a minimum of 24 inches each side of opening from lintel bearing down to finish floor.

I. Grout all masonry units 100% solid below finish floor and other locations noted on the drawings.

J. Lay masonry units with core cells vertically aligned.

K. Permit mortar to cure 7 days before placing grout.

L. Reinforce masonry unit cores and cavities with reinforcement bars and grout as indicated on drawings.

M. Retain vertical reinforcement in position with wire rebar positioners spaced at 48" maximum intervals full height of masonry.

N. Wet masonry unit surfaces in contact with grout just prior to grout placement.

O. When grouting is stopped for more than one hour, terminate grout 1-1/2 inches below top of upper masonry unit to form a positive key for subsequent grout placement.

P. High Lift Grouting: High lift grouting shall not be used for this project.

3.8 CONTROL AND EXPANSION JOINTS

A. Continue horizontal joint reinforcement through control joints.

B. Do not continue horizontal joint reinforcement through expansion joints.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joint in accordance with Section 07900 for sealant performance.

E. Form expansion joints as detailed.

3.11 BUILT-IN WORK

A. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, and other items to be built-in the work and furnished by other sections.

B. Install built-in items plumb and level.

C. Bed anchors of metal door [and glazed] frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 24 inches from framed openings.

D. Do not build in organic materials subject to deterioration.

3.12 TOLERANCES

A. Maximum Variation From Alignment: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and total 1/2 inch overall.

D. Maximum Variation from Plumb: 1/4 inch per story.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

3.13 CUTTING AND FITTING

A. Saw cut or core drill for neat fit at chases, pipes, conduit, sleeves. Coordinate with other sections of work to provide correct size, shape, and location. Fill space around penetrating devices with approved firestop materials.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 CLEANING

A. Clean work with non acidic and non staining high pressure wash.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Use non-metallic tools in cleaning operations.

3.15 PROTECTION OF FINISHED WORK

A. Protect finished Work form damage.

B. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

THE BRICK INDUSTRY ASSOCIATION

TECHNICAL NOTES on Brick Construction

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7B

December 2005

Water Penetration Resistance - Construction and Workmanship

Abstract: This *Technical Note* covers essential construction practices needed to assure water-resistant brick masonry. Procedures for preparing materials to be used in brick construction are recommended, including proper storage, handling and preparation of brick, mortar, grout and flashing. Good workmanship practices are described, including the complete filling of all mortar joints, tooling of mortar joints for exterior exposure and covering unfinished brick masonry walls to protect them from moisture.

Key Words: air space, brick, construction, flashing, initial rate of absorption, joints, mortar, tooling, weeps, workmanship.

SUMMARY OF RECOMMENDATIONS:

General
- Store materials on the job site to avoid wetting and contamination
- For drainage walls, keep the air space free of excessive mortar droppings
- Do not disturb newly laid masonry
- Cover tops of unfinished walls until adjacent construction protects them from water entry

Brick
- Pre-wet brick with a field measured initial rate of absorption (IRA) exceeding 30 g/min•30 in.^{2} (30 g/min•194 cm^2)

Mortar
- When mixing mortar, use accurate batching measurements and maximum amount of water that produces a workable mortar
- For brick with an IRA exceeding 30 g/min•30 in.^{2} (30 g/min•194 cm^2), increase water or maximize water retention by increasing lime proportions within limits of ASTM C 270
- For brick with an IRA lower than 5 g/min•30 in.^{2} (5 g/min•194 cm^2), reduce water or minimize water retention by decreasing lime proportions within limits of ASTM C 270

Joints
- In exterior wythes, completely fill all mortar joints intended to have mortar
- Minimize furrowing of bed joints and prohibit slushing of head joints
- Fill collar joints completely with grout or mortar, preferably grout; do not slush collar joints
- Tool mortar joints when thumbprint hard with a concave, "V" or grapevine jointer

Flashing and Weeps
- Do not stop flashing behind face of brickwork
- Where required, turn up flashing ends into head joint a minimum of 1 in. (25.4 mm) to form end dams
- Lap continuous flashing pieces at least 6 in. (152 mm) and seal laps
- Where installed flashing is pierced, make watertight with sealant or mastic compatible with flashing
- Install weeps immediately above flashing

INTRODUCTION

The best design, detailing and materials will not compensate for poor construction practices and workmanship. Proper construction practices, including preparation of materials and workmanship, are essential to achieve a water-resistant brick masonry wall.

This *Technical Note* discusses construction techniques and workmanship and is the third in a series of *Technical Notes* addressing water penetration resistance of brick masonry. Other *Technical Notes* in the series address brickwork design and details (7), materials (7A) and condensation (7C and 7D). Maintenance of brick masonry is addressed in *Technical Note* 46. All of these items are essential to obtain water-resistant brick masonry walls.

PREPARATION OF MATERIALS

Preparation of masonry materials before bricklaying begins is very important. Specific procedures must be followed to ensure satisfactory performance and avoid future problems. Preparation includes material storage, mixing mortar and grout and, in some cases, wetting the brick.

Storage of Materials

All materials at the jobsite should be stored to avoid contamination. Masonry units, mortar materials, ties and reinforcement should be stored off the ground, preferably in a dry location. In addition, all materials should be covered with tarpaulins or other weather-resistant materials to protect them from the elements.

Wetting Brick

Brick with an initial rate of absorption (IRA) greater than 30 g/min•30 in.² (30 g/min•194 cm²) at the time of laying tend to draw too much moisture from the mortar before initial set. As a result, construction practices should be altered when using brick with high IRA to achieve strong, water-resistant masonry. The IRA of brick in the field will typically be less than that reported in laboratory tests. Laboratory test results may be used to determine if measuring IRA in the field is necessary. ASTM C 67, Test Methods for Sampling and Testing Brick and Structural Clay Tile, includes a standard procedure for measuring IRA in the field.

A crude method of indicating whether brick need to be wetted prior to placement consists of drawing, with a wax pencil, a circle 1 in. (25.4 mm) in diameter on the brick surface that will be in contact with the mortar. A quarter can be used as a guide for the circle. With a medicine dropper, place 20 drops of water inside this circle and note the time required for the water to be absorbed. If the time exceeds 1½ minutes, the brick should not need wetting; if less than 1½ minutes, adjustments to typical construction practice are recommended.

Specification for Masonry Structures [Ref. 4] requires that brick with an IRA exceeding 30 g/min•30 in.² (30 g/min•194 cm²) be wetted prior to laying to produce an IRA less than 30 g/min•30 in.² (30 g/min•194 cm²) when the units are placed. However, execution of this method may be impractical on large-scale construction projects and the contractor may consider other alternatives, as discussed in the following section, Mixing of Mortar and Grout.

If brick are to be wetted, the method of wetting is very important. Sprinkling or dipping the brick in a bucket of water just before laying would produce the surface wet condition which may not be sufficient, as shown in Figure 1b. The units should have a saturated interior, but be surface dry at the time of laying, as shown in Figure 1d.

Satisfactory procedures for wetting the brick consist of letting water run on the cubes or pallets of brick, or placing them in a large tank of water. This should be done the day before the units are laid, or not later than several hours before the units will be used so that the surfaces have an opportunity to dry before the brick are laid. Wetting low-absorption brick or excessive wetting of brick may result in saturation, as shown in Figure 1c. This can cause “bleeding” of the mortar joints and “floating” of the brick.

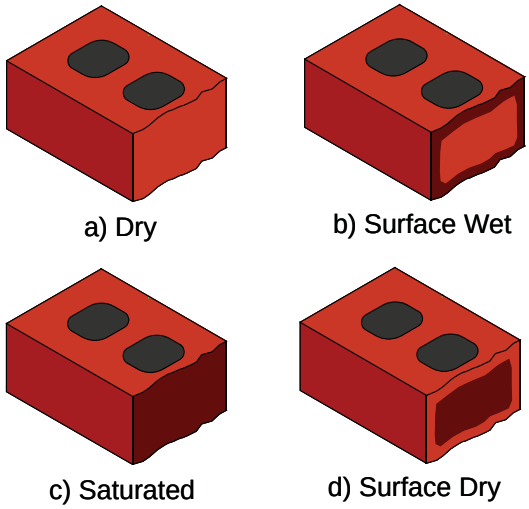

Figure 1
Moisture Content of Brick

Mixing of Mortar and Grout

Typically, a high water content in the mortar is necessary to obtain complete and strong bond between mortar and brick. In general the mortar should be mixed with the maximum amount of water that produces a workable mortar. Factors such as the jobsite environment and the IRA of the brick should be considered when determining the proper amount of water to include in the mortar.

Mortar to be used with brick that have an IRA greater than 30 g/min•30 in.² (30 g/min•194 cm²) should be mixed to maximize water retention by increasing mixing water or lime content within the limits of ASTM C 270. This is particularly important when pre-wetting the brick to reduce their IRA is impossible or impractical. Admixtures designed to increase the water retention of the mortar may also be used to improve the compatibility of mortar with high IRA brick. Only admixtures with test data showing no deleterious effects should be used.

Mortar for use with brick that have an IRA less than 5 g/min•30 in² (5 g/min•194 cm²) should be mixed with reduced amounts of water or lime to minimize water retention. Lime proportions should remain within the limits of ASTM C 270.

When brick with widely different absorption rates are used together in brickwork, it is important to maintain the correct water content in the mortar used with the different brick.

All cementitious materials and aggregates must be mixed for at least 3 minutes and not more than 5 minutes in a mechanical batch mixer. If, after initial mixing, the mortar stiffens due to the loss of water by evaporation, addi-

tional water should be added and the mortar remixed (retempered). All mortar should be used within 2½ hr (2 hr in hot weather conditions, see *Technical Note* 1) of initial mixing and grout should be used within 1½ hour of introducing water into the mix. No mortar or grout should be used after it has begun to set.

One of the most common problems with mortar is oversanding. Oversanded mortar is harsh, unworkable and results in poor extent of bond and reduced bond strength, thus increasing the potential for water penetration problems. The cause of oversanding is frequently the use of the shovel method of measuring the sand. The amount of sand that a shovel will hold varies depending on the moisture content of the sand, the person doing the shoveling and the different size of shovels used on the jobsite. To alleviate this problem, proper batching methods must be used. Measurement of sand by shovel should not be permitted without periodically gauging the shovel count using a bucket or box of known volume. *Technical Note* 8B provides detailed guidelines for various methods of more accurately batching mortar.

Blending of Brick

While not related to water penetration resistance, blending of brick at the jobsite is an important preparation task related to workmanship and the acceptable appearance of brickwork. Because brick is made from natural materials that vary in physical properties, variations in color may occur between production runs and occasionally within the same run. Modern manufacturing processes use automatic equipment which may not permit inspection of each brick, also resulting in minor color and texture variations. For these reasons, straps of brick from different cubes should be placed together around the wall. The mason should then select brick from adjacent straps when laying a given section of brickwork. By blending the brick throughout the wall in this manner, the effect of potential color variations on the finished brickwork is minimized.

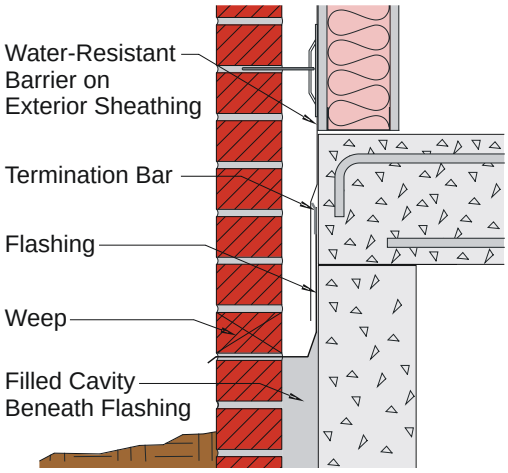

Figure 2
Wall Base Flashing Detail

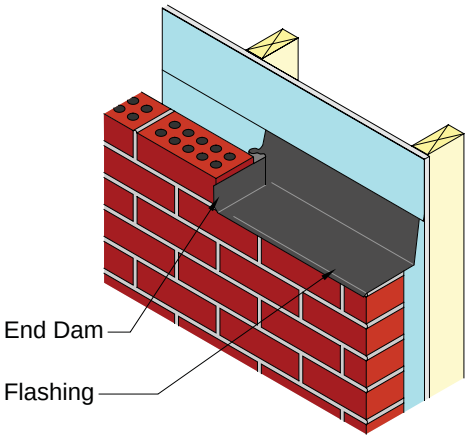

Figure 3
End Dam Detail

WORKMANSHIP

The importance of good workmanship to attain quality brickwork cannot be overemphasized. While design and the quality of materials contribute to the water penetration resistance of brickwork, workmanship is a highly important factor in the construction of water-resistant masonry.

Placing Flashing and Weeps

Flashing must be installed properly and integrated with adjacent materials to form an impervious barrier to moisture movement. The flashing should be wide enough to start outside the exterior face of the brick wythe, extend across the cavity, and turn up vertically against the backing or interior wythe at least 8 in. (203 mm). The top (vertical) edge should be placed in a mortar joint of the backing wythe, in a reglet in concrete backing, or attached to sheathing with a termination bar, as shown in Figure 2. Sections of flashing are to be overlapped at least 6 in. (152 mm) and the lap sealed with a compatible adhesive. Water-resistant sheet membranes should overlap the flashing in a shingle fashion by at least 6 in. (152 mm).

Flashing that is placed so that the outside edge projects from the face of the wall may be cut flush with the face of the brickwork. In no circumstances should the flashing be stopped behind the face of the brickwork. Continuity at corners and returns is achieved by cutting and folding straight sections or using preformed corner pieces. Discontinuous flashing should terminate with an end dam in a head joint, rising at least 1 in. (25.4 mm) as shown in Figure 3.

Flashing must be placed without punctures or tears. Openings created for reinforcement or anchors must be closed with a compatible sealant. Protection may be needed around bolts fastening shelf angles to the structure.

Weeps are required, and should be formed in mortar joints immediately above the flashing. Open head joints, formed by leaving mortar out of a joint, are the recommended type of weep. Open head joint weeps should be at least 2 in. (51 mm) high. Weep openings are permitted by most building codes to have a minimum diameter of 3/16 in. (4.8 mm). The practice of specifying the installation of weeps one or more courses of brick above the flashing can cause a backup of water and is not recommended. Noncorrosive metal, mesh or plastic screens can be installed in open head joint weeps if desired.

Spacing of open head joint weeps at no more than 24 in. (610 mm) on center is recommended. Spacing of wick and tube weeps is recommended at no more than 16 in. (406 mm) on center. Weep spacing is permitted by most building codes up to 33 in. (838 mm) on center. If other than an open head joint weep is used, be sure the weep is clear of all mortar to allow the wall to drain (see *Technical Note* 21C). Rope wicks should be flush with, or extend 1/2 in. (12.7 mm) beyond the face of the wall to promote evaporation. The rope should continue into the bottom of the air space, placed along the back of the brick and be at least 16 in. (406 mm) long.

Filling Mortar Joints

To reduce water penetration, there is no substitute for proper filling of all mortar joints that are designed to receive mortar. Improperly filled mortar joints can result in leaky walls, reduce the strength of masonry, and may contribute to disintegration and cracking due to water penetration and subsequent freezing and thawing.

A uniform bed of mortar should be spread over only a few brick, and furrowed lightly, if at all. Filled joints result when plenty of mortar is placed on the end of the brick to be laid and it is shoved into place so that mortar is squeezed out of the top of the head joint, as shown in Photo 1. After placement, mortar squeezed out of bed joint should be cut off prior to tooling, as shown in Photo 2. When placing closures, plenty of mortar is needed on the ends of brick in place and on the ends of the brick to be laid. The closure should be shoved into place without disturbing brick on either side, as shown in Photo 3.

Bed Joints. A bed joint is the horizontal layer of mortar on which a brick is laid. The length of time between placing the bed joint mortar and laying the succeeding brick influences the resulting bond. If too long a time elapses, poor extent of bond will result. Brick should be laid within 1 minute or so after the mortar is placed.

For solid brick, bed joints should be constructed without deep furrowing of the mortar, as full bed joints (covering the entire bedding surface) are an inherent requirement for water-resistant brick masonry construction. For hollow brick, bed joints may be laid with face shell bedding (mortar placed only on the front and back face shells). Both face shells must be completely covered with mortar.

Photo 1
Shoving Brick into Place

Photo 2
Cutting Excess Mortar

Photo 3
Placing the Closure

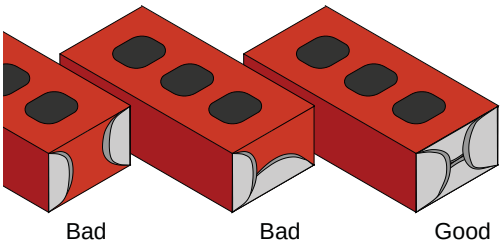

Figure 4
Head Joints

Head Joints. A head joint, sometimes called a cross joint, is the vertical mortar joint between two brick. For both solid and hollow brick it is important that head joints be completely filled. The best head joints are formed by completely buttering the ends of the brick with mortar and shoving the brick into place against previously laid brick.

Photo 4
Concave Mortar Joints

Photo 5
"V" Mortar Joints

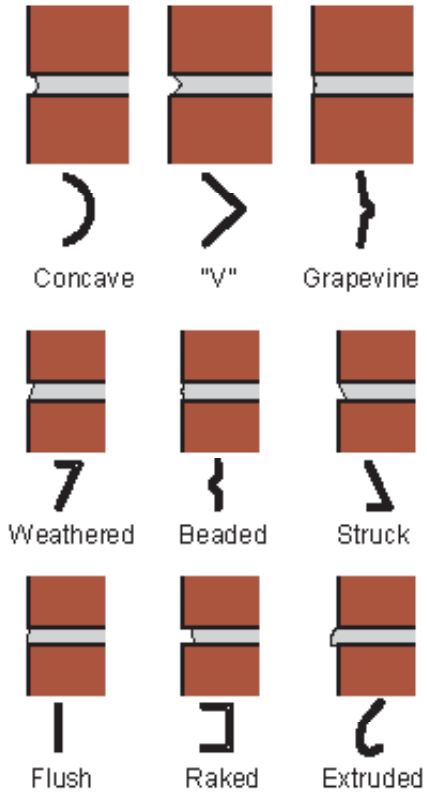

Figure 5
Typical Mortar Joints

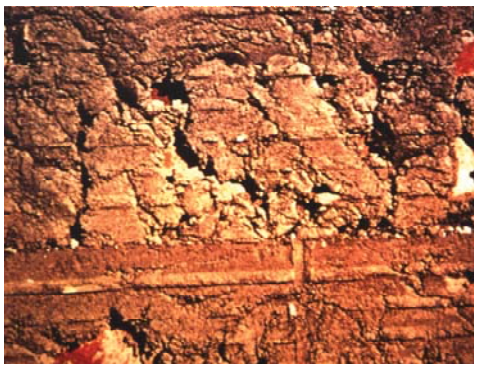

Photo 6
Poorly Filled Collar Joint

"Slushing" ("throwing" mortar into the joint with the edge of a trowel) does not adequately fill joints or compact the mortar, resulting in joints that are less resistant to water penetration. The results of head joint forming are shown in Figure 4.

Tooling of Mortar Joints

Proper tooling, or "striking", of mortar joints helps seal the wall surface against moisture penetration. Mortar joints should be tooled when they are "thumbprint" hard, (pressing the thumb into the mortar leaves an indentation, but no mortar is transferred to the thumb) with a jointer slightly larger than the joint. It is important that joints are tooled at the appropriate time as this affects both their effectiveness and appearance. Joints that are tooled too early often smear and result in rough joints. If tooling is delayed too long the surface of the joint cannot be properly compressed and sealed to the adjacent brick. Each portion of the completed brickwork should be allowed to set for the same amount of time before tooling in order to ensure a uniform mortar shade. Early tooling often results in joints of a lighter color. Later tooling results in darker shades.

Concave, "V" and grapevine joints best resist water penetration in exterior brickwork. These joints produce a more dense and weathertight surface, as the mortar is pressed against the brick, as shown in Photos 4 and 5. For interior masonry work, other joints such as the weathered, beaded, struck, flush, raked or extruded joints shown in Figure 5 can also be used.

Collar Joints

The vertical, longitudinal joint between wythes of masonry is called a collar joint. The manner in which these joints are filled is very important. Grouting is the most effective method of ensuring that collar joints are completely filled. However, grouting spaces less than ¾ in. (19.1 mm) is not permitted. Mortar protrusions (fins) that extend more than ½ in. (12.7 mm) into a cell or cavity that will be grouted must be removed prior to grouting. For mortar-filled collar joints, the outer face of the inner masonry wythe should be parged and the back of brick in the exterior wythe buttered in order to fill the collar joint.

"Slushing" of collar joints is not effective since it does not completely fill all voids in the joint, as shown in Photo 6. Frequently, the mortar is

caught and held before it reaches the bottom of the joint, leaving openings between the face brick and the backing. Even when this space is filled, there is no way to compact the mortar. The mortar does not bond with the brick over its entire surface and channels are left between the mortar and the brick. Some of these channels may allow water to reach the back of the wall. A properly constructed collar joint is completely filled with grout or mortar.

Parging

Parging is the process of applying a coat of portland cement mortar to masonry. Parging the outer face of the inner wythe of a multiwythe wall with Type M or S mortar as damp proofing may help resist rain penetration and can also reduce air leakage. Membranes or liquid-applied materials usually provide superior performance to parging, which will crack if the wythe cracks. However, parging can provide a smooth base for these materials. If parging alone is to resist water penetration, proper curing is necessary to reduce shrinkage cracks. Parging the back side of the exterior wythe is not recommended for drainage-type walls, as this may result in more debris in the air space or break the brick/mortar bond.

The face of the wall to be parged must not have any mortar protrusions. Protruding mortar can cause bond breaks in the parge coat, resulting in a leaky wall. When applied in multiple layers, each should be a minimum thickness of ¼ in. (6.4 mm). The first coat should be allowed to partially set, roughened, and allowed to cure for 24 hours. It is then moistened for application of the second coat. The parged surface should be troweled smooth so that it sheds water easily. When completed in adjacent areas, the edges of the parging should be feathered and new parging should overlap existing parging by a minimum of 6 in. (152 mm). Lap joints should be spaced no closer than 6 feet (1.83 m).

Keeping Air Spaces Clean

In a drainage wall system, such as a cavity wall or an anchored veneer wall, it is essential that the air space be kept clean. If it is not, mortar droppings may clog the weeps, protrusions may span the air space and water penetration to the interior may occur.

To the greatest extent possible, mortar droppings should be prevented from falling into the air space or cavity. An aid to prevent this is to bevel the bed joint away from the air space or cavity, as shown in Figure 6. When brick are laid on a beveled bed joint, a minimum of mortar is squeezed out of the joint, as shown in Photo 7. The mortar squeezed from the joints on the air space or cavity side may be troweled onto the units. This same procedure may be used for laying the exterior wythes of grouted and reinforced brick cavity walls.

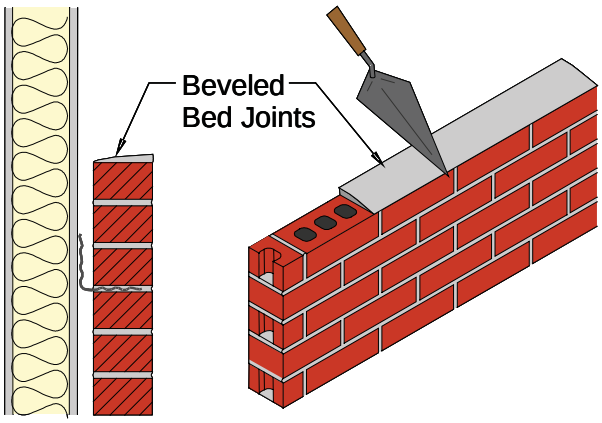

Figure 6
Beveled Bed Joints

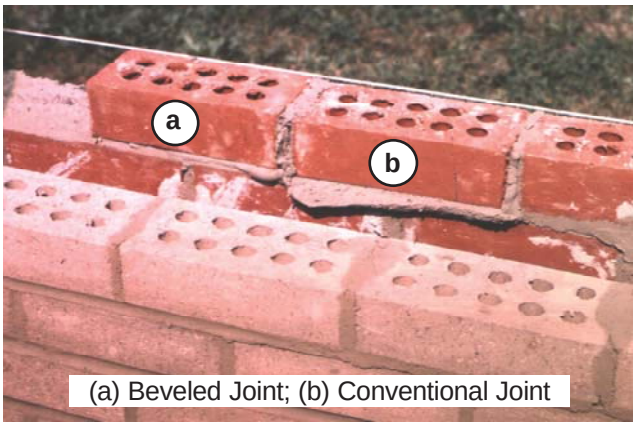

Photo 7
Beveled and Conventional Mortar Joints

Another method allows access to the base of the cavity for cleaning. When the brickwork is initially constructed, every third brick or so in the course above the flashing of the exterior wythe is omitted. Once the brickwork is complete, mortar droppings at the base of the cavity can be easily removed and weeps provided when the omitted brick are placed in the wall with mortar.

Alternately, a wooden or metal strip, slightly smaller than the cavity width, can be placed in the air space. This strip rests on the wall ties as the wall is built. Wire or rope is attached to the strip so the strip can be lifted out as the mason builds the wall. Care should be taken when raising or removing the strip to not disturb the brickwork.

Drainage materials and mortar dropping control devices may also be used to keep the air space adjacent to the weeps free from mortar. Use of these devices does not guarantee that bridging of the air space will not occur, thus the amount of mortar droppings should be limited as much as possible.

Disturbance of Newly Laid Masonry

Newly laid brick should never be pushed, shoved, tapped or otherwise disturbed once they are laid in their final position and the mortar has begun to set. Any disturbance at this point will break the bond and may lead to a leak. If adjustments are necessary, the incorrectly placed brick should be removed and re-laid in fresh mortar.

Protection of Unfinished Brickwork

Covering of masonry walls at the end of each work day, and especially in times of inclement weather, is essential for satisfactory performance. Covering unfinished walls with tarpaulins or other water-resistant materials, securely tied or weighted in position, should be rigorously enforced. Mortar boards, scaffold planks and light plastic sheets weighted with brick should not be accepted as suitable cover. Metal clamps, similar to bicycle clips, are commercially available in a variety of sizes to meet various wall thicknesses. These are used in conjunction with plastic sheets or water-repellent tarpaulins and offer excellent protection for extended periods of time.

Tops of walls should also be covered after the mason's work is finished if a permanent coping is not attached immediately after the brickwork is completed. Protection of openings in brickwork such as those for windows, movement joints, etc. should also be considered as they may allow moisture ingress from rain and snow and can lead to moisture-related problems such as efflorescence, and in some cases could affect the final mortar color.

SUMMARY

Quality construction practices and good workmanship are essential to achieve brickwork that is resistant to water penetration. This *Technical Note* does not cover all construction practices, but describes material storage and preparation procedures, construction practices and installation techniques that are indicative of high quality and, when combined with proper design, detailing and materials, result in brickwork that is resistant to water penetration.

> *The information and suggestions contained in this* Technical Note *are based on the available data and the combined experience of engineering staff and members of the Brick Industry Association. The information contained herein must be used in conjunction with good technical judgment and a basic understanding of the properties of brick masonry. Final decisions on the use of the information contained in this* Technical Note *are not within the purview of the Brick Industry Association and must rest with the project architect, engineer and owner.*

REFERENCES

1. *The BDA Guide to Successful Brickwork*, Second Edition, The Brick Development Association, Arnold (a member of the Hodder Headline Group), London, England, 2000.
2. Drysdale, R.G., Hamid, A.A., and Baker, L.R., *Masonry Structures: Behavior and Design*, Second Edition, The Masonry Society, Boulder, CO, 1999.
3. Koski, J.A., "Waterproof the Backup Wythe," *Masonry Construction*, August 1992.
4. *Specification for Masonry Structures*, ACI 530.1-05/ASCE 6-05/TMS 602-05, The Masonry Society, Boulder, CO, 2005.

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

SECTION INCLUDES

A. Structural steel columns, beams, lintels, trusses, rod bracing, and other steel framing members.

B. Base plates, column anchor bolts,

C. Steel to steel connection bolts.

REFERENCES

A. ASTM A36, A992 –Structural Steel.

B. ASTM A53 – Grade B Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.

C. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.

D. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.

E. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.

F. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.

G. ASTM A325 - High Strength Bolts for Structural Steel Joints.

H. ASTM A490 - Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.

I. ASTM A500 – Grade B Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Rectangular Shapes.

J. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

K. ASTM A572 - High Strength Low Alloy Columbium-Vanadium Steel of Structural Quality.

L. ASTM F1554 – Anchor Rods

M. AWS A2.0 - Standard Welding Symbols.

N. AWS D1.1 - Structural Welding Code.

O. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings – Allowable Stress Design..

P. AISC - Specification for Architectural Exposed Structural Steel.

Q. SSPC - Steel Structures Painting Council.

SUBMITTALS

A. Shop Drawings:

1. Indicate dimensions, elevations, profiles, sizes, spacing, and locations of structural members, miscellaneous members, attachments, and fasteners.

2. Connections detailed fully.

3. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths and returns.

4. All truss connections shall be fully welded all around. All truss members shall be fully closed so as not to allow moisture to collect inside.

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

C. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. Perform Exposed Work in accordance with AISC - Specification for Architectural Exposed Structural Steel.

QUALIFICATIONS

A. Fabricator: Company specializing in performing the work of this Section with minimum five years documented experience.

B. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of North Carolina.

FIELD MEASUREMENTS

A. Verify that field measurements are as shown on Drawings.

PART 2 PRODUCTS

MATERIALS

A. Structural Steel Wide Flange Members: Certified to ASTM A992 (Fy = 50 ksi).

B. Plates, Angles, Bars: Certified to ASTM A36 (Fy = 36 ksi)

C. Rods: to ASTM A36 (Fy = 36 ksi)

D. Structural Tubing: ASTM A500, Grade B (Fy = 46 ksi).

E. Pipe: ASTM A53, Grade B (Fy = 35 ksi).

F. Bolts, Nuts, and Washers: ASTM A325.

G. Anchor Rods: F1554 Grade 50.

H. Welding Materials: AWS D1.1; type required for materials being welded.

I. Headed Shear Studs: ASTM A108 Type B, Fu = 60 ksi.

J. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7000 psi at 7 days.

K. Shop Applied Primer - Epoxy Finished Members: One coat of green solvent based inorganic zinc. Shop primer shall be certified to be compatible with the intumescent fireproofing and UL assemblies, and with epoxy systems as applicable and specified. Reference Section 09900.

L. Shop Applied Primer – Exposed and Intumescent Fireproofed Members: One coat of grey oxide alkyd. Shop primer shall be certified to be compatible with the intumescent fireproofing and UL assemblies, as applicable and specified. Reference Section 09900.

M. Shop Applied Primer – Cementitious Spray-on Fireproofed Members: Not required to be primed. Shop primer shall be certified to be compatible with the fireproofing UL assemblies.

FINISH

A. Prepare structural component surfaces required to be shop primed in accordance with SSPC SP-2, SP-3 or SP-6 as applicable for the final finish type. Reference Section 09900.

B. Shop priming is required for all building interior exposed to view structural steel members. Shop priming not required for structural steel members where steel is to be enclosed and concealed from view in walls and ceilings or encased in concrete or masonry. Shop primer shall be certified to be compatible with the intumescent fireproofing and epoxy systems and applicable UL assemblies. Apply sufficient primer to insure required dry film thicknesses specified. Reference Section 09900.

1. Members finished with epoxy systems: 2-3 mils DFT, SP-6 surface preparation
2. Members finished with alkyd systems: 2 mils DFT, SP-2 or SP-3 surface preparation

C. Unless otherwise noted, all exposed exterior structural steel members and steel framing shall be hot-dipped galvanized after fabrication to comply with ASTM A123 G60 standards, including but not limited to: steel pipe, structural steel columns (tubes or wide flanged), beams (tubes or wide flanged), connections, steel angle framing. Reference Section 09900 for paint primer and top coats.

D. Members to receive cementitious spray-on fireproofing are not required to be primed. Shop primer shall be certified to be compatible with the fireproofing UL assemblies.

E. Top flanges of beams receiving headed shear studs embedded within concrete shall not be primed.

F. Lintels in exterior walls shall be hot dip galvanized to G60 standards, after fabrication. All seams in built-up members to be hot dip galvanized such as beam and plate lintels shall be seal welded. Field paint lintels as per 09900.

PART 3 EXECUTION

EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify that lay down areas are sufficient, clean, level, and of sufficient strength and stability to support safely members and handling equipment.

HANDLING AND STORAGE

A. Provide proper equipment too safely off load material to prevent damage.

B. Provide adequate dunnage and skids to keep steel from getting muddy and dirty.

C. Store steel in such a manner to prevent the accumulation of water and debris.

D. Do not erect steel that is muddy or stained with any deleterious material. Clean steel if necessary before erection.

ERECTION

A Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

B. Do not field cut or alter structural members without approval of Architect/Engineer.

C. After erection, clean and prime paint welds, abrasions, and surfaces where shop primer has been disturbed, deteriorated or damaged.

D. All eaves shall be aligned to be straight and true. All joist extended ends at the eaves and all HSS outriggers at the gables shall be pulled into alignment and securely welded to the continuous edge plate or angle as applicable. Edge plates and angles shall be string lined for straightness.

E. Gable outriggers shall be accurately laid out to fit under the wide flute of the metal deck and shall be welded to the top of the affected joists. The metal deck shall be puddle welded to the top of the HSS outriggers at 12" o.c. in addition to welding to the supporting joists.

F. The bent plate ridge plate shall be aligned vertically and horizontally and shall be securely welded to the ends of the joist extended ends to form straight and level ridge.

G. The continuous eave bent plates and gable edge angles shall be butt welded straight and full strength at joints. Provide a break in the continuous bent plate and angle members over supports at maximum 40 foot intervals. The minimum length of these members shall be 20 feet. These break joints shall be over a support and shall be welded thereto.

H. Grout under column base plates to get full uniform bearing.

FIELD QUALITY CONTROL

A Field inspection will be performed by the Architect.

B. All connection bolts and field welds shall be inspected by an independent testing lab selected by the owner and paid by the contractor from the material testing allowance.

C. All steel beam to beam, beam to column, brace connections, and joist girder to column. Joists to joist girder, and joists to column connection bolts shall be tightened to AI5C turn of the nut criteria.

D. Shop welds and fabrication quality shall be certified by the materials testing laboratory. At the option of the lab the inspection may be conducted in the field after delivery or at the fabrication plant during fabrication and/or prior to shipment.

E. All structural steel members shall be inspected by the testing laboratory for sweep, camber, and twist to comply with ASTM A6 and AISC Code of Standard Practice for fabricated structural steel. Types of weld tests and frequency of tests shall comply with AWS D1.1 - Structural Welding Code, 2006 Edition.

F. All out of tolerance members shall be corrected prior to erection by the contractor.

G. All connections with misfitting bolts shall be field welded as directed by the inspector to fully compensate for the strength of the misfitting bolts.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.1 SECTION INCLUDES

A. Cold-formed structural metal stud framing at exterior and interior wall locations.

B. Framing accessories

1.2 REFERENCES

A. ASTM A36 Standard Specification for Carbon Structural Steel.
B. ASTM A123 Zinc (Hot—Dip Galvanized) Coatings on Iron and Steel Products.
C. ASTM A1003 Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic-Coated for Cold-Formed Framing Members.
D. ASTM A525 General Requirements for Steel Sheet, Zinc—Coated (Galvanized) by the Hot—Dip Process.
E. ASTM A591 Steel Sheet, Cold—Rolled, Electrolytic Zinc—Coated.
F. ASTM C645 Non-Load (Axial) Bearing Steel Studs, Runners (Track) and Rigid Furring Channels for Screw Application of Gypsum Board.
G. ASTM C754 Installation of Steel Framing Members to Receive Screw—Attached Gypsum Wallboard, Backing Board, or Water—Resistant Backing Board.
H. ASTM C1513 Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
I. COSP Specification for the Design of Cold-Formed Steel Structural Members, Code of Standard Practice.
J. GA 203 Installation of Screw Type Steel Framing Members to Receive Gypsum Board.
K. Metal Framing Manufacturers Association (MFMA) Guidelines for the Use of Metal Framing.
L. SSPC (Steel Structures Painting Council) Steel Structures Painting Manual.

1.3 SYSTEM DESCRIPTION

A. Metal stud framing system for exterior walls shall be 6” or 8" x 68 mil minimum structural studs, as noted on Drawings, as manufactured by Marino\Ware, Dietrich, Unimast, Clark Metal Framing Systems or approved equal. Refer to Drawings for metal stud sizes and thickness.

B. Refer to drawings for interior metal stud sizes and gages.

C. Design and size connection components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with the current North Carolina State Building Code wind loading requirements.

D. Maximum Allowable Deflection: 1/600 span.

E. System to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

F. Wall studs shall align in straight and true lines.

1.4 SUBMITTALS

A. Shop Drawings: Submit shop drawings to indicate plans, elevations, prefabricated work, component details, stud layout, framed openings, anchorage to structure, bracing, connection details, type and location of fasteners, weld lengths and locations, and accessories and finishes, or items required of other related work.

   Show and describe method for securing studs to tracks, splicing, and for blocking and reinforcement to framing connections.

B. Product Data: Provide manufacturer's product data and technical data sheets describing standard framing member materials and finish, product criteria, load charts, limitations.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

D. Delegated Design Submittals: Submit structural calculations as follows:

   a. Structural calculations for connections and attachments, prepared by manufacturer for approval, sealed by a professional engineer registered in the State in which the project is located.

   b. Description of design criteria.

   c. Selection of framing connection requirements.

   d. Verification of attachments to structure and adjacent framing components.

E. Welder's current certifications for light gauge metal framing.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with MFMA and ASTM C754.

1.6 QUALIFICATIONS

A. Manufacturer:

   a. Having [5] years of experience manufacturing components similar to or exceeding requirements of project.

   b. Having sufficient capacity to produce and deliver required materials without causing delay in work.

B. Manufacturer's Structural Engineer:

   a. Professional engineer registered in the state in which the project is located.

   b. Having a minimum of five years of experience with projects of similar scope.

C. Installer: Acceptable to the manufacturer, experienced in performing the work of this section with minimum five years documented experience, and specialized in installation of work similar to that required for this project.

D. Welders: Certified by the AWS within the previous 12 months.

1.7 COORDINATION

A. Coordinate with all trades the placement of components within the stud framing system to provide a totally sound and complete system installation ready to receive sheathing and wallboard.

PART 2: PRODUCTS

2.1 STUD FRAMING MATERIALS

A. Studs: ASTM A525, ASTM A591, cold rolled steel, channel shaped, punched for utility access

1. Depth: 8", 6”, 3 5/8", and as shown on the drawings.

2. Thickness: 68 mil minimum at 8" and 6” studs and 33 mil minimum 3 5/8” studs.

3. Width minimum 1 5/8" with 1/2" stiffening return both flanges.

B. Runners: Of same material and thickness as studs unless otherwise noted.

C. Furring and Horizontal CRC Bracing Members: Of same material as studs; thickness to suit purpose.

D. Vertical Deflection Clips and Tracks: Manufacturer’s standard clips and tracks, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to studs.

E. Fasteners: Stainless steel or zinc coated #12 pan head, self-drilling, self tapping screws.

F. Anchorage Devices: Powder actuated fasteners and screws as shown on drawings.

G. Touch Up Primer for Galvanized Surfaces: SSPC — Paint 20 Type I Inorganic.

2.2 JOIST FRAMING

A. Steel Floor and Ceiling Joists: Cold-formed steel joists, of web depths indicated on Drawings, as follows:

a. Type as indicated on Drawings.

b. Minimum Base Metal Thickness: As indicated on the Drawings.

c. Section Properties: As indicated on the Drawings.

B. Steel Joist Track: Cold-formed steel joist track, of web depths indicated, unpunched, with unstiffened flanges. Type as indicated on the Drawings. Minimum Base Metal Thickness: Match steel joists. Flange Width 1 1/4 inches, minimum.

2.3 ACCESSORIES

A. Framing Connectors:
   A. Type: Steel-framing accessories fabricated from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

   B. Provide accessories of manufacturer’s standard thickness and configuration, unless otherwise indicated, as follows:

1. Web stiffeners, solid blocking, utility angles, joist hangers, gusset plates, rigid clips, breakaway clips.

C. Anchors, Clips and Fasteners

1. Steel Shapes and Clips: ASTM A36/A36M and zinc coated by hot-dip process according to ASTM A123/A123M.

2. Cold-formed Steel Connections: ASTM A653/A653M, zinc coated by hot-dip process according to ASTM A123/A123M.

3. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E488.

4. Powder-actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E1190 and as indicated on the drawings.

5. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

6. Welding Electrodes: Comply with AWS standards.

7. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

8. Shims: Load bearing, high-density multimonomer plastic, non-leaching.

9. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.4 FABRICATION

A. Fabricate cold-formed metal framing and accessories assemblies of framed sections to sizes and profiles required; with framing members fitted, plumb, square, and true to line, reinforced, and with connections securely fastened, and braced to suit design requirements, in accordance with referenced specification standards, and manufacturer's written instructions, and requirements in this Section.

B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

C. Studs shall bear tightly against the top and bottom tracks.

D. Fabricate framing assemblies using jigs or templates.

E. Cut framing members by sawing or shearing; do not torch cut.

F. Fasten cold-formed metal framing members by welds, screw fasteners, clinch fasteners or rivets as standard with fabricator. Do not wire-tie framing members.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

c. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

2.5 FINISHES

A. Studs: Galvanize to G60 coating class (minimum) or as indicated on Drawings.

B. Tracks and Headers: Galvanize to G60 coating class (minimum) or as indicated on Drawings.

C. Accessories: Same finish as framing members.

PART 3: EXECUTION

3.1 EXAMINATION

A. Verify that conditions are ready to receive work.

B. Verify that rough-in utilities are in proper location, and coordinated with framing.

3.2 ERECTION

A. General:

1. Erect in accordance with ASTM C1007 and manufacturer's installation instructions.

2. Field Welding: Per AWS D1.3, and the following:

a. Stud-to-Track Connections: 1/2 inch (13 mm) fillet weld, full length of inside flange dimension, inside each flange of stud onto track web.

b. Other Connections: Flat, plug, butt or seam.

c. Minimum Steel Thickness for Welded Connections: 18 gauge.

d. Field Fastening: Minimum of 2 self-tapping metal screws per connection, unless otherwise indicated.

B. Wall Systems:

1. Align and secure top and bottom runners.

2. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

3. Install studs vertically uniformly at the spacings shown on the drawings.

4. Align stud web openings horizontally.

5. Secure studs to tracks using screws or welding.

6. Stud splicing not permissible.

7. Fabricate corners using a minimum of three studs.

8. Minimum double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings. Refer to drawings for additional jamb and head conditions.

9. Brace stud framing system rigid.

10. Coordinate erection of studs with requirements of doorframes, window frames, and; install supports and attachments.

11. Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.

12. Blocking: Secure wood blocking to studs. Secure steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, etc. as required by Architect.

13. Coordinate placement of insulation in stud spaces made inaccessible after stud framing erection.

14. Fabricate and install headers at openings as indicated on Drawings.

15. All multiple members shall be stitch welded together with 1" seam welds spaced at 16" oc maximum both sides of members to form a totally composite member. Multiple members in composite units shall not be spliced.

16. All connections not shown on the drawings shall be designed by the supplier to support the imposed loads.

17. Provide continuous 2” x 43 mil horizontal strap bridging at 48" maximum intervals on both flanges. Install with 1 screw per stud. Provide solid blocking using a piece of metal stud between studs at each end of bridging run and at 12' oc maximum. Terminate bridging at wall openings with solid blocking bridging as required.

18. Place one stud tightly against each side of the tubular steel columns in line with the wall. Align the face of stud flush with face of tubular columns for smooth finish application for dry wall and sheathing. Fasten stud to column with powder actuated fasteners spaced at 16" oc.

19. Touch-up field welds and damaged galvanized surfaces with primer.

C. Steel Joists:

1. Locate joist end bearing directly over load bearing studs or provide approved load-distributing member to top of stud track.

2. Provide web stiffeners at reaction points where indicated in drawings.

3. Provide joist bridging as shown in drawings.

4. Provide end blocking where joist ends are not otherwise restrained from rotation.

5. Place joists at maximum 12 inches on center and not more than 2 inches from abutting walls. Connect joists to supports using mechanical fastener method.

6. Touch-up field welds and damaged galvanized surfaces with primer.

3.3 ERECTION TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation of any Member from Plane: 1/4 inch.

C. Maximum Variation From Plumb: 1/4 inch in 10' height.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall consist of all labor and materials required to provide all miscellaneous fabricated metal items scheduled on Drawings and specified in this Section.

Miscellaneous metal items for which drawing information is fully descriptive that are not necessarily named herein, shall be provided as shown and as required, providing complete assemblies.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by Manufacturers listed for each item.

SUBMITTALS:

Shop Drawings: Submit shop drawings in quadruplicate to Architect in accordance with GENERAL CONDITIONS for approval of all fabricated miscellaneous items. Shop drawings shall indicate following: fabrication, assembly and erection details, sizes of all members, fastenings, supports, and anchors; patterns; clearances, and all necessary connection to work of other trades.

Catalog Cuts: For standard manufactured items, catalog cuts may be submitted as specified in GENERAL CONDITIONS, providing all technical performance characteristics and other pertinent information are given.

PRODUCT HANDLING:

Handling and Storage: Handle all materials carefully to prevent damage and store at site above ground in covered, dry locations.

Replacement: Damaged items that cannot be restored to like-new conditions shall be removed and replaced at no additional cost to Owner.

PART 2: PRODUCTS

BASIC MATERIALS:

Structural Shapes: ASTM A 36/A572 Dual Certified.

Steel Pipes: ASTM A 72 welded wrought iron pipe, standard weight, Schedule 40.

Steel Pipes: ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products

Steel Tubing: ASTM A 500, Grade B.

Cast Iron: ASTM A 48j, Class 30, with minimum tensile strength of 30,000 psi.

Zinc-coated iron or Steel Sheets: ASTM A 446.

Cold-rolled Carbon Steel Sheets: ASTM A 366-66.

Exterior Lintels: ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products

Metal Bar Grating: NAAMM A202.1 Metal Bar Grating Manual

Stainless Steel Sheet: Type #304

FABRICATION:

Measurements: Verify all measurements and take all field measurements necessary before fabrication.

Fasteners: Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with material to which fastenings are applied. Permanent connections shall be riveted, welded or bolted. Exposed welds shall be ground smooth and flush.

Components: Include materials and parts necessary to complete each item properly, even though such work may not definitely be shown or specified.

Provide and install miscellaneous bolts and anchors, supports, braces, and connections necessary for completion of work.

Drill or punch holes for bolts and screws. Poor matching of holes will be rejected. Conceal fastenings where practicable.

Painting and Protective Coating:

All ferrous metal, except stainless steel and galvanized surfaces, shall be properly cleaned and given one shop coat of red lead or zinc chromate primer.

Anchors built into masonry shall be coated with asphalt paint unless specified to be galvanized. Metal work to be encased in concrete shall be left unpainted unless specified or noted otherwise.

Where hot-dip galvanized or zinc-coated metal is specified or shown, it shall not be shop-primed unless specifically required otherwise for paint finish, which shall require bonderized or paint-grip primer. Recoat at all field welds and grindings, and where initial galvanized coating has been removed or deteriorated.

Galvanizing:

Hot-dip galvanizing or zinc coatings applied on products fabricated from rolled, pressed and forged steel shapes, plates, pipes, bars and strips shall comply with ASTM A 123-68.

Unless otherwise noted, all exposed exterior structural steel members and steel framing shall be hot-dipped galvanized after fabrication to comply with ASTM A123 G60 standards, including but not limited to: steel pipe, structural steel columns (tubes or wide flanged), beams (tubes or wide flanged), steel angle framing, connections. Reference 09900 Paint for paint primer and topcoats requirements.

Lintels in exterior walls shall be hot dip galvanized to ASTM A123 G60 standards after fabrication. Reference 09900 Paint for paint primer and topcoats requirements.

Exterior handrails shall be hot dip galvanized to ASTM A123 G90 standards, not less than .90 oz/square foot, after fabrication.

Exterior steel stair treads, unless otherwise noted, shall be hot dip galvanized to ASTM A123 G90 standards, not less than .90 oz/square foot, after fabrication.

Steel bar grating, unless otherwise indicated shall be hot dip galvanized to ASTM A123 G90 standards, not less than .90 oz/square foot, after fabrication.

MISCELLANEOUS ITEMS:

Supplementary Structural Steel: All structural framing incorporated in building design and detailed on Architectural Drawings, but not shown on Structural Steel Drawings, shall be furnished as part of miscellaneous metal work.

Miscellaneous Lintels, Shelf Angles, Beams and Plates, Brackets: Provide miscellaneous lintels and shelf angles, beams, plates, and brackets as indicated.

Lintels shall have 8" bearings at each end unless shown otherwise.

Weld or bolt members together where so indicated, to form complete composite assembly. Set beams on plates as indicated.

Where shelf angles are attached to concrete with bolts and adjustable inserts, provide slotted holes of proper size and spacing in vertical leg of shelf angles.

Miscellaneous Fasteners: Furnish all bolts, nuts, anchor bolts, plates, anchors, ties, clamps, hangers, nails, spikes, screws, straps, toggle and expansion bolts, and other items of rough hardware of sufficient size and number to tie together various parts of building and secure all of its parts in place. Such miscellaneous items shall be of same material as metals they contact.

Supports, Bracing:

Furnish and install all bracing and suspension type supports, fastened to structure, for following and additional conditions, as may be required.

1. Exterior soffits

2. Head of exterior doors and window wall

Steel Bar Grating: Provide galvanized steel bar gratings, cat-walk type, where indicated on Drawings, in accordance with ASTM A36/A36M and NAAMM A202.1 Welded. Steel bar gratings shall be hot dip galvanized to ASTM A123 G90 and ASTM A525 G90 standards. Top surface shall be serrated. Provide complete assemblies, that include all required accessories in matching galvanized materials; to include but not limited to: Fasteners and J-hooks, perimeter closures, and edge banding. Anchor in place by welding, and weld joints of intersecting metal sections. Touch up all cuts and welds with SSPC 20 Type I Inorganic, zinc rich primer.

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Handrails: Provide pipe handrails as detailed, fabricated from 1-1/2 O.D. pipe. Weld all joints and grind smooth. Fabricate entire assembly carefully in accordance with details. After installation, use wire brush, sand blast, or otherwise treat to provide completely smooth surface for application of paint. Interior wall

handrails consist of straight sections of black steel pipe, mounted on wall brackets. Install brackets with approved anchoring device. Close ends with molded end closures.

All exterior handrails shall be G-90 hot dipped galvanized. All welds and grindings to be recoated on site with a field applied galvanizing coating to match.

Ladders: Where indicated, vertical wall mounted interior ladders shall be 20" wide, fabricated with 3/8"x 1-1/2" hot-rolled rails and 3/4" round steel rungs extending through rails with connection welds, provided at all roof hatch locations. Space rungs 12" o.c. Anchor ladders at bottom and top. Brackets shall be of same size as side rails and of such length as to hold ladder 7" away from wall.

Exterior ladders shall be G-60 hot-dipped galvanized.

PART 3: EXECUTION

WORKMANSHIP:

Ferrous metal surfaces shall be clean and free from mill scale, flake rust and rust pitting; well formed and finished to shape and size, with sharp lines and angles and smooth surfaces.

Castings shall be of uniform quality, free from blow-holes, porosity, hard spots, shrinkage distortion or other defects. Castings shall be smooth and well cleaned by shot-blasting or other approved method. Covers subject to street or foot traffic shall have machined horizontal bearing surfaces. Provide machined bearing or contact surfaces for other joints where indicated or required.

COORDINATION: At proper time, deliver and set in place items of metal work to be built into adjoining construction.

PAINTING: Finish painting of items not factory painted shall be as specified in Section 09900.

STEEL FRAMED STAIRS:

GENERAL: Construct stairs to conform to sizes and arrangements shown; joint pieces together by welding unless otherwise indicated. Provide complete stair assemblies including metal framing, hangers, columns, railings, newels, balusters, struts, clips, brackets, bearing plates and other components necessary for the support of stairs and platforms and as required to anchor and contain the stairs on the supporting structure. Certify with drawings bearing the seal of an N. C. Registered Engineer indicating capacity to support 100 p.s.f. uniform live load or 300 pound concentrated load as required by code.

EXTERIOR STEEL FRAMED STAIRS: Exterior steel framed stairs, ships ladders, ladders shall be finished in ASTM A123 G60 hot dip galvanized. Treads shall be G90 hot dip galvanized.

STAIR FRAMING: Fabricate stringers of structural steel channels, or plates, or a combination thereof, as shown. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as shown. Bolt or weld headers to strings and newels and framing members to strings and headers; fabricate and join so that bolts, if used, do not appear on finish surfaces.

METAL PAN RISERS, SUBTREADS, AND SUBPLATFORMS: Shape metal pans for risers and subtreads to conform to configuration shown. Provide minimum 12 gage thickness of structural steel sheet for metal pans indicated but not less than that required to support total design loading.

Form metal pans of hot-rolled or cold-rolled carbon steel sheet, unless otherwise indicated.

Attach risers and subtreads to stringers by means of brackets made of steel angles or bars. Weld brackets to strings and attach metal pans to brackets by welding, riveting or bolting.

Provide subplatforms of configuration and construction indicated, or if not indicated, of same metal as risers and subtreads and in thickness required to support design loading. Attach sub platform to platform framing members with welds.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall be to provide expansion control joint covers as shown on Drawings and specified in this Section.

Building expansion joints with joint covers specified (walls, floors and ceilings) are required at all locations where enclosed connectors meet building units.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section, refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purpose of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured by the C/S Group Company. Other Manufacturers who can furnish products or systems of same materials specified and equal in all respects will also be acceptable, such as Architectural Art Mfg., Balco, Inc., and M M Systems.

SUBMITTALS:

Manufacturer's Data: Submit three (3) copies of folder containing complete Manufacturer's data and installation procedures for all products to be used in work of this Section.

Shop Drawings: Submit Shop Drawings in compliance with GENERAL CONDITIONS. These drawings shall be coordinated with adjacent work.

PRODUCT HANDLING:

Working Areas: Provide suitable areas for storage of materials and equipment.

Delivery: Deliver products to site in original sealed containers or packages bearing Manufacturer's name and brand designation.

PART 2: PRODUCTS

FLOOR JOINT COVERS: Balco, Inc. Model 75FPE-1 Series or C/S Group Model SJPW Series. Coordinate with finish floor material. Floor to floor units to be complete with extruded aluminum frames, center plates and cover plates extruded from 6063T5 alloy. Frames to be anchored to slab with 1/4” (6.25 mm) diameter expansion bolt anchors. Flexible vinyl expansion filler. Floor joints to be coordinated to provide alignment with wall and ceiling expansion joint covers. All aluminum surfaces in contact with masonry shall receive a shop coat of zinc chromate primer.

WALL JOINT COVERS: C/S Group Model ASM-100 or ASM-100 W/FB Series. Extruded aluminum cover plates and snap-lock anchor clips to be 6063-T52 alloy. Cover plate to be supplied with continuous duroflex seal. Snap-lock anchor shall be secured 24" O.C., complete with serrations to assure positive adjustable anchorage. Finish shall be satin clear anodize, prime coat for field painting, Medium , dark Bronze or Kynar 500 colors, to be selected by Architect to suit condition of use.

CEILING JOINT COVERS: C/S GROUP MODEL HC OR HCW. Cover shall be dual durometer P.V.C. The vertical legs shall be a rigid material for positive anchoring. The exposed bellows shall be a flexible P.V.C. to allow for expansion and contraction of the joint cover. Color to be white.

PART 3: EXECUTION

INSPECTION

Examine all surfaces to which products are scheduled to be installed. If unsatisfactory conditions exist, report to General Contractor and do not proceed with work until conditions have been satisfactorily corrected.

INSTALLATION

Install expansion joint covers at locations indicated on Architectural and / or Structural Drawings and at all locations where enclosed connectors meet building units, in accordance with Manufacturer's printed instructions and Shop Drawings, approved by Architect.

All installations shall be performed by capable workmen under direction of foreman fully qualified by experience in each respective field of installation work.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall consist of all labor and materials required to provide all rough carpentry work scheduled on Drawings and specified herein.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

CODE COMPLIANCE:

All framing to comply with the current edition of the Building Code having jurisdiction in North Carolina.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality of work under this Section, drawings and Specifications are based on products manufactured or furnished by Manufacturer listed for each product.

COORDINATION WITH OTHER TRADES: Coordinate locating of nailers, furring, grounds, and similar supports for other trades so that installation of finish work may be properly executed to fulfill design requirements.

MOISTURE CONTENT OF LUMBER: Maximum moisture content for lumber products shall be 19 percent on air dried stock, and 15 percent maximum on kiln-dried (KD) stock.

DRESSED LUMBER: Surface lumber four sides (S4S) unless specified otherwise for particular products.

DELIVERY AND STORAGE: As soon as materials are delivered to site, place under cover and protect properly from weather. Do not store or erect material in wet or damp portions of buildings or in areas where plastering or similar work is to be executed until such work has been completed and has become reasonably dry.

PART 2: PRODUCTS

FRAMING LUMBER

Various materials for framing shall be of sizes shown and shall conform to Grading Standards of SPIB. All framing material shall be #2 SYP.

Where indicated on the Drawings, provide FRT Fire Retardant Treated lumber.

PLYWOOD or ORIENTED STRAND BOARD MATERIALS: Softwood plywood or OSB sheathing shall conform to requirements of U. S. Product Standard PS 1-66, Construction and Industrial. All plywood or

OSB sheathing which has any edge or surface permanently exposed to weather shall be "EXTERIOR" type.

Where indicated on the Drawings, provide FRT Fire Retardant Treated plywood.

Where indicated on the Drawings, provide PT Preservative Treated plywood.

PRESERVATIVE TREATED WOOD PRODUCTS: Protective pressure treatment of lumber or products shall be .40 pcf retention of chromated copper arsenate as produced by Wolman, Osmose, Boliden or approved equal. Material shall be treatment grade marked, for ground contact, kiln dried not to exceed 19%, and all cut ends shall be coated with the same preservative, at job site during construction.

All lumber products in contact or fastened to concrete, concrete masonry or brick masonry to be preservative treated wood products.

FASTENING DEVICES: Anchors and fasteners for securing wood items, unless noted otherwise, shall meet following requirements:

Bolts:

- Bolts, nuts, studs and rivets shall conform to Federal Specifications FF-B-571a and FF-B-575, as applicable.
- Lag screws or lag bolts: Federal Specification FF-B-561b.
- Toggle Bolts: Federal Specification FF-B-588b.
- Screws: Federal Specification FF-S-111b.
- Nails and Staples: Federal Specification FF-N-105a.

All fastening devices used in exterior or concrete construction shall be hot-dip galvanized.

All fastening devices used in Fire Retardant Treated or Preservative Treated lumber and plywood to be corrosion resistant per manufacturer's recommendations.

Ground Anchorage: Wood plugs or nailing blocks are not acceptable for fastening grounds, furring, or blocking to concrete or masonry. Hardened steel nails, expansion screws, toggle-bolts, metal plugs, or metal inserts, as most appropriate for each type of masonry or concrete construction shall be used.

Explosive-Driven Fastenings: Explosive or powder-driven fastenings may be used only when approved by Architect.

PART 3: EXECUTION

GENERAL REQUIREMENTS FOR FRAMING AND BRACING:

Finish: Unless otherwise indicated, use S4S lumber for all framing members.

Size: Unless otherwise indicated, framing shall conform to nominal size requirements shown on Drawings.

Space framing on 16 inch centers, unless shown otherwise on Drawings.

Install required blocking, bracing, or other framing required for support of built-in equipment,

including casework.

INSTALLATION OF WOOD GROUNDS:

Location: Install permanent and temporary wood grounds as indicated for proper execution of work of all trades. Remove temporary grounds when no longer required.

Fastening: Except as otherwise required for special locations, form grounds of kiln-dried southern yellow pine, 1-1/2 inches wide, and of thickness to properly align related items of work. Securely fasten grounds into position by means of nails, brads, bolts, or other methods that will provide maximum results.

Coordination: Coordinate locations, sizes and fastenings of grounds with work of other trades. When grounds are to provide backing for fastening of grilles, fixtures, louvers, and similar items of work, exercise care in installation of grounds to provide for correct installation of those other items of work.

INSTALLATION OF WOOD BLOCKING:

Location: Install all wood blocking required to provide anchorage for other materials. Form to shapes and sizes as indicated or as may be required to accomplish particular installation. Form blocking of sizes shown or of minimum 2 inch thick nominal material.

At location of wall mounted equipment install 2"x 8" blocking unit between properly located studs at height indicated in Finish Hardware Schedule, or where indicated for wall mounted equipment. Install wood blocking behind all cabinets and toilet accessories as required.

Steel: Blocking in conjunction with steel work shall be bolted to steel with bolts, washers and nuts, countersunk where required.

Roofing: Form blocking in conjunction with gravel stops and built-up roofs to shapes as detailed. Anchor with countersunk bolts, washers and nuts.

Anchorage: Wedge, anchor and align blocking to provide rigid and secure installation of both blocking and other related work.

INSTALLATION OF WOOD FURRING:

Location: Provide all free-standing, suspended, solid-anchored, and other types of wood furring as required for receipt, alignment and complete installation of various types of finishing materials.

Spacing: Space furring members as required. Provide headers and other nailing members within furring framework. Install with faces true to line and plumb, using wood shims as necessary.

Fastening: Install furring into position by whatever means required to provide secure, rigid, and correct installation. When necessary, use nailing plugs, power-actuated anchors, toggle bolts, anchor bolts, washers and nuts, nails, and similar fastenings.

CLEANING UP: At completion, remove all excess materials and all debris resultant from operations of work of this Section. Leave entire work in neat, clean condition, satisfactory for receipt of other related items of work to be installed as part of work of other Sections.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall include furnishings all labor and materials required to provide all finish carpentry and millwork, as scheduled on Drawings and as specified herein.

Work Included This Section:

All finish carpentry, cabinetwork, and millwork, as identified on Drawings, which shall include, but not necessarily be limited to the following:

1. Cabinets (base and wall hung)
2. Interior wood trim and paneling.
3. Work Counters
4. Shelves and Slatwall
5. Hanging all wood doors as scheduled. Doors will be fabricated prefit.

Furnish all millwork and cabinet work, deliver to building, assemble, level, secure to floors and/or walls, as shown on Drawings, equipment schedule, Specifications, and processed Shop Drawings.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI), except as otherwise indicated.

QUALITY CONTROL:

Millwork Contractor shall be approved by Architect on basis of quality of work performed during at least 10 years of manufacturing, capability to meet requirements of these specifications, reputation of performing satisfactory work on time, and completion of at least three satisfactory installations of projects of comparable size.

SUBMITTALS:

Shop Drawings: Submit shop drawings in accordance with GENERAL CONDITIONS on all items fabricated for this Project. Shop Drawings shall locate all grounds, blocking, and other anchoring devices required to properly secure the work.

Do not fabricate millwork until final Shop Drawings have been processed by Architect. Reviewing and processing shop drawings by Architect does not relieve Contractor of checking and verifying job dimensions and conditions required by details on processed Shop Drawings and Contract Drawings.

Reviewing and processing shop drawings by Architect does not authorize changes. No changes will be made without explicit written authorization.

Samples: Submit samples of following items for approval by Architect prior to preparation of Shop Drawings and deliver to Project Site.

- Submit complete and current plastic laminate colors and patterns sample chain from Formica, that includes samples of all standard and premium textures and patterns options.
- Submit complete laminate colors/pattern/textures chains from Formica, Nevamar, and Wilsonart, chains from all three manufacturers, for Architect to select from.
- Submit complete and current colors and patterns sample chain of PVC edgeband.
- Cabinet door and drawer, showing constructions.
- Shelving Wood trim countertop and backsplash (plastic laminate clad)

PRODUCT HANDLING:

Delivery: Do not deliver millwork items to job site until building is sufficiently conditioned to prevent damage by moisture, dampness, excessive humidity, extreme dryness, extreme heat or cold.

Storage: Store millwork in enclosed areas having same temperature and humidity conditions as areas in which millwork will be installed.

Damaged Items: Remove from site immediately all items damaged due to improper handling or storage.

ENVIRONMENTAL CONDITIONS:

Building Conditions: Install millwork only when normal temperature and humidity conditions approximate interior conditions that will exist when building is occupied.

Glazing shall be in place, and all exterior openings closed. All concrete, plastering, and other wet work shall be completed and dry.

Heat and Ventilation shall be provided to maintain proper conditions before, during and after completion of installing casework.

FIELD MEASURING AND COORDINATION:

Before fabrication begins, inspect and field measure all areas to receive work, as follows:

Field measure areas where the work is to be installed.

Field coordinate with adjacent electrical and data outlet locations, and adjacent equipment locations, prior to rough-in of electrical devices.

PART 2: PRODUCTS

MATERIALS:

General: Except as otherwise indicated, comply with following requirements for architectural woodwork not specifically indicated as prefabricated or prefinished standard products.

Wood Moisture Content: Provide kiln-dried (KD) lumber with an average moisture content range of 9% to 13% for exterior work and 6% to 11% for interior work. Maintain temperature and relative humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed the following:

Interior Wood Finish: 8% - 113% for damp regions (as defined by AWI).

Interior Wood for Transparent Finish:

Solid Wood: Plain-sawn premium clear red oak.

Plywood: Plain sliced premium clear red oak.

Plastic Laminate: Comply with NEMA LD-3 for type (vertical and horizontal grades), thickness, color, pattern, finish and textures indicated for each application, or if not indicated, as selected by the Architect from the manufacturer's complete line of colors and patterns, and from the manufacturer's complete line of standard and premium textures options.

Manufacturer:

Standard: For purpose of designating type and quality for plastic laminate work under this Section, Drawings and Specifications are based on products manufactured by Formica.

The basis of design is Formica's complete line of plastic laminate colors and patterns, including all of Formica's complete line of standard and premium textures options.

Submit complete and current laminate color/patterns/textures sample chains from Formica, Nevamar, and Wilsonart, all three manufacturers, for Architect to choose from.

Provide exterior grade plywood or water-resistant resin impregnated composition board countertops at all locations with a sink. Use CD exterior grade veneer plywood, fabricated with water resistant glues and adhesives.

Quality Standards: For following types of architectural woodwork; comply with indicated standards as applicable:

Casework and Countertops: AWI Section 400.

Shelving: AWI Section 600.

Design and Construction Features: Comply with details shown for profile and construction of architectural woodwork; and, where not otherwise shown, comply with applicable Quality Standards, with alternate details as Fabricator's option.

Solid Surface Countertops and Benches: Where Corian Solid Surface countertops or benches are indicated on Drawings, provide ½" Corian or equal solid surfacing material. Architect to select from manufacturer's full range of colors and patterns.

Laminated Slatwall Paneling: Where indicated on Drawings, provide 3/4 inch thick medium density fiberboard paneling, laminated with high pressure laminate, grooved to receive standard-sized fixture mounting brackets for display. Color to be selected from panel manufacturer's standard options. Grooves shall be lined with powder coated extruded aluminum inserts, color selected by Architect.

Slatwall Display Accessories: Provide 4 rows of 12" deep x ¾" thick melamine slatwall shelving, with all necessary shelf brackets, for complete shelving assemblies. Provide (2) 25-count packs of assorted slatwall peg hooks; one pack with assorted 2", 4", 6" sizes, and one pack with assorted 8", 10", 12" sizes.

INTERIOR ARCHITECTURAL WOODWORK:

Wood Casework, Transparent Finish or Plastic Laminate Clad

AWI Section: 400

Grade: Custom, with book matching of adjoining leafs with transparent finish

Construction: Reveal Overlay.

CABINET HARDWARE AND ACCESSORY MATERIALS:

Hardware Standards: Except as otherwise indicated, comply with ANSI A 156.9 "American National Standard for Cabinet Hardware". Millwork Contractor to provide slides, dual hinges, catches, standards, brackets, locks, and pulls as shown and required.

Drawer and Door Pulls: Hafele No. 151.33.203, cast aluminum, brushed finish.

Catches: Heavy-duty roller ball catches.

Catches for Tall Cabinet Door Pairs: EPCO Heavy-Duty Elbow Catch, spring-loaded, in bright nickel finish, manufactured in solid brass, with slotted screw adjustment holes.

Hinges: Reveal overlay, 5-knuckle, non-removable pin, institutional hospital type, brushed nickel finish, by Terry or Rockford Process Control, or equivalent.

Edge Band: 3mm PVC, unless indicated otherwise, exposed or concealed.

Unless otherwise noted, all edges shall be banded with 3mm PVC, with all PVC banding edges eased with radiused edges.

Shelving Edge Band: Provide 3mm PVC edgebanding of shelves on front and rear edges only, with 1mm PVC edgebanding on remaining two side edges.

Countertop Support Bracket: Wall mounted bracket, powder coated A-36 steel angle, 3/8” thick x 2.5” with beveled edges, with integral steel gusset. Mount with masonry expansion anchors at masonry support wall. Equivalent to model Front Mounting PLUS Brackets by Centerline Brackets.

Glass shall be Grade A, double strength, where scheduled.

Stainless steel sinks will be furnished and installed by Plumbing Contractor in countertop openings provided by Millwork Contractor.

PART 3: EXECUTION

INSPECTION OF SURFACES:

Inspection: Before installation begins, inspect all areas to receive work, as follows:

Field measuring areas where the work is to be installed.

For any deficiency which might prevent satisfactory installation of cabinetwork, millwork, or hanging wood doors, including coordination with adjacent electrical and data outlet, and adjacent equipment locations.

For presence and proper positioning of grounds and other anchoring devices built into work as required by approved millwork Shop Drawings.

Acceptance of Surfaces: Do not start fabrication or work until deficiencies of surfaces to receive work have been corrected. Beginning of installation in any area shall constitute acceptance of that area as satisfactory to receive this work, and shall constitute acknowledgement that all areas have been field measured, and all coordination with adjacent systems have been performed. Contractor shall be fully accountable for final results and workmanship specified herein.

INSTALLATION:

Cabinetwork:

Install all cabinetwork in place, level, plumb, and accurately scribed and secured to wall and/or floor, as shown on Shop Drawings approved by Architect.

Wall cabinets shall be fastened using ¼" diameter lag bolts in lead shields with chrome finish washers @ 24" maximum spacing, minimum of 4 anchors per wall hung cabinet section, 2 anchors across top and 2 anchors across bottom.

Base cabinets shall be fastened using ¼" diameter lag bolts in lead shields @ 24" maximum spacing, minimum of 4 anchors per cabinet section.

Installation shall be complete, including all trim and fillers required.

At completion of installation leave all cabinets clean and free of defects.

Wood Doors:

Hang all wood doors according to Door Schedule and Shop Drawings approved by Architect.

Leave each door neatly hung, swinging easily, and performing all functions intended by finish hardware schedule.

CLEANUP: At completion of all Finish Carpentry, Cabinetwork and Millwork installations clean up all areas in which work was performed and leave ready for installation of related work.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall consist of furnishing all labor and materials required to insulate exterior walls, exterior stud/brick cavity walls, interior stud walls, foundations, interior ceilings, and all locations shown on Drawings and as specified herein.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

QUALITY ASSURANCE:

Extent of insulation work is shown on drawings and indicated by provisions of this section.

Applications of insulation specified in this section include the following:

- Foundation and underslab wall board insulation (supporting backfill)
- Cavity Wall foam wall board insulation
- Spray Applied Polyurethane Insulation
- Ceiling fiberglass blanket Insulation.
- Sound Attenuation Batt Insulation (install at all interior metal stud / gypsum wallboard partitions, and where indicated on Drawings)
- Exterior Below Grade Waterproofing

QUALITY ASSURANCE:

Thermal Conductivity: Thicknesses indicated are for thermal conductivity (k-value at 75 degrees F or 24 degrees C) specified for each material. Provide adjusted thicknesses as directed for equivalent use of material having a different thermal conductivity. Where insulation is identified by "R" value, provide thickness required to achieve indicated value.

SUBMITTALS:

Product Data: Submit manufacturer's product specifications and installation instructions for each type of insulation and vapor barrier material required.

PRODUCT HANDLING:

General Protection: Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2: PRODUCTS

FOUNDATION WALL AND UNDERSLAB BOARD INSULATION:

Extruded Polystyrene Board Insulation: Where indicated on Drawings, provide rigid, closed-cell, extruded polystyrene insulation board with integral high-density skin and tongue and groove edges; complying with ASTM C578, Type IV, 25 psi compressive strength, R-value of 5.00 @ 75 degrees F mean temperature; 0.1% maximum water absorption; 1.5 perm-inch max. water vapor transmission; in manufacturer's standard lengths and widths.

Maximum ASTM E84 flame spread of 15, and Smoke Development of 165.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work included, but are not limited to the following:

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

- Dupont Styrofoam XPS
- Owens Corning Foamular

Mechanical Anchors: Type and size as recommended by insulation manufacturer for type of application and condition of substrate.

Adhesive Mastic: Type, size and spacing for each condition as recommended by insulation manufacturer for type of application and condition of substrate.

Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints between units and filling voids in work.

CAVITY WALL FOAM BOARD INSUALTION

Extruded Polystyrene Board Insulation: Where indicated on Drawings, provide rigid, closed-cell, extruded polystyrene insulation board with integral high-density skin and tongue and groove edges; complying with ASTM C578, Type IV, 25 psi compressive strength, R-value of 5.00 @ 75 degrees F mean temperature; 0.1% maximum water absorption; 1.5 perm-inch max. water vapor transmission; in manufacturer's standard lengths and widths.

Maximum ASTM E84 flame spread of 15, and Smoke Development of 165.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work included, but are not limited to the following:

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

- Dupont Styrofoam XPS
- Owens Corning Foamular

Mechanical Anchors: Type and size as recommended by insulation manufacturer for type of application and condition of substrate.

Adhesive Mastic: Type, size and spacing for each condition as recommended by insulation manufacturer for type of application and condition of substrate.

Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints between units and filling voids in work.

SPRAY APPLIED POLYURETHANE INSULATION:

Provide labor, materials, and equipment necessary to two-component, self-adhering spray-apply using blowing agent HFC-245fa, closed-cell polyurethane foam (SPF) insulation, air seal and water repellent treatment for cavity wall CMU throughout the Project. Not required at CMU surfaces to receive EIFS finish.

Spray Polyurethane Foam Insulation shall be a seamless self-adhering spray-applied rigid polyurethane foam system, forming a membrane that seals CMU surfaces. Spray apply in liquid form, to form a seamless, thermal, moisture and air barrier and envelope across CMU to structural steel surfaces, and at wall-to-roof decking transition areas.

Application: Substrate to which insulation is applied must be clean, dry as confirmed by testing, and free of frost, ice, loose debris, or contaminates that will interfere with adhesion of the spray applied insulation.

Apply primers to surfaces where required by manufacturer's installation instructions. Spray apply to substrates when ambient air temperatures no less than 50 degrees F or as authorized by manufacturer, and when ambient humidity is within manufacturer's guideline ranges, and following all manufacturer's installation guidelines. Apply after the perimeter wall is in place, and rough-in plumbing and electrical penetrations inspections are completed.

Mask off all areas and surfaces to not to receive insulation. Upon completion, remove all overspray, and remove all masking materials. Shield the spray polyurethane foam from interior exposure with an approved thermal barrier.

Where damage occurs which violates the spray foam's air seal and moisture seal, repair as needed using specified spray polyurethane material or specified foam repair kit material.

Accessories:
A. Foam Repair Kit and Materials: Provide as per manufacturer's standard products, provided by manufacturer or equivalent kits.
B. Mineral Wool: Safing Mineral Wool Board, 4.0 lb./cu.ft. density, as manufactured by Rock Wool Manufacturing, or equivalent.
C. Moisture Detection Paper (MDP) Strips: MDP Strips manufactured by NCFI Polyurethanes or equivalent.
D. Liquid-Applied air barrier flashing, equivalent to Prosoco FastFlash, Carlisle Barrier Seal, or Tremco.

Physical Characteristics and Properties: Foamed-In-Place Wall Insulation shall equal or exceed the following:
A. Free Rise Core Density: 2.0 lbs/cu.ft. per ASTM D-1622
B. Compressive Strength: 27 psi (min) per ASTM D-1621
C. R-Value: 6.8 (min) per inch, 13 per 2 inches, per ASTM C-518
D. Moisture Vapor Transmission: 1.3 perm per inch, 0.65 perm at 2" thick, per ASTM E 283 and 2178
E. Water Resistive Barrier: No Penetration per a 6.24 psf test condition, ASTM E-331
F. Air Leakage Certification: 0 at 1.57 psf, per ASTM E-283 and 2178
G. Surface Burning Characteristics: Flame Spread Index < 25 and Smoke Developed Index < 450 per ASTM E-84

Acceptable Products:
A. InsulBloc Spray Foam System 11-017 by NCFI Polyurethanes, PO Box 1528, Mt. Airy, NC 27030
B. Equivalent products by Polymaster.
C. Equivalent products by CertainTeed.
D. Or equivalent products per information submitted to and accepted by the Architect.

Quality Assurance:
A. Compliance with AC 377 and ASTM C1029.
B. Insulation shall be installed per the manufacturer's printed instruction submitted to the Architect prior to the start of work.
C. Insulation shall be installed by a contract installer who has been trained and certified by the manufacturer. The contract installer shall have not less than three (3) years experience in the trade and be properly licensed to perform the scope of work.
D. Follow and adhere to all manufacturer's and OSHA safety guidelines.
E. Upon completion of the installation, the contract installer shall provide 4-color infrared thermal images of all exterior wall surfaces to the Architect to confirm that the spray applied cavity insulation completely covers all surfaces required to be insulated, with the required thickness. If the thermal images show voids, the contract installer shall apply foam to correct the deficiency at no added cost to the Owner.
F. Provide a one year product performance warranty by the manufacturer.

Barrier System Required in Areas Not Protected with Drywall or Masonry:
A. Areas of Spray Foam Insulation not protected with Drywall or Masonry shall be protected with an approved intumescent covering, equal to International Fireproofing Technologies, Inc., "DC-315", spray applied 21 mils wet / 14 mils dry minimum, meeting all requirements of the NC Building Code and IRC.

EXTERIOR BELOW GRADE WATERPROOFING

WATERPROOFING MEMBRANE (at Gymnasium wood floor perimeter): MEL-ROL, Rolled, Self-Adhering Waterproofing Membrane, manufactured by W. R. Meadows. General contractor to apply to all perimeter foundation walls at the Gymnasium wood floor. Reference Section 09550 Wood Flooring.

Where indicated on Drawings, provide hot mopped liquid asphalt on three inter-mopped layers of #30 lb. asphalt roofing felts, all bonding together and flood coated with hot liquid asphalt.

CEILING INSULATION:

Unfaced Blanket-type Glass Fiber Ceiling Insulation: Inorganic non-asbestos fibers formed into semi-rigid blankets, R-13, 24" x 48" batt size. Do not insulate over lighting fixtures. Provide over all ceilings, unless otherwise noted.

SOUND ATTENUATION BATT INSULATION:

Sound Attenuation Batt Insulation: Mineral wool blankets, 2 1/2" thick, manufactured by USG, USM, Owens-Corning or equal providing STC ratings scheduled. Install in strict accordance with manufacturer's printed instructions and at all interior metal stud / gypsum wallboard partitions. Provide all necessary anchoring accessories and devices for a complete no-sag installation.

PART 3: EXECUTION

INSPECTION AND PREPARATION:

Installer must examine substrates and conditions under which insulation work is to be performed, and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with insulation work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

Clean substrates of substances harmful to insulations or vapor barriers, including removal of projections which might puncture vapor barriers.

INSTALLATION:

General:

Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

Extend insulation full thickness as shown over entire area to be insulated. Spray, cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

Coordinate with masonry wire reinforcing and veneer anchors installations.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pre-Engineered Building Insulation System for New Construction.

1.2 RELATED SECTIONS

A. Section 13120 – Pre-Engineered Metal Buildings

B. Section 13900 – Fire Protection Systems

B. Division 15 - Mechanical; Rough-in utilities.

B. Division 16 - Electrical; Rough-in utilities.

1.3 REFERENCES

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials in Sheet Form (Procedure B).

C. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

D. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

E. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

F. ASTM C 1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

1.4 DESIGN REQUIREMENTS

A. Thermal Resistance of Installed System: Roof R-Value of 30.

B. Insulating system shall have a continuous vapor barrier inside of building purlins, and insulation to provide complete isolation from inside conditioned air.

1.5 SUBMITTALS

A. Submit under provisions of General Conditions and General Requirements Section 01040.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions.

C. Shop Drawings: Indicate locations of connections and attachments, general details, anchorages and method of anchorage and installation.

D. Verification Samples: For each finish product specified, two samples, minimum size 6

inches (150 mm) square or long, representing actual products required by the manufacturer for this project.

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

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing product systems specified in this section with minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products indoors and protect from moisture, construction traffic, and damage.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Obtain a full and complete on-site analysis of actual roof structure field conditions for manufacturer’s assessment of vapor barrier criteria for proposed product features to be submitted.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide a new construction insulation system consisting of Batt Roof Insulation, Roof Insulation, Syseal Vapor Barrier Liner Fabric specifically designed for the roof structure in place, Thermal Breaks, Straps, and other devices and components in a complete insulation system assembly as follows:
   1. Batt Roof Insulation: Fiberglass batt or fiberglass blanket complying with ASTM C 665 and ASTM E 84 with a thermal resistance as follows:
      a. R-30; 9 inches.
   2. Vapor Barrier Liner Fabric (type subject to recommendation by the manufacturer for the actual roof structure conditions): Syseal type woven, reinforced, high-density polyethylene yarns coated on both sides with a continuous white or colored polyethylene coatings, as follows:
      a. Product complies with ASTM C 1136, Types I through Type VI.
      b. Perm rating: 0.02 for fabric and for seams in accordance with ASTM E 96.
      c. Flame/Smoke Properties:
         1) 25/50 in accordance with ASTM E 84.
         2) Self-extinguishes with field test using matches or butane lighter.
      d. Size and seaming: Manufactured in large custom pieces by extrusion welding from roll goods, and fabricated to substantially fit defined building areas with minimum practicable job site sealing.
      e. Provide with factory double, extrusion welded seams. Stapled seams or heat-melted seams are not acceptable due to degradation of fabric.
      f. Factory-folded to allow for rapid installation.
      g. Color:

1) Selected from standard colors by Architect.

3. Vapor Barrier Lap Sealant: Solvent-based, polyethylene fabric adhesive.
4. Vapor Barrier Tape: Double-sided sealant tape 3/4 inch wide by 1/32 inch thick.
5. Vapor Barrier Patch Tape: Single-sided, adhesive backed sealant tape 3 inches wide made from same material as Syseal type liner fabric.
6. Thermal Breaks:
   a. 3/16 inch thick by 3 inch wide white, closed-cell polyethylene foam with pre-applied adhesive film and peel-off backing.
   b. Polystyrene snap-on thermal blocks.
7. Straps:
   a. 100 KSI minimum yield tempered, high-tensile-strength steel.
   b. Size: Not less than 0.020 inch (0.50 mm) thick by 1 inch (25 mm) by continuous length.
   c. Galvanized, primed, and factory finish painted to match vapor barrier liner finish color on the exposed side.
8. Fasteners:
   a. For light gage steel: #12 by 3/4 inch plated Tek 2 type screws with sealing washer, painted to match color of vapor barrier and straps.
   b. For heavy gage steel: #12 by 1-1/2 inch plated Tek 4 type screws with sealing washer, painted to match color of vapor barrier and straps.
   c. For wood, concrete, other materials: As recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that building structure including all bracing and any concealed building systems are completed and approved prior to installing liner system and insulation in the structure.

B. Correct any unsatisfactory conditions before proceeding.

C. If conditions are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION - GENERAL

A. Install roof insulation system in accordance with manufacturer's installation instructions and the approved shop drawings.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Install in exterior spaces without gaps or voids. Do not compress insulation.

D. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

E. Fit insulation tight in spaces and tight to exterior side of the sealed liner fabric and around mechanical and electrical services within plane of insulation.

3.3 ROOF INSULATION INSTALLATION

A. Straps:
   1. Cut straps to length and install in the pattern and spacings indicated on shop drawings.
   2. Tension straps to required value.

B. Vapor Barrier Fabric:
   1. Install vapor barrier fabric in large one piece custom fabricated pieces to substantially fit defined building areas with minimum practicable job site sealing.
   2. Position pre-folded fabric on the strap platform along one eave purlin.
   3. Clamp the two bottom corners at the eave and also centered on the bay.
   4. Pull the other end of the pleat-folded fabric across the building width on the strap platform, pausing only at the ridge to fasten the straps and fabric in position where plane of roof changes and to release temporary fasteners on the opposite ridge purlins.
   5. Once positioned, install fasteners from the bottom side at each strap/purlins intersection.
   6. Trim edges and seal along the rafters.
   7. All seams must be completely sealed and stapled seams not acceptable.

C. Insulation:
   1. Unpack, and shake to a thickness exceeding the specified thickness.
   2. Ensure that cavities are filled completely with insulation.
   3. Place on the vapor barrier liner fabric without voids or gaps.
   4. Place thermal block on top of purlins or bottom of purlins for retrofit work, if no other thermal break exists.
   5. Place new insulation between purlins at the required thickness for the R-value specified.

D. Seal vapor barrier fabric to the wall fabric and elsewhere as required to provide a continuous vapor barrier.

3.4 CLEANING

A. Clean dirt or exposed sealant from the exposed vapor barrier fabric.

B. Remove scraps and debris from the site.

3.5 PROTECTION

A. Protect system products until completion of installation.

B. Repair or replace damaged products before completion of insulation system installation.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 - GENERAL

A. SECTION INCLUDES

1. The extent of panel system work is indicated on the drawings and in these specifications

2. Panel system requirements include the following components:

   a. Aluminum faced composite panels with mounting system. Factory formed shapes, panel mounting system including reveal joint extrusions, anchorages, shims, furring, fasteners, gaskets and sealants, related flashing adapters, and masking (as required) for a complete watertight installation.

B. RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Technical Specification Divisions 2 through 16 apply to this Section.

C. RELATED WORK SPECIFIED ELSEWHERE

1. Section 05100: Structural steel.
2. Section 06100: Back up walls.
3. Section 07200: Insulation
4. Section 07600: Metal flashing and counter flashing.
5. Section 07920: Caulking and sealants.
6. Section 09200: Interior wall finishes.

QUALITY ASSURANCE

A. Composite Panel Manufacturer shall have a minimum of 5 years experience in the manufacturing of this product.

B. Composite Panel Manufacturer shall be solely responsible for panel manufacture and application of Kynar finish.

C. Fabricator/Installer shall be one in the same. No sub-letting or brokering of trade.

D. Fabricator/Installer shall have a minimum 5 years experience of metal panel work similar in scope and size to this project.

E. Field measurements should be taken prior to the completion of shop fabrication. Coordinate fabrication schedule with construction progress as directed by the Contractor to avoid delay of work. Field fabrication may be allowed to ensure proper fit. However, field fabrication shall be kept to an absolute minimum with the majority of the fabrication being done under controlled shop conditions.

F. Shop drawings shall show the preferred joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on the inside face of the panel system as determined by ASTM E 331.

G. Maximum deviation from vertical and horizontal alignment of erected panels: 1/4" in 20' non-accumulative.

H. Panel fabricator/installer shall assume undivided responsibility for all components of the exterior panel system including, but not limited to attachment to sub-construction, panel to panel joinery, panel to dissimilar material joinery, and joint seal associated with the panel system.

I. Composite panel manufacturer shall have established a Certification Program acceptable to the local Code Authorities.

REFERENCES

A. Aluminum Association

1. AA-C22-A41: Anodized - Clear Coatings.
2. AA-C22-A42: Anodized - Integral Color Coatings.

B. American Society for Testing and Materials

1. E 330-84: Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads.

2. E 283-84: Rate of Leakage through Exterior Windows, Curtain Walls, and Doors.

3. D 1781-76: Climbing Drum Peel Test for Adhesives.

4. E 84-79: Surface Burning Characteristics of Building Materials.

5. E 162-83: Surface Flammability of Materials Using a Radiant Heat Energy Source.

6. D 3363-74: Method for Film Hardness by Pencil Test.

7. D 2794-90: Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

8. D 3359-90: Methods for Measuring Adhesion by Tape Test.

9. D 2247-87: Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

10. B 117: Method of Salt Spray (Fog) Testing.

11. D 822: Practice for Operating Light and Water Exposure Apparatus (Carbon-Arc Type) for testing Paint, Varnish, Lacquer, and Related Products.

12. D 1308-87: Effect of Household Chemicals on Clear and Pigmented Organic Finishes

13. D 1735: Method for Water Fog Testing of Organic Coatings.

C. International Conference of Building Officials

1. UBC 17-5: Room Fire Test Standard for Interior of Foam Plastic Systems.

SUBMITTALS

A. Submittals shall be in conformance with Section 01050.

B. Samples

1. Panel System Assembly: Two samples of each type of assembly. 12" x 12" minimum.

2. Two samples of each standard and premium colors, 3" x 4" minimum.

C. Shop Drawings: Submit shop drawings showing project layout and elevations; fastening and anchoring methods; detail and location of joints, sealants, and gaskets, including joints necessary to accommodate thermal movement; trim; flashing; and accessories.

D. Affidavit certifying material meets requirements specified.

E. Two copies of manufacturer's literature for panel material.

DELIVERY, STORAGE AND HANDLING

A. Protect finish and edges in accordance with panel manufacturer's recommendations.

B. Store material in accordance with panel manufacturer's recommendations.

PART 2: PRODUCTS

PANELS

A. Composite Panels

1. ALUCOBOND aluminum composite material manufactured by 3A Composites, Inc. USA, 208 West 5th Street Benton, KY 42025 (800-626-3365, 770-664-5928).

2. Items of the same function and performance which have received prior approval from the Architect shall be allowed for this project. Approval shall be based on documentation submitted showing the adequacy of the material.

B. Thickness: 4mm (0.157")

C. Product Performance

1. Bond Integrity

When tested for bond integrity, in accordance with ASTM D1781-76 (simulating resistance to panel delamination), there shall be no adhesive failure of the bond a) between the core and the skin nor b) cohesive failure of the core itself below the following values.

Bond Strength: 214 psi (Vertical Pull)

Peel Strength: 22.5 in lb/in as manufactured

22.5 in lb/in after 8 hours in water at 200°F

22.5 in lb/in after 21 days soaking in water at 70°F

2. Fire Performance

ASTM E84-79 - Flame Spread 0, Smoke Developed 0
ASTM E162 - No surface flaming
UBC 17-5 - No flame spread along interior face or penetration through the wall assembly.

D. Finishes

1. Coil coated KYNAR® 500 or HYLAR® 5000 based polyvinylidene fluoride (2 and 3-coat PVDF) resin in conformance with the following general requirements of AAMA 605.2-92.

   a. Color: Only Premium Metallic Mica 2 and 3 coat colors, Premium Mica, as selected by the Architect from the manufacturer's color palettes, and all Mica color choices.

   b. Coating: Dry Film Thickness, ASTM D1400
      1) 0.25 mil primer, +/- 0.05 mils
      2) 1.0 mil minimum topcoat

   c. Hardness: ASTM D-3363; F minimum using Eagle Turquoise Pencil.

   d. Impact:
      1) Test method: ASTM D-2794; Gardner Variable Impact Tester with 5/8" mandrel.
      2) Coating shall withstand reverse impact of 1.5"/pounds per mil substrate thickness.
      3) Coating shall adhere tightly to metal when subjected to #600 Scotch Tape pick-off test. Slight minute cracking permissible. No removal of film to substrate.

   e. Adhesion:
      1) Test Method: ASTM D-3359.
      2) Coating shall not pick off when subjected to an 11" x 11" x 1/16" grid and taped with #600 Scotch Tape.

   f. Humidity Resistance
      1) Test Method: ASTM D-2247.
      2) No formation of blisters when subjected to condensing water fog at 100% relative humidity and 100°F for 3000 hours.

   g. Salt Spray Resistance:
      1) Test Method: ASTM B-117; Expose coating system to 3000 hours, using 5% NaCl solution.
      2) Corrosion creepage from scribe line: 1/16" max.
      3) Minimum blister rating of 8 within the test specimen field.

   h. Weather Exposure
      1) Outdoor:
         a. Five year exposure at 45° angle facing south Florida exposure.
         b. Maximum color change of 5 Delta E units as calculated in accordance with ASTM D-2244.
         c. Maximum chalk rating of 8 in accordance with ASTM D-659.
         d. No checking, crazing, adhesion loss.
      2) Accelerated:
         a. ASTM D-822, 5000 hours in Atlas Type Weatherometer; using cycle of 102 minutes light and 18 minutes diminished light and demineralized water.
         b. No checking, crazing, adhesion loss or objectionable color change or chalking.

   i. Chemical Resistance:
      1) ASTM D-1308 utilizing 10% Muriatic Acid for an exposure time of 15 minutes.
      2) ASTM D-1308 utilizing 20% Sulfuric Acid for an exposure time of 18 hours.
      3) No loss of adhesion or gloss and no color change.

PANEL FABRICATION

A. Composition: Two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials. The core material shall be free of voids and/or air spaces and not contain foamed insulation material.

Products laminated sheet by sheet in a batch process using glues or adhesives between materials shall not be acceptable.

Provide factory formed shapes, with radiuses and bends as indicated on Drawings.

B. Aluminum Face Sheets:
   1. Thickness: 0.50mm (0.0197")
      a. Alloy: AA3003 Painted material

C. Panel Weight:
   1. 4mm (0.157"): 1.12 lbs./ft²

D. Tolerances

   1. Panel Bow: Maximum 0.8% of any 1828mm (72”) panel dimension.
   2. Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to an absolute minimum. All fabrication shall be done under controlled shop conditions when possible.
   3. Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle.
   4. Maximum deviation from panel flatness shall be 1/8" in 5'0" on panel in any direction for assembled units. (Non-accumulative - No Oil Canning)

E. System Type: Rout and Return Wet:
System must provide a wet seal (caulked) reveal joint as detailed on drawings. The sealant type shall be as specified in Section 07900 and with foamed type backer rod as indicated on architectural drawings.

F. System Characteristics

Plans, elevations, details, characteristics, and other requirements indicated are based upon standards by one manufacturer. It is intended that other manufacturers, receiving prior approval, may be acceptable, provided their details and characteristics comply with size and profile requirements, and material/performance standards as follows:

1. Composite panels shall be capable of withstanding building movements and weather exposures based on the following test standards required by the Architect and/or the local building code.

   a. Wind Load

      If system tests are not available, mock-ups shall be constructed and tests performed under the direction of an independent third party laboratory, which show compliance to the following minimum standards:

      Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 20 pounds per square foot (psf) and 30 psf on parapet and corner panels. Wind load testing shall be conducted in accordance with ASTM E330 to obtain the following results.

      Normal to the plane of the wall between supports, deflection of the secured perimeter-framing members shall not exceed L/175 or 3/4", whichever is less.

      Normal to the plane of the wall, the maximum panel deflection shall not exceed L/60 of the full span.

      Maximum anchor deflection shall not exceed 1/16".

      At 1-1/2 times design pressure, permanent deflections of framing members shall not exceed L/100 of span length and components shall not experience failure or gross

permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1/16".

b. Air/Water System Test

If system tests are not available, mock-ups shall be constructed and tests performed under the direction of an independent third party laboratory, which show compliance to the following minimum standards:

Air Infiltration - When tested in accordance with ASTM E283, air infiltration at 1.57 psf must not exceed 0.06 cfm/ft² of wall area.

Water Infiltration - Water infiltration is defined as uncontrolled water leakage through the exterior face of the assembly. Systems not using a construction sealant at the panel joints (i.e. Rout and Return Dry and Rear Ventilated Systems) shall be designed to drain any water leakage occurring at the joints. No water infiltration shall occur in any system under a differential static pressure of 6.24 psf after 15 minutes of exposure in accordance with ASTM E331.

ACCESSORIES

A. Extrusions, formed members, sheet, and plate shall conform to ASTM B209 and the recommendations of the manufacturer. Reveals shall match color of adjacent panel material.

B. Panel stiffeners, if required, shall be structurally fastened or restrained at the ends and shall be secured to the rear face of the composite panel with silicone of sufficient size and strength to maintain panel flatness. Stiffener material and/or finish shall be compatible with the silicone.

C. Sealants and gaskets within the panel system shall be as per manufacturer's standards to meet performance requirements.

D. Fabricate flashing materials from 0.030" minimum thickness aluminum sheet painted to match the adjacent curtain wall / panel system where exposed. Provide a lap strap under the flashing at abutted conditions and seal lapped surfaces with a full bed of non-hardening sealant.

E. Fasteners (concealed an non-corrosive): Fasteners as recommended by panel manufacturer. Do not expose fasteners except where unavoidable and then match finish of adjoining metal.

PART 3: EXECUTION

INSPECTION

A. Surfaces to receive panels shall be even, smooth, sound, clean, dry and free from defects detrimental to work. Notify contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with erection until unsatisfactory conditions have been corrected.

B. Surfaces to receive panels shall be structurally sound as determined by a registered Architect/Engineer.

INSTALLATION

A. Erect panels plumb, level, and true.

B. Attachment system shall allow for the free and noiseless vertical and horizontal thermal movement due to expansion and contraction for a material temperature range of -20°F to +180°F. Buckling of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental

effects due to thermal movement will not be permitted. Fabrication, assembly, and erection procedure shall account for the ambient temperature at the time of the respective operation.

C. Panels shall be erected in accordance with an approved set of shop drawings.

D. Anchor panels securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support.

E. Conform to panel fabricator's instructions for installation of concealed fasteners.

F. Do not install component parts which are observed to be defective, including; warped, bowed, dented, abraised, and broken members.

G. Do not cut, trim, weld, or braze component parts during erection in a manner which would damage the finish, decrease strength, or result in visual imperfection or a failure in performance. Return component parts which require alteration to shop for refabrication, if possible, or for replacement with new parts.

H. Separate dissimilar metals and use gasketed fasteners where needed to eliminate the possibility of corrosive or electrolytic action between metals.

ADJUSTING AND CLEANING

A. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.

B. Repair panels with minor damage.

C. Remove masking (if used) as soon as possible after installation. Masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the General Contractor.

D. Any additional protection, after installation, shall be the responsibility of the General contractor.

E. Make sure weep holes and drainage channels are unobstructed and free of dirt and sealants.

F. Final cleaning shall not be part of the work of this section.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 - GENERAL

RELATED WORK SPECIFIED ELSEWHERE:

07610 Metal Roofing
13120 Pre-Engineered Buildings

DESCRIPTION OF WORK:

Contract work of this Section shall include, but not be limited to providing following:

All sheet metal work required for complete assemblies of items specified at all areas indicated on Drawings, including but not necessarily required:

Gutters
Downspouts
Copings
Soffit panels
All sheet metal work required for moisture control
Metal valley flashing
Metal base flashings and counter flashings

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

Standards: Workmanship and methods employed for forming, anchoring, cleating, and expansion and contraction of sheet metal work shall conform to application details and description as indicated in current edition of Architectural Sheet Metal Manual, published by Sheet Metal and Air Conditioning Contractors National Association, Inc. and hereinafter referred to as "SMACNA Manual", unless otherwise noted on Contract Drawings or specified herein.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for the work under this Section, Drawings, and Specifications are based on products manufactured or furnished by Manufacturers listed under PRODUCTS.

SUBMITTALS:

Shop Drawings: Submit for approval in accordance with GENERAL CONDITIONS.

Details and layout shall show weights, gauges or thicknesses of sheet metal, joints, expansion joint spacing, and procedures to be followed during installation. Indicate bolt size and spacing, nailers or blocking required to be furnished by others for securing work of this Section.

Catalog Cuts: For Standard manufactured items, catalog cuts may be submitted as specified in GENERAL CONDITIONS.

Guarantee: Installation of all items of this Section shall be guaranteed to be leak-free for period of five years from date of acceptance of project. Any repairs or replacements required to maintain waterproof installation shall be done at no cost to Owner.

PRODUCT HANDLING:

Handling and Storage: Damaged items that cannot be restored to like-new condition shall be removed and replaced at no additional cost to Owner.

PART 2 - PRODUCTS

MATERIALS:

Flatwork, Flashings, Copings, Gutters and Gravel Stops: Pre-finished 24 gauge galvalume steel sheet, 0.5 ounces/square foot, minimum yield of 50,000 PSI.

Gutter: 24 gauge pre-finished galvalume gutter. Provide pre-finished gutter spacers and brackets as shown on Drawings.

Soffit Panels: 6” wide 24 gauge prefinished flush galvalume steel panels, Opaline OPF060 panels as manufactured by Atas International. Panels manufactured with a smooth finish and concealed clipless fastening system. Provide all trim accessories necessary for a complete assembly.

Downspouts: Downspouts, 20 gauge pre-finished galvalume steel, Kynar 500 finish. Wall mounting brackets shall be matching material.

Finish/Colors: Premium 70% PVDF fluorocarbon coating produced with Kynar 500 or Hylar 5000 resin.

ACCESSORIES:

General: Provide all accessories or other items essential to completeness of sheet metal installation, though not specifically shown or specified. All such items shall be of same material or compatible to base material to which applied and gauges shall conform to SMACNA Manual recommendations.

Fasteners: All screws, bolts, rivets and other fastenings for sheet metal, unless otherwise noted, shall be like material and of size and type suitable for intended use, stainless where indicated.

Sealant: Elastomeric polyurethane sealant equal to Sonneborn Sonolastic NP-1. Clean all sheet metal surfaces prior to application with xylene and prime with Primer equal to Sonneborn 733 primer. Follow manufacturer’s written product installation guidelines, recommendations and instructions. Color to be selected by Architect.

PART 3 - EXECUTION

CONDITION OF SURFACES:

Proper Surfaces: Surfaces to which sheet metal and flashing are applied shall be even, smooth, sound, thoroughly clean and dry and free from projections or other defects that would affect application. Defects shall be corrected by trades involved before installation of sheet metal work.

INSTALLATION:

Workmanship: Fabricate and install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from waves warps, or buckles, match existing work unless shown otherwise. Exposed edges of sheet metal shall be folded back to form 1/2 inch wide hem on side concealed from view. Finished work shall be free from water leakage under all weather conditions.

Fastenings: Unless otherwise indicated or specified, all fastenings shall be concealed. Installation of and joints of all sheet metal work, including fascia claddings, shall be in accordance with recommendations of SMACNA.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.01 DESCRIPTION

A. General

1. Furnish all labor, material, tools, equipment, and services for a complete roofing and wall panel system, and soffit panel system to include all flashing, curbs, gutters and downspouts as indicated, in accordance with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

4. See Division 1 for General Requirements.

B. Related work specified elsewhere:

1. Flashing and Sheet Metal: Section 07600.
2. Metal Roof Retrofit System Section 07950
3. Drawings Building Code Summary

1.02 QUALITY ASSURANCE

A. Applicable standards:

1. SMACNA: "Architectural Sheet Metal Manual" Sheet Metal and Air Conditioning Contractors National Association, Inc.

2. AISC: "Steel Construction Manual" American Institute of Steel Construction.

3. AISI: "Cold Form Steel Design Manual," American Iron and Steel Institute.

4. ASTM A792-AZ50: Specifications for steel sheet, aluminum-zinc alloy coated (galvanized) by the hot dip process, general requirements (galvalume).

5. Underwriters Laboratories Inc. wind uplift classification UL 90

6. 2000 International Building Code, Table 1604.5, Classification Of Buildings And Other Structures For Importance Factors, Category II Seismic, Snow and Wind Factors.

7. 2000 International Building Code, Table 1604.5, Classification Of Buildings And Other Structures For Importance Factors, Category III Seismic, Snow and Wind Factors.

8. LEEDS NC, U. S. Green Building Council

9. Energy Star Roof Rating

10. Cool Metal Roof Coalition

11. Cool Roof Rating Council

B. Manufacturer's qualifications:

1. Manufacturer has a minimum of three years experience in manufacturing panels of this nature.

C. Installer's qualifications:

1. Installation of panels and accessories by installers with a minimum of two years experience in panel projects of this nature.

1.03 SUBMITTALS

A. Shop drawings:

1. Submit complete shop drawings and erection details to Architect for review. Do not proceed with manufacture prior to review of shop drawings. Do not use drawings prepared by Architect for shop or erection drawings.
2. Shop drawings show methods of erection, elevations, and plans of roof and wall panels, sections and details, anticipated loads, flashings, roof curbs, vents, sealants, interfaces with all materials not supplied and proposed identification of component parts and their finishes.
3. Manufacturer’s Information: Describe available LEED points.
4. Certification: Manufacturer to certify that roof system submitted is in compliance with Building Category Importance Factors requirements

B. Mockups and Samples:

1. Roofing contractor to build a full-sized roof corner mockup on-site for review and approval by the Architect. Roof corner mockup to include roof metal rake intersection with eave metal gutter and fascia.

2. Submit samples and color chips for all proposed finishes.

a. Submit one 8 in. long sample of roof panel, including clips.

b. Submit one 8 in. long sample of wall panel, including clips.

c. Submit 3 in. x 5 in. color chip samples in all standard colors.

C. LEEDS NC: Submit certification from Manufacturer of roofing materials and accessories that products are sustainable products, listing all applicable LEED U.S. Green Building code council’s credits made available by certification.

D. Warranty

1. Provide contractor’s written NDL (No Dollar Limit) weathertightness warranty twenty (20) years, against leaks in roof panels arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions. Warranty coverage shall include all

curbs, flashing and miscellaneous trim and accessories. Warranty shall be non-pro-rated, signed by the metal roofing system contractor and shall provide for both labor and materials.

2. Provide manufacturer's NDL (No Dollar Limit) written warranty for twenty (20) years against perforation of metal roof panels due to corrosion under normal weather and atmospheric conditions. Warranty shall be signed by metal roofing system manufacturer and shall provide for complete replacement of panels and associated trim.

3. Provide manufacturer's NDL (No Dollar Limit) written paint film warranty for twenty (20) years on finish film integrity and color retention. The finish will not crack, check, peel, flake, or blister, or chalk in excess of ASTM 4214, number 8 rating, or fade in excess of 5 units per ASTM D 2244, under normal atmospheric conditions. Warranty shall be signed by metal roof system manufacturer.

4. Inspection and Report Services: Contractor shall retain independent third party agent who shall perform an inspection of the entire roof system and shall submit a written report to the Owner detailing all conditions requiring maintenance and repair by parties under the above warranties. Third party agent shall be a registered roof consultant (RRC) with minimum of 5 years as a registered roof consultant and 5 years of active project experience. Provide written certification of qualifications.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Obtain roofing products from local regional source, within 500 miles of project site.

B. Delivery: Deliver panels to jobsite properly packaged to provide protection against transportation damage.

C. Handling: Exercise extreme care in unloading, storing and erecting panels to prevent bending, warping, twisting, and surface damage.

D. Storage: Store all material and accessories above ground on well skidded platforms. Store under water- proof covering. Provide proper ventilation to panels to prevent condensation build-up between each panel.

PART 2: PRODUCTS

2.01 MATERIALS

A. Roof panel profile: 2 in. high x 3/4 in. wide rib x 16 in. wide striated panel.

B. Panel style: Large batten, vertical leg, concealed fastener, standing seam, utilizing male and female rib configurations, with factory applied hot melt mastic in female rib, continuously locked together by an electrically powered mechanical seaming device during installation.

C. Gauge: 24 gauge (UL-90 rated - Underwriters Laboratories).

D. Substrate: Galvalume steel sheet, 0.5 ounces/square foot, minimum yield of 50,000 PSI.

E. Recycled Content: Metal roof materials shall be 35% recycled content.

F. Clip: Floating clip, low profile, 22 gauge, with factory applied mastic (# UL-90 rated-Underwriters Laboratories).

G. Texture: Smooth.

H. Finish: Premium fluorocarbon coating produced with Kynar 500 or Hylar 5000 resin (20 year warranty).

I. Reflectivity and Emissivity: Metal roof Panels shall be high reflectance and high remittance in accordance with Energy Star. Initial Reflectance (Galvalume Only) shall be at least 0.68 when tested with ASTM E-903. The three year aged reflectance shall be at least 0.57, when tested in accordance with ASTM E-1918 (Measured AS Solar Reflectivity, Not Visible Reflectance).

J. Color: Selected from manufacturer's standard Energy Star Rated roof colors, with Solar Reflectance Index (SRI) value equal to or greater than SRI 29.

K. Acceptable manufacturer: MBCI; Product: BattenLok Series

L. Acceptable optional manufacturers:

1. Equivalent products by:
    i. AEP Span
    ii. American Building Company
    iii. Butler Manufacturing Company
    iv. McElroy Metal, Maxima 216
    v. Peterson Aluminum Corporation, Tite-Loc

M. Provide downspouts in profiles, shapes and materials as indicated on Drawings, 24 gauge and 20 gauge galvalume galvanized steel with Kynar 500 or Hylar 5000 resin finish. Provide straps, brackets and anchors in matching material as indicated on Drawings.

N. U-Channel Gutter Bracket Strap: Provide 16-gauge prefinished galvanized U-bar channel gutter strap, factory powder coat painted to match roof.

O. Pipe flashing shall be Dektite, or equivalent by Master Flash, Westform Metals or IPS Roofing Products.

P. Provide roof and gutter expansion joints as indicated on Drawings, in matching Kynar 500 or Hylar 5000 resin finish.

Q. All roof curbs are by metal roof contractor. Refer to mechanical drawings and coordinate curbs required with HVAC Contractor.

R. Provide special rolled / radiused panels and trim where shown on drawings.

S. Provide special shapes where shown on drawings.

T. Corrugated wall panels where indicated on Drawings shall be fabricated from 24 gauge Galvalume AZ50 ASTM A 792 galvalume steel, PVDF fluoropolymer Kynar 500 factory applied paint system with a 20-year finish warranty, formed to provide a weathertight closure assembly. Panel shall be a 1 ½" deep ribs x 30" wide panel, exposed fastener type, smooth finished, corrugated profiled. Provide all accessories, corrosion resistant color matching fasteners, trims, channels and flashings for a complete weathertight assembly. Provide "T10-B Wall Panel" by Metal Sales Manufacturing Corporation, or approved equivalent.

U. Metal soffit panels and trim where indicated to be 22-gauge galvalume steel, flat profile and smooth textured, with a factory KYNAR 500 finish, selected from standard colors. Provide 12 inch wide solid non-vented panels, unless otherwise noted. Soffit system shall be equivalent to Metal Roofing Systems (MRS) Flush Seam panel, or equivalent products by MBCI or Peterson. Provide soffit panels in compliance with ASTM 1592, and the Architectural Aluminum Manufacturers Association (AAMA) Specifications 1402-86 Standard Specifications for Aluminum siding, soffit, and fascia. Provide all necessary accessories and trims for complete assemblies.

V. Self-adhering polymer modified bituminous membrane, 40 mil minimum thickness, Vycor Ice and Water Shield by W.R. Grace or equivalent products by GAF Materials Corp. or Calisle Coatings and Waterproofing.

2.02 FABRICATION

A. Material shall be in-line tension leveled prior to roll forming finished panel profile.

B. Factory roll form panels in continuous lengths, full length of detailed runs. Field formed panels will not be accepted.

C. Standard panel length shall be no more than 45 feet.

D. Panel laps shall be 5” minimum.

E. Fabricate trim, flashing and accessories to detailed profiles.

F. Fabricate trim and flashing from same material as panel.

PART 3: EXECUTION

3.01 SURFACE CONDITIONS

A. Examination

1. Inspect installed work of other trades and verify that such work is complete to a point where this work may continue.

2. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.

B. Discrepancies:

1. In event of discrepancy, notify Architect.

2. Do not proceed with installation until discrepancies have been resolved.

3.02 INSTALLATION

A. Install panels so that they are weathertight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.

B. Install panels in accordance with manufacturer's instructions and shop drawings.

C. Provide concealed anchors at all panel attachment locations.

D. Install panels plumb, level, and straight with seams and ribs/battens parallel, conforming to design as indicated.

E. Do not place scratched panels or material in the work.

F. Metal roofing contractor is responsible for cutting and sealing all roof penetrations and installations of all curbs. Refer to plumbing and mechanical drawings. Coordinate roof penetrations and curbs required with Plumbing and HVAC Contractors.

G. Install self-adhering polymer modified bituminous membrane ice and water shield, to cover entire roof surface.

3.03 CLEANING, PROTECTION

A. Dispose of excess materials and remove debris from site.

B. Clean work in accordance with manufacturer's recommendations.

C. Protect work against damage until final acceptance. Replace or repair to the satisfaction of the Architect, any work that becomes damaged prior to final acceptance.

D. Scratched panels or scratched flat surfaces will not be accepted. Scratched materials shall be replaced with new matching material at contractor’s expense. Repainting to conceal surface scratches will not be accepted.

END OF SECTION

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division -1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Types of shingle applications specified in this section include the following:

Asphalt shingle roofing

Ridge vent (see roof plan for mfr. and type)

QUALITY ASSURANCE:

UL Listing: Provide labeled materials which have been tested and listed by UL for Class and Rating indicated.

Adhere to standards set forth by NRCA Roofing and Waterproofing Manual – Fifth Edition, Steep Sloped Roofing standards.

SUBMITTALS:

Product Data: Submit technical product data, installation instructions and recommendations from shingle manufacturer, including data that materials comply with requirements.

Samples: Submit full range of samples for color selection. After selection, submit 2 full-size shingles for verification of color selected.

DELIVERY, STORAGE AND HANDLING:

Deliver materials in manufacturer's unopened, labeled containers.

Store materials to avoid water damage, and store rolled goods on end. Comply with manufacturer's recommendations for job-site storage and protection.

JOB CONDITIONS:

Substrate: Proceed with shingle work only after substrate construction and penetrating work have been completed.

Weather Conditions: Proceed with shingle work only when weather conditions are in compliance with manufacturer's recommendations and when substrate is completely dry.

SPECIFIED PRODUCT WARRANTY:

Provide shingle manufacturer's warranty on installed work, agreeing to pay for repair or replacement of defective shingles as necessary to eliminate leaks. Period of warranty is 25 years from date of substantial completion.

PART 2 - PRODUCTS

ASPHALT SHINGLE MATERIALS:

Asphalt Shingles: Atlas “Pinnacle Pristine” high performance architectural shingles to match existing roof.

Material: Fiberglass base, mineral granule-surfaced type, laminated architectural shingle with “Scotchgard Protector” for mildew resistance.

Fire resistance: ASTM E 108 Class A, UL 790 Class A Fire Resistance

Wind resistance: 130 MPH

Waterproofing Underlayment: CertainTeed “WinterGuard”; ASTM D 1970 sheet barrier of self-adhering rubberized asphalt membrane shingle underlayment having internal reinforcement, and “split” back plastic release film; install all roof surfaces; provide material warranty with equal in duration to that of shingles being applied.

Asphalt Plastic Cement: Fibrated asphalt cement complying with ASTM D 2822, designed for trowel application.

Hip and Ridge Shingles: Job-fabricated units cut from actual shingles used.

Nails: Aluminum or hot-dip galvanized 11 or 12-gage sharp pointed conventional roofing nails with barbed shanks, minimum 3/8" diameter head, and of sufficient length to penetrate through plywood sheathing.

Perimeter Edge Metal Eave Drip: pre-finished aluminum .032 thick continuous “T” type perimeter flashing at eave and rakes. Install under underlayment on eaves and over underlayment on rakes.

Ridge Vent: Refer to roof plan for mfr. and model.

Pipe Flashing: Sshall be Dektite, or equivalent by Master Flash, Westform Metals or IPS Roofing Products.

ICE DAM PROTECTION:

Ice dam protection: equal to Ice and Water Shield as manufactured by GAF, self adhering polymer-modified bitumen with self-healing properties, sheet good rolls, continuous installation at all valleys and roof edge eaves.

PART 3 - EXECUTION

INSPECTION

Installer of shingles must examine substrate and conditions under which shingling work is to be performed and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with shingling work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

PREPARATION OF SUBSTRATE:

Clean substrate of any projections and substances detrimental to shingling work. Cover knotholes or other minor voids in substrate with sheet metal flashing secured with roofing nails.

Coordinate installation of shingles with flashing and other adjoining work to ensure proper sequencing. Do not install roofing until all vent stacks and other penetrations through roofing have been installed and are securely fastened against movement.

INSTALLATION

General: Comply with instructions and recommendations of shingle manufacturer, except to extent more stringent requirements are indicated.

Asphalt Shingles:

Underlayment: Apply specified waterproofing underlayment layer horizontally over entire surface, in accordance with manufacturer's written instructions, lapping succeeding courses 4" minimum, installed in place until shingle installation.

Shingles: Install starter strip of roll roofing or inverted shingles with tab s removed; fasten shingles in manufacturer's recommended pattern, weather exposure and number of fasteners per shingle. Use horizontal and vertical chalk lines to ensure straight coursing.

Comply with installation details and recommendations of shingle manufacturer and NRCA Steep Roofing Manual.

Flashings and Edge Protection: Install metal flashing, pipe vent flashings and edge protection as shown and in compliance with details and recommendations of the NRCA Steep Roofing Manual. Pipe vents shall be painted to match roof surface.

EXTRA STOCK:

Provide minimum of 1% of installed quantity of type and color shingle used in the work. Provide in unopened clearly labeled bundles or containers, place where directed by Architect.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK :

Work of this Section shall require furnishing all labor and materials to provide sealants, non-rated caulking, fire-rated fire caulking, and related primers, including expansion joint fillers, interior and exterior, as shown on Drawings and as specified in this Section.

Caulking and primers required for installation of all work included in Sections for Window Wall, Storefront Systems shall be part of work under that Section and shall be done in accordance with the applicable portions of this Section.

Acoustical caulking for installation of gypsum board is specified in Section 09250.

Required applications of sealants and caulking include, but are not necessarily limited to, following general locations:

Flashing reglets and retainers.
Coping Members, Bed and Joints.
Interior and exterior wall joints around doors and windows perimeters.
Exterior wall control joints
Horizontal and vertical interior CMU wall and structural steel joints
Joints at penetrations of walls, decks and floors by piping and other services and equipment.
Fire-rated penetrations of walls, decks and floors by piping and other services and equipment.
Concrete walk and pavement expansion joints
Exposed interior concrete floor slab control joints

Required applications of joint fillers and gaskets include, but are not necessarily limited to, the following general types of work and locations:

Expansion joint fillers in structural concrete.

Exterior wall expansion joint fillers.

Fire-rated pipe and conduit through penetrations.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

ASTM E 814 (UL 1479) Standard Tests of Penetration Firestop Systems

ASTM E 1966 (UL 2079) Standard Test Method for Fire Resistive Joint Systems

UL - Underwriters Laboratory

ASTM C 920

Comply with 21 CFR 177.2600 for sealants in contact with food.

LEED SC, U. S. Green Building Council

SCAQMD - South Coast Air Quality Management District

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for the work under this Section, Drawings and Specifications are based on products of Sonneborn BASF Corporation and 3M Corporation.

Source: Products for use on this Project shall be of one Manufacturer, unless noted specifically otherwise.

All sealants shall comply with requirements of the South Coast Air Quality Management District (SCAQMD) Rule #1168.

SUBMITTALS:

Manufacturer's Data: For information only, submit 2 copies of Manufacturer's specifications, installation instructions and recommendations for each type of material required. Include Manufacturer's published data, certifications or laboratory test reports indicating that each material complies with requirements. Show by transmittal that copy of instructions and recommendations has been distributed to installer.

Submit applicable UL Tested Assemblies for each type of fire-rated through penetration and fire-stopping required.

Certifications: Submit written certifications that all primers, backings, and caulking materials are chemically compatible with each other and with the overcoating or topcoating materials.

Submit environmental certifications from Manufacturers of all joint sealant materials products, listing all applicable LEED credits made available by certifications.

Samples:
Caulking and Sealants: Submit samples of interior and exterior caulking compounds and related sealants required for installation. Install 12” samples in the work on site in locations requested by the Architect, for review.

Joint Fillers and Gaskets: Submit 3, 12" long samples of each joint filler or gasket which will be reviewed by Architect for color and texture only. Compliance with all other requirements is exclusive responsibility of Contractor.

Guarantee: Furnish Owner, in care of Architect, guarantee in accordance with requirements of General Conditions for period of three (3) years from date of acceptance of project against defective workmanship and materials, warranting airtightness and water tightness of exterior sealant and installation. Repairs shall be made promptly or material replaced after proper notice at no additional cost to Owner.

PRODUCT HANDLING:

Store and handle materials in strict compliance with Manufacturer's instructions.

Store in original containers until ready for use. Damaged material will be rejected and shall be removed from site.

PART 2: PRODUCTS

JOINT BACKING MATERIAL:

Non-Traffic Joints: Except where otherwise specified, packing shall be closed-cell expanded polyethylene cord or square rod conforming to ASTM D 1752, or closed-cell vinyl type conforming to ASTM D 1667, Grade VE-41.

Floor Joints: Packing shall be closed cell neoprene cord or square rod conforming to ASTM C 509-66T, with minimum shore "A" hardness of 45.

Fire-Rated Through Penetrations: non-combustible rock wool type mineral wool.

NON-RATED CAULKING COMPOUNDS /SEALANTS

Interior Joints: Caulking, other than where sealant is called for, shall be a solvent free, low modulus, one-part silyl-terminated polyether, non-sag sealant. Tack free time shall be minimum 90 minutes. Material shall be butyl-free skinning type, paintable within one hour.

Latex sealants are restricted to use only in non-moving joints in drywall construction.

Sonolastic 150 VLM manufactured by Sonneborn, or approved equal, with 7.24% of post-consumer material recycled content, VOC (volatile organic content) of 2 g/L.

MasterSeal CR-100 two-component self-leveling 100% polyurea control joint filler, for interior exposed and bare concrete floor slab control joints; for Boiler and Mechanical rooms, utility and custodial spaces. Not for use under VCT or carpeting adhered type floor finishes.

Exterior Joints: Caulking for exterior joints other than where other sealant is called for, shall be polyurethane:

Sonneborn NP-1 for walls, with 5% of post-consumer material recycled content, VOC (volatile organic content) of 43 g/L.

Sonneborn NP-2 for walls, with 5% of post-consumer material recycled content, VOC (volatile organic content) when mixed of 53-80 g/L.

Sonolastic SL-1 or SL-2 for concrete expansion joints in non-vehicular traffic areas, with 5% of post-consumer material recycled content, VOC (volatile organic content) maximum of 104 g/L.

Sonomeric 1 for concrete expansion joints in vehicular traffic areas, with 5% of post-consumer material recycled content, VOC (volatile organic content) maximum of 128 g/L.

Approved equivalent products by Tremco or Pecora are acceptable.

PRIMER:

Type: Primer, where required by Sealant Manufacturer, shall be solution or compound designed to insure adhesion of sealant and shall be compatible with sealant.

Source: Material shall be provided by Sealant or Caulking Manufacturer and shall be selected for compatibility with sealant, with substrate and shall be non-staining.

PRODUCT COMPATIBILITY: All primer, backing, and caulking materials shall be chemically compatible with each other for use as an assembly, and with all surfaces in contact with these materials.

FIRE BARRIER SEALANTS

All fire caulk sealants used for fire barriers shall have been tested and passed the criteria of ASTM E 814 (UL 1479) Standard Tests of Penetration Firestop Systems, ASTM E 1966 (UL 2079) Standard Test Method for Fire Resistive Joint Systems and CAN/ULC-S115 Standard Method of Fire Tests of Firestop Systems. All fire caulk sealants shall meet the requirements of the IBC, IRC, IPC, IMC, NFPA 5000, NEC (NFPA 70), NFPA 101 and NBCC. All fire caulks shall be listed in a tested and published through penetration UL assembly.

3M Fire Barrier Sealant FD 150+: one-component, gun grade, latex based elastomeric sealant. Paintable and repairable; firestops construction joints, and through penetrations. Not acceptable for use with CPVC pipe. VOC (volatile organic content) of <250 g/L.

3M Fire Barrier Silicone Sealant 2000+: one-component, gun grade, natural cure silicone elastomer based sealant; firestops dynamic construction joints, through penetrations, static construction joints, and blank openings. Non-paintable. VOC (volatile organic content) of <32 g/L.

3M Fire Barrier Sealant CP 25WB+: High-performance, one-component, gun-grade, latex-based, intumescent sealant. Paintable, firestops and seals single or multiple through penetrations, blank openings, and static construction joints. Not acceptable for use with CPVC pipe. VOC (volatile organic content) of <1 g/L.

3M Fire Barrier Water Tight Sealant 3000WT: High-performance, one-component, neutral cure, intumescent silicone sealant. Fully cured acts as barrier to water leakage, repairable, firestops single and multiple through penetrations, bottom-of-wall static construction joints, blank openings, VOC (volatile organic content) of <31 g/L.

Provide 3M Ultra GS Wrap Strip where required by the through penetration assembly.

PART 3: EXECUTION

Proper Surfaces: Material in contact with sealant shall be dry, full cured, and free of laitance, loose aggregate, form release agents, curing compounds, water repellents and other surface treatment that would be detrimental to adhesion of sealant.

Masonry shall be cleaned and joints raked to proper depth to receive back-up and sealant.

Concrete shall be finished joints cleaned and fins removed.

Curing: Joints in masonry, concrete and stucco work shall not be sealed until substrate has cured minimum of 28 days.

PREPARATION:

Joint Cleaning: Clean all joints thoroughly, and blow out or vacuum loose particles from joints. Surfaces with protective coatings (such as aluminum) shall be wiped with xylol or methyl ethyl ketone solvent to remove protective coatings and oil deposits.

Sheet Metal: New sheet metal shall be wiped down with copper sulphate solution or with strong acetic acid solution to etch the zinc coating and remove oil and foreign matter from surface.

Joint Design: Coordinate work of other trades so that shape of joint, dimensions, and anticipated movement shall conform to following: (Comply with manufacturer's joint design requirements)

Minimum Width: Opening not less than 1/4" wide.

Minimum Depth: Opening not less than 1/8" deep.

Maximum Movement: The width of the opening shall be at least 4 times its maximum movement.

Width Depth Ratio: Comply with manufacturer's joint design requirements. Unless otherwise required, the depth of the sealant shall be no greater than the width. Depth should be more than 1/8" and not more than 1/2" deep, unless otherwise required by manufacturer.

All caulking joints shall be recessed openings. "Fillet" type caulking into corners will not be acceptable.

Joint Packing: Packing shall be installed in all joints to receive sealant. Packing shall be sized to require 20% to 50% compression upon insertion, and placed in accordance with "Joint Design" paragraph. (In joints not of sufficient depth to allow packing, install polyethylene bond-breaking tape at back of joint). Avoid lengthwise stretching of packing material.

Masking: Apply masking tape where required to protect adjacent surfaces. Adhere tape in continuous strips in alignment with joint edge, and remove immediately after joints have been sealed and tooled.

INSTALLATION:

Application of sealants shall be as recommended by Sealant Manufacturer. Work shall be done with standard handguns or mechanical guns. Extrude sealant through nozzles of such diameter as to allow full bead of material to run into joint, but not to exceed width of joint. Force sealant into joint by tooling to insure full contact with sidewalls and backing.

Locations: Use sealants in locations hereinbefore specified for joints as specified.

Joint Finishing: Unless otherwise indicated, all joints in horizontal surfaces shall be finished flush, all joints in vertical surfaces shall be finished slightly concave in shape. Use tooling stick or knife to strike off excess material, and properly shape bead. Use xylol or tolune to prevent sealant from adhering to tooling stick. Finished bead shall be smooth, even, and free from all wrinkling, air pockets, and foreign matter.

Install expansion joint filler as recommended by Manufacturer. Filler shall be size recommended by Manufacturer for use in the expansion joint erected and shall be installed with special tool and adhesive-lubricant.

CLEAN-UP:

Excess Material: Remove all excess material adjacent to joint by mechanical means and/or with solvent (such as xylol or toluol). Leave work in neat and workmanlike manner.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work required under this Section consists of providing galvanized hollow metal doors, frames, transoms, mullions, view window frames, and related items necessary to complete work indicated on Drawings and described in these specifications. Provide galvanized steel doors and frames for all openings where reasonably inferable from plan drawings, whether specifically scheduled and detailed or not.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

Hollow Metal Manufacturers Association, HMMA

QUALITY ASSURANCE:

Manufacturers: Except as otherwise specified herein, all hollow metal doors and frames shall be products of one of following manufacturers, or an equal approved by Architect. Manufacturers shall be certified members of the Hollow Metal Manufacturers Association, HMMA. All doors and frames shall be from the same manufacturer.

- Amweld Bldg. Prod. Div.
- Ceco Corp.
- Curries Company
- Acme Steel Door Corporation
- Pioneer Fireproof Door Co.
- Steelcraft Mfg. Co.

SUBMITTALS:

Shop Drawings: Submit shop drawings, in accordance with GENERAL CONDITIONS, of all items specified herein to Architect for approval. Obtain approval of Drawings prior to proceeding with manufacturing. Shop drawings shall indicate following: elevations of each door type; details of each frame type; location in building for each item; conditions at openings with various wall thicknesses and materials; typical and special details of construction; methods of assembling sections; location and installation requirements for hardware; size, shape and thickness of materials; anchorage; joints and connections; and any additional pertinent information.

General Contractor shall field verify all door and frame sizes, door and frame prep requirements, and hardware prep requirements prior to fabrication.

Samples: Sample of door section indicating edge, top and/or bottom construction, insulation, hinge reinforcement and face stiffening. Sample of frame section showing welded corner joints, welded hinge reinforcements, dust covers and face finish.

PART 2: PRODUCTS

GALVANIZED METAL FRAMES: Except where otherwise scheduled, all frames for doors, shall be formed of galvanized steel to sizes and shapes indicated, to include but not limited to double and single rabbett frame profiles where indicated. Frames shall be combination type with integral trim and fabricated with full welded unit type construction at joints.

Type and Gauges of Metal: Metal for frames shall be commercial quality, cold-rolled, galvanized steel sheets, with clean smooth surfaces conforming to ASTM A 366. Except where other gauges are indicated or specified, frames shall be fabricated from steel, not lighter than following U.S. Standard gauges:

- Exterior frames - 14 gauge
- Interior frames to 3-0 in width - 16 gauge (generally)
- Interior frames over 3-0 in width - 14 gauge

Metal Reinforcements: Provide concealed metal reinforcements for hardware as required. Gauge of metal for reinforcement shall be in accordance with manufacturer's recommendations for type of hardware and the thickness and width of doors to be hung in frame, provided gauges used are not lighter than following:

- Hinge and pivot reinforcements - 7 gauge, 1-1/4"x 10" min. size.
- Strike reinforcements - 12 gauge.
- Flush bolt reinforcements - 12 gauge.
- Closer reinforcements - 12 gauge.
- Surface-mounted hardware reinforcements - 12 gauge.

Workmanship and Design: Finished work shall be strong and rigid, neat in appearance, and free from defects. Fabricate molded members straight and true, with corner joints well formed and in true alignment, and with fastenings concealed where practicable.

Forming Corner Joints: Joints for welded type frames shall be mitered and continuously arc-welded for full depth and width of frame and trim. All contact edges shall be closed tight and all welds on exposed surfaces dressed smooth and flush.

Provisions for Hardware: Wood doors shall be solid core, prefitted. Prepare frames at factory for installation of hardware. Frames shall be mortised, reinforced, drilled and tapped to templates to receive all mortised hardware; frames to receive surface-applied hardware shall be provided with reinforcing plates only. Where concealed overhead door closers are required in frame members, provide necessary additional space, cutouts, reinforcement and provisions for fastenings in heads of frames to receive closers. Provide cover boxes in back of all hardware cutouts. Punch doorframes to receive rubber door silencers; provide three (3) silencers on lock side of single doorframes and one silencer for each leaf in heads of double doorframes.

Wall Anchors: Provide metal anchors of shapes and sizes required for adjoining type of wall construction. Fabricate jamb anchors of steel, not lighter than gauge used for frame. Locate anchors on jambs near top and bottom of each frame and at intermediate points not over 24" apart.

For frames set in masonry provide 10” long, corrugated or other deformed type adjustable anchors at jambs, 4 per jamb.

For frames set in metal stud partitions weld jamb anchor clips to back of frames at jamb. Make provision for securing anchors to steel studs with 1/4" round-head machine screws, nuts and washers, or by welding. Furnish 4 anchors per jamb.

Floor Anchors: Provide floor clips of not less than 16-gauge steel and fasten to bottom of each jamb member for anchoring frame to floor construction. Clips shall be fixed and drilled for 3/8" diameter anchor bolts.

Shipment: Provide temporary steel spreaders fastened across bottom of frames; where construction will permit concealment, leave spreader in place after installation; otherwise remove spreaders after frames are set and anchored.

GENERAL REQUIREMENTS FOR GALVANIZED METAL DOORS:

Type and Gauges of Metal: Metal for doors shall be commercial quality, leveled, cold-rolled, galvanized steel sheets with clean, smooth surfaces, conforming to ASTM A 366-68. All units shall be galvanized. Gauges of face sheets shall be as specified for door types.

Hardware Reinforcements: Doors shall be mortised, reinforced, drilled and tapped at factory for fully templated hardware only, in accordance with approved hardware schedule and templates provided by Hardware Contractor. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only; all drilling and tapping shall be done by others. Steel doors for locksets shall have welded box reinforcements.

All hardware furnished by Hardware Supplier for single-acting doors shall be designed for beveled edges as specified.

Edge Profiles shall be provided on lock stiles of doors as follows:

- Single-acting swing doors - beveled 1/8" in 2".
- Opposite swing double doors - beveled 1/8" in 2".

Provide clearances as follows:

Between doors and frames; at head and jambs - 1/8".

At doorsills; where no threshold is scheduled - 3/8" maximum. Allow for carpet height where required.

At doorsills; where threshold is scheduled - 1/4" maximum between door bottom and threshold.

Between meeting stiles of pair of doors - 1/8".

Workmanship: Finish work shall rigid, neat in appearance, and free from defects. Form molded members straight and true, with joints coped or mitered, well formed, and in true alignment. All welded joints on exposed surfaces shall be dressed smooth so that they are invisible after finishing.

GALVANIZED FLUSH DOORS:

Construction: Construct doors of two outer steel sheets not lighter than 18 gauge, with edges welded and finished flush. Seams or joints will not be permitted on door faces or edges. Reinforce the outer face sheets with 20-gauge interlocking vertical channels of Z-shaped members spaced not over 6" apart and spot-welded to outer face sheets. All doors shall have galvanized steel faces and rails.

Cap tops of exterior doors to prevent the accumulation of water.

Reinforcement: Provide continuous reinforcing channels welded to face sheets at top and bottom of door. Place cork, fiberboard, or mineral wool board in spaces between reinforcing channels.

Moldings shall be not lighter than 18-gauge steel. Doors shall be prepared to receive hardware specified under HARDWARE Section.

Optional Construction: Continuous truss-formed inner core of sheet metal, not lighter than 28-gauge, may be substituted for reinforcing specified, provided it is spot-welded to face sheets every 2-3/4" horizontally and vertically over entire surface of both sides.

APPROVED FIRE DOORS AND FRAMES:

Provide approved hollow metal fire doors and frames at locations indicated in Door Schedule. Approved doors, frames and hardware shall be constructed and installed in accordance with requirements of Underwriter's Laboratories for Class of door opening indicated or specified.

Fire doors and frames which bear Underwriter’s label for class of opening indicated will be only basis of acceptance.

SHOP PAINTING / GALVANIZING:

All interior and exterior doors and all interior and exterior frames shall be galvanized.

Apply primed finish to all galvanized metal surfaces furnished in this Section.

Clean and chemically treat metal surfaces to assure maximum paint adherence; follow with dip or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer on all exposed surfaces.

Finish surfaces shall be smooth and free from irregularities and rough spots.

Approved primer shall be compatible with finish coats specified in Section 09900.

LOCATION OF HARDWARE: Location of hardware for hollow metal doors and frames shall be as specified in Section 08700.

PART 3: EXECUTION

ERECTION:

Hollow metal shall be erected by skilled workers. Frames shall be carefully plumbed and aligned. Trim and glazing stops shall be coped or mitered with hairline fit. Brace frames until permanent anchors are set. Anchor bottoms of frames to floor with expansion bolts or with power fasteners.

In application of glazing beads, or other trim parts, exercise care to avoid running screws or other fasteners tightly enough to dimple metal.

Minor damage to metal, incurred during erection, may be repaired by filling with lead or lead alloy ground smooth and flush, if strength and appearance of finish work are not impaired, and if Architect approved. Otherwise, furnish new material.

PROTECTION AND CLEANING:

Protect doors and frames from damage during transportation and at job site. Store at site under cover on wood blocking or on suitable floors.

After installation, protect doors and frames from damage during subsequent construction activities.

Damaged work will be rejected and shall be replaced with new work.

Upon completion, metal surfaces of doors and frames shall be thoroughly cleaned, ready for paint finish by others.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART I: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall include furnishing, delivering, and storing where directed at site, the following:

Solid Core Wood Doors, as shown on drawings and specified herein. Intent of drawings and specifications is to provide all wood doors for the entire project as indicated on plans, whether specifically scheduled or not. Provide wood doors for all openings where reasonably inferable from plan drawings.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

SUBMITTALS:

Submit complete schedule indicating dimensions, cutouts, hardware sets, species, and other pertinent data, which references the individual architectural door mark number as shown on the plan sheets.

General Contractor shall field verify all door and frame sizes, door and frame prep requirements, and hardware prep requirements prior to fabrication.

Submit Manufacturer's data sheets, completely describing door construction, WDMA I.S. 1-A (formerly NWWDA) and AWI Classifications.

Door Supplier to submit written certification on the supplier's letterhead that the doors provided shall conform to every aspect of this specification.

Door physical finish samples shall accompany submittals. The samples will show the range of color variation.

Warranty statement shall accompany the submittal.

QUALITY ASSURANCE:

Flush wood veneer doors shall conform to the latest edition of the following standards: WDMA I.S. 1-A requirements for "Premium Grade".

Tolerances for warp, telegraphing, squareness, and prefitting dimensions as per the latest editions of WDMA I.S. 1-A, AWI Section 1300 and NFPA 80 1-11.4, 1999 edition.

Each door shall bear an identifying label indicating the manufacturer, door number and order number, as well as fire rating where applicable.

Where fire rated doors are required, provide doors labeled by ITS/Warnock Hersey International. Construction details and hardware application shall be as approved by the labeling agency.

Provide doors to meet UBC 7-2-1997 requirements for positive pressure opening assemblies in areas where this has been adopted by local authorities having jurisdiction.

MANUFACTURERS:

Standards: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on 5-ply door products meeting WDMA I.S. 1-A Premium Grade manufactured or furnished by Marshfield Door Systems.

Acceptable Manufacturers: Products of following manufacturers, meeting all requirements of these specifications, will also be acceptable.

- Marshfield
- Eggers Doors
- Oshkosh
- Algoma
- VT Industries

Samples: Sample corner section of door indicating edge, top/and/or bottom construction, core and hardware reinforcement.

Color Samples: Provide physical color samples in the veneer species specified, in the full range of manufacturer's standard colors.

Certificates: Provide certificate from manufacturer stating compliance with these specifications.

Guarantee: Provide guarantee for life of installation. Any defects noted during warranty period shall be corrected at no cost to the building Owner. Such corrective work shall include all labor and material for repair, replacement, refinishing and rehanging as required.

PRODUCT HANDLING:

Storage: Store doors at site so as to raise edges off floor and away from walls, letting air circulate freely. Store in enclosed area free from excessive heat, cold and humidity. Do not install scratched, dented or otherwise damaged doors in work.

Packaging: Door Manufacturer shall package doors in a manner to provide protection until they are installed.

Coordination: Provide Door Manufacturer with following:

- Two (2) copies of approved door schedule and Shop Drawings.
- Two (2) copies of the approved hardware schedule.
- One (1) copy of floor plan of building, showing Architect's marks and opening identification.
- Two (2) sets of templates for applicable locks, hinges and other finish hardware.

PART 2: PRODUCTS

SOLID CORE DOORS:

Construction: Doors shall be flush type, solid core, 5-ply, Premium Grade, Type PC-5ME. Seven-ply and non-bonded core construction not accepted. Doors shall be 1-3/4" thick and shall be widths and height shown on door schedule. All doors between use areas and corridors and all smoke doors shall be 20 minute fire rated unless required to be of higher rating.

Veneer: Face veneer to be plain sliced red oak, “A” grade, book and running matched, factory finished.

Finish: Doors to be factory stained and prefinished, delivered to job in protective wrapping. No doors shall be hung until finish work is complete.

Top and bottom rails shall be factory sealed with an approved sealer.

Core shall be of one piece slab, particle board, density 28-32 lb. per cu. ft. or greater bonded to stiles and rails with Type II adhesive, using high frequency method, then sanded as a unit. Meet particleboard standard ANSI A208.1, Grade 1-LD-2.

Vertical stiles shall be two piece 1 3/8" thick, with an inner stile of SCL laminated to outer ¼” hardwood stile, matching the veneer, to provide minimum thickness after trimming of 1 3/8". Top and bottom rails shall be of structural composite lumber (SCL) construction 1 3/8” thick before prefitting. Blocking shall be provided where mortise closers or other similar devices occur.

Composite cross bands shall be applied to core prior to application of matching hardwood stiles. Exposed cross banding is not allowed along stile edges.

Veneers are to be applied to the cross banded core in a HOT PRESS using Type I exterior water resistant adhesive. Five ply construction. Exposed veneer edges are not permitted.

Openings: Factory cut openings for glass. Flush wood glass stops required for non-rated openings, species to match veneer. 20 minute rated glass kits will utilize concealed metal glass retaining clips equal or similar to VT Industries VT Fire Clip.

Glass: 1/4" tempered glass, impact resistant as required, will be furnished and installed as per Section 08800.

COMPOSITE FIRE DOORS:

Grade: WDMA I.S. 1-A, Premium, Type FD-5

Construction shall conform to Underwriter's Laboratories Class "B" 1 Hr. and 1-1/2 Hr. and Class "C" 3/4 Hr. rating requirements and shall have been tested in accordance with ASTM E 152 for fire resistance, heat transmission, and structural integrity.

Core: Core shall be calcium silicate with non-asbestos fibers, 30.8 – 34.7 lbs./ft3 nominal density, containing no asbestos. Core shall be jointed together with tongue-and-groove joints in accordance with Underwriter's Laboratories, Inc. procedure manual. Core shall be smoothly sanded prior to application of cross band and face veneer.

Edge Bands: Outer stiles are to be of same species as veneer. Inner stiles to be structural composite lumber (SCL) for 45 minute rated doors, or GP Firestop I for 60 and 90 minute rated doors which can be warranted for use with mortise butt hinges and No. 12 – 1 ¼” steel threaded-to-head screws. The door manufacturer shall drill 5/32” diameter pilot holes for all hinges.

Rails are to be structural composite lumber (SCL) for 45 minute rated doors, or GP Firestop for 60 and 90 minute rated doors, manufacturer’s standard width.

Composite cross bands shall be applied to core prior to application of matching hardwood stiles. Exposed edge banding is not allowed along stile edges.

Veneers are to be applied to the cross banded core in a HOT PRESS using Type I exterior water resistant adhesive. Five ply construction. Exposed veneer edges are not permitted.

Where UBC 7-2-1997 requirements for positive pressure must be met, doors shall include all requirements as part of the door construction per "Category A" guidelines as published by ITS/Warnock Hersey. No intumescent is allowed on the frame. Only smoke gasketing applied around the perimeter of the frame to meet the "S" rating is permissible.

Vision panels and glass lights where indicated on plans, furnish and install vision panels glazed with 1/4" tempered or wire glass as indicated. Glass stops will be flush type and will utilize concealed metal glass retaining clips equal or similar to VT Industries VT Fire Clip. Where UBC 7-2-1997 requirements for positive pressure must be met, install a light kit labeled for UBC 7-2-1997 positive pressure applications to meet the appropriate fire rating.

Astragal sets, metal edges, or edge guards will not be allowed on positive pressure doors concealing intumescent within door structure.

FACTORY FINISHING:

AWI, catalyzed polyurethane, premium grade. Stain coat, three coats of sealer, two polyurethane topcoats finish per AWI Section 1500. AWI Types 2 and 3 are not acceptable.

Top and bottom rails shall be factory sealed.

HARDWARE PREPARATION:

Machining: Doors shall be factory machined for application of finish hardware that required cutting of door (except surface applied hardware) including pilot holes for hinge screws and lock fronts.

Coordination: Door manufacturer shall assume responsibility of properly coordinating hardware schedule, door schedule, and hollow metal frame shop drawings and shall supply machined doors individually identified for proper openings.

LOCATION OF HARDWARE: Refer to Section 08700.

PART 3: EXECUTION

CONDITION OF SURFACES:

Frames shall be set plumb and secure before installation of doors.

Responsibility: Contractor will be held responsible for correct door frame installation. Frames out of square, cocked at bottom or bowed in or out along vertical jambs more than 1/8" shall be reinstalled.

Temperature and Humidity: Doors shall not be installed until areas of installation have temperature and humidity near that of completed building.

DOOR INSTALLATION:

Fire door installation is required to be in accordance with the NFPA 80, “Standard for Fire Doors and Fire Windows”. Machined fire doors shall be provided with detailed installation instructions when doors bear a label indicating compliance to UBC 7-2-1997 or UL 10C.

Hanging: Doors shall be fitted, hung plumb, and true to within following allowable warpage tolerances: 1/4" for doors of areas 10 sq. ft. or greater, 1/8" for doors under area of 10 sq. ft. Install fire doors in accordance with NFPA Pamphlet 80 1-11.4, 1999 edition and U.L. requirements.

Non-rated clearances: Provide clearances of 1/8" at sides and top; lock edge shall have required bevel to clear frame. Provide at bottom, for specific locations, minimum adequate clearance of finish floor coverings and/or thresholds, not to exceed 3/4". Provide other undercuts as required.

Category “A” clearances between door edge and frame must be at least 1/16” and no greater than 1/8” at the head and jambs. See NFPA 80 1-11.4, 1999 edition, for clearance under door bottoms.

Factory machined doors improperly sized for opening or improperly machined for hardware by Door Manufacturer shall be rejected and returned to factory for proper replacement.

GLAZING:

Set glass against fixed molding with specific glazing compound utilizing glass retaining clips as specified.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1 - GENERAL

DESCRIPTION OF WORK:

Work of this Section shall be to provide aluminum rolling counter doors, as shown on the Drawings and specified in this Section.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section, refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purpose of designating type and quality for work under this Section, Drawings and Specifications are based on products fabricated by Cookson. Other listed Manufacturer's who can furnish similar products or systems of same materials specified, will also be acceptable.

SUBMITTALS:

Manufacturer's Data: Submit for approval three (3) copies of folder containing complete Manufacturer's data and installation procedures for all products to be used in work of this Section.

Shop Drawings: Submit Shop Drawings in compliance with GENERAL CONDITIONS. These drawings shall be coordinated with work of Kitchen Equipment Contractor.

PRODUCT HANDLING:

Working Areas: Provide suitable areas for storage of materials and equipment.

Delivery: Deliver products to site in original sealed containers or packages bearing Manufacturer's name and brand designation.

PART 2 - PRODUCTS

ALUMINUM ROLLING METAL COUNTER DOOR:
All aluminum manual crank operated rolling counter door, Cornell Model Series ESC10. Equivalent products by Cookson and Clopay Building Products are acceptable.

Curtain: To be constructed of interlocked .040” thick extruded aluminum slats (Slat No. 1F), nylon endlocks. Width of slats: 1 1/2" x 1/2" deep.

Bottom bar shall be extruded aluminum, tubular in shape 1-5/16” deep x 2-1/4” high and provided with continuous lift handles and double vinyl astragal.

Barrel: Curtain to be coiled around a steel pipe tubing of not less than 4" diameter, and capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width. Counter balancing unit to be enclosed and shall rotate on grease sealed ball bearings.

Counter Balance: Shall consist of adjustable oil-tempered torsion spring assembly capable of counter balancing weight of curtain, with maximum effort to operate not to exceed 25 lbs.

Operation: Curtain shall be crank operated, with finger lifts mounted in the bottom bar.

Guides: To be fabricated from heavy duty extruded aluminum shapes, with snap-on cover to conceal fasteners. Provide polypropylene pile runners on both sides of curtain to eliminate metal to metal contact between guides and curtain.

Locking Device: Bottom bar of curtain shall be furnished with a concealed sliding bolt deadlock operated by a thumb knob.

Hood: Fabricated from .040” thick aluminum and shall be furnished as necessary to encase curtain roll.

Finish: All aluminum components to be 204-R1 clear anodized finish.

PART 3 - EXECUTION

INSPECTION

Examine all surfaces to which products are scheduled to be installed. If unsatisfactory conditions exist, report to General Contractor and do not proceed with work until conditions have been satisfactorily corrected.

INSTALLATION:

All installations shall be performed by capable workmen under direction of foreman fully qualified by experience in each respective field of installation work.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes: Aluminum Swing Doors, including:

1. YKK AP Series 50D Wide Stile Swing Entrances.

B. Related Sections:

1. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.

1.02 SYSTEM PERFORMANCE DESCRIPTION

A. Completed assemblies shall comply with all current NC Building code requirements.

B. Performance Requirements: Provide aluminum swing doors that comply with performance requirements indicated, as demonstrated by testing manufacturers assemblies in accordance with test methods indicated.

1. Air Infiltration (Single Acting Butt Hinges or Offset Pivots): Air infiltration shall be tested in accordance with ASTM E 283 at static pressure of 1.57 PSF (75 Pa). Infiltration shall not exceed the following:

a. Pair of Doors: 0.18 CFM/FT (1.02 m3/h·m) of crack length.

b. Single Doors: 0.50 CFM/FT (2.84 m3/h·m) of crack length.

2. Structural: Door corner structural strength test using a dual moment loading criteria as follows:

a. A representative corner section consisting of a 12 inch top rail and a 24 inch long stile.

b. Top rail of each section is anchored to a fixed surface at 3 inches from corner joint; a load arm was subsequently mounted at 19 inches from inside edge of top rail on suspended side rail.

c. A load was applied to the load arm at 19 inches from inside edge of side rail and amount of rotation of load arm observed. Process was repeated at increasing loads until point of failure defined as greater than 45 degrees rotation of load arm occurred.

d. Test results shall be supported by an independent laboratory test report, as follows:

i. YKK AP Model: 50D Swing Door; 300 lbs.

3. Structural Uniform Load Test:

    a. Single Doors: 90 psf.

    b. Pair of Doors: 90 psf.

4. Forced Entry Resistance: 300 lbs. satisfactory.

1.03 PROJECT CONDITIONS / SITE CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication: show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.04 SUBMITTALS

A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."

B. Product Data: Submit product data for each entrance series specified

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, and finish colors.

D. Samples: Submit verification samples for colors. Minimum 2-1/2 inch by 3 inch (61 mm by 73 mm) samples on actual aluminum substrates indicating full color range expected in installed system.

E. Quality Assurance / Control Submittals:

1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.

2. Installer Qualification Data: Submit installer qualification data.

F. Closeout Submittals:

1. Warranty: Submit executed warranty documents specified herein, endorsed by YKK AP authorized official and installer.

2. Project Record Documents: Submit project record documents, including operation and maintenance data for installed materials in accordance with Division 1 Project Closeout (Project Record Documents) Section.

    a. Maintenance Data: Maintenance procedures for care and cleaning of entrance systems.

PART 2: PRODUCTS

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)

A. Entrance Door Acceptable Manufacturers:

1. YKK AP America Inc., Austell, GA 30168, Telephone: (678) 838-6000

2. Old Castle Model Equivalent

3. Tubelite Standard Wide Stile Entrances

B. Aluminum Storefront Entrance Door Products:

1. Wide Stile Swing Doors: YKK AP Series 50D Wide Stile Swing Doors with 6” mid-rail.

a. Description: 5" Door Stile

2. Corner Construction: Fabricate door corners joined by concealed reinforcement secured with screws, and sigma deep penetration welding.

3. Glazing Stops: Manufacturer's standard snap-in glazing stops with EPDM glazing gaskets to prevent water infiltration.

4. Weather stripping: Manufacturer's standard pile type in replaceable rabbets for stiles; manufacturer's standard EPDM bulb type in doorframes.

C. Hardware: ADA Compliant:

a. Aluminum Threshold: Pemko 2005AV, or equivalent by National Guard or Hagar.

b. Weather stripping – perimeter wool pile: National Guard, Pemko, or Hager.

c. Continuous door sweep with drip – Pemko 345-V, or equivalent.

d. Push/Pull unless exit device indicated on door schedule.

e. Closer: LCN 4040XP, with backstop arm and hold-open feature, with prefinished metal cover.

f. Heavy-duty continuous Hinge: Pemko, McKinney, or Select Products.

g. Removable mullion at pairs of doors: Von Duprin; keyed operation.

2.02 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.

B. Aluminum Sheet:

1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050 inch (1.27 mm) minimum thickness.

2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080 inch (1.95) mm) minimum thickness.

2.03 ACCESSORIES

A. Manufacturer's Standard Accessories:

1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners, countersunk, finish to match aluminum color.

2. Sealant: Non-skinning type, AAMA 803.3.

3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.

2.04 RELATED MATERIALS (Specified In Other Sections)

A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

2.05 FABRICATION

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer’s recommendations.

2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

B. Fabrication Tolerances:

1. Material Cuts: Square to 1/32 inch (0.8 mm) off square, maximum, over largest dimension; proportionate amount of 1/32 inch (0.8 mm) on other two dimensions.

2. Maximum Offset: 1/64 inch (0.4 mm) in alignment between two consecutive members in line, end to end.

3. Maximum Offset: 1/64 inch (0.4 mm) between framing members at glazing pocket corners.

4. Joints (Between adjacent members in same assembly): Hairline and square to adjacent member.

5. Variation (In squaring diagonals for doors and fabricated assemblies): 1/16 inch (1.6 mm).

6. Flatness (For doors and fabricated assemblies): +/- 1/16 inch (1.6 mm) off neutral plane.

2.06 FINISHES AND COLORS

A. Anodized Finish: YKK AP AMERICA Anodized Finish

1. Clear Anodized (MATCH EXISTING) with clear protective composite coating.

B. Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:

1. Anodized Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612-02. Aluminum extrusions shall be produced from quality-controlled billets meeting AA-6063-T5.

a. Exposed surfaces shall be free of scratches and other serious blemishes.

b. Extrusion shall be given a caustic etch followed by an anodic oxide treatment and sealed with an organic electrodeposition applied protective top coating.

c. The anodized coating shall comply with all the requirements of AAMA 612-02; Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction suites, and to resist the loss of color and gloss.

d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

C. Finishes Testing:

1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh; Do not clean area further.

2. Submit samples with test area noted on each sample.

D. Anodized Finish Warranty: 10-year warranty commencing on Date of Substantial Completion.

PART 3: EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

1. Verify location of preset anchors, perimeter fasteners, and block-outs are in accordance with shop drawings.

3.03 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.04 INSTALLATION

A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.

1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.

2. Shim and brace aluminum system before anchoring to structure.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Adjust swing doors for operation in accordance with manufacturer's recommendations.

B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to owner's acceptance, and remove construction debris from project site. Legally dispose of debris.

C. Protection: The General Contractor shall protect the installed product's finish surfaces from damage during construction.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.01 SUMMARY

A. Section Includes: Aluminum Storefront Systems

1. YKK AP Series YES 45F-T MegaTherm™ Storefront System 2” x 4 ½”.
2. Glass and glazing.
3. Perimeter trims.
4. Sills, extruded aluminum sub-sills, with end dams and weeps.
5. Bent plate sill pan
6. All installation hardware and accessories required for a secure installation.
7. Shims, plates and anchors required for a secure installation.
8. Perimeter sealing.

B. Related Sections:

1. Sealants: Refer to Division 7 Joint Treatment Section for sealant requirements.

2. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.

1.02 SYSTEM DESCRIPTION

A. Completed assemblies shall comply with all current NC Building code requirements.

B. Performance Requirements: Provide aluminum storefront systems that comply with performance requirements indicated, as demonstrated by testing manufacturer's assemblies in accordance with test method indicated.

1. Wind Loads: Completed storefront system shall withstand wind pressure loads normal to wall plane indicated:

a. Exterior Walls:

1. Positive Pressure:

2. Negative Pressure:

b. Interior Walls (Pressure Acting in Either Direction):

2. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330-84 with allowable stress in accordance with AA Specifications for Aluminum Structures.

a. Without Horizontals: L/175 or 3/4" (19.1mm) maximum.

b. With Horizontals: L/175 or L/240 + 1/4" (6.4mm) for spans greater than 13'-6" (4.1m) but less than 40'-0" (12.2m).

3. Thermal Movement: Provide for thermal movement caused by 180 degrees F. (82.2 degrees C.) surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.

4. Air Infiltration: Completed storefront systems shall have 0.00 CFM/FT2 (0.00 m3/h·m2) maximum allowable infiltration when tested in accordance with ASTM E 283-84 at differential static pressure of 6.24 PSF (299 Pa).

5. Water Infiltration: No uncontrolled water on indoor face of any component when tested in accordance with ASTM E 331-86 at a static pressure of 15 PSF (718 Pa).

6. Watertight Installations: Field Tested in accordance with AAMA 501.2-03.

7. Thermal Performance: When tested in accordance with AAMA 1503.1-88 Condensation Resistance Factor (CRF), and ASTM C 236-89 Thermal Transmittance (U Value) as follows:

    a. CRF: A minimum of 59.

    b. U Value: 0.58 BTU/HR/FT2/ºF or less.

1.03 SUBMITTALS

A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."

B. Product Data: Submit product data for each type storefront series specified.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors and textures.

D. Samples: Submit verification samples for colors on actual aluminum substrates indicating full color range expected in installed system.

1. Typical framing member
2. Extruded aluminum subsill with weeps and end dams
3. Bent plate sill pan

E. Quality Assurance / Control Submittals:

1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.

2. Installer Qualification Data: Submit installer qualification data.

F. Closeout Submittals:

1. Warranty: Submit warranty documents specified herein.

2. Project Record Documents: Submit project record documents for installed materials in accordance with Division 1 Project Closeout (Project Record Documents) Section.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by Owner, submit reference list of completed projects.

2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.

B. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

C. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner’s and Architect’s acceptance of finish color, and workmanship standard.

D. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legal dispose of mock-up when no longer required.

E. Incorporation: Mock-up may be incorporated into final construction upon Owner’s approval.

F. Field Test: Conduct field test to determine water-tightness of storefront system. Conduct test in accordance with AAMA 501.2-03 at locations selected by Architect.

1.05 PROJECT CONDITIONS / SITE CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.06 WARRANTY

A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.

1. Beneficiary: Issue warranty in the legal name of the project Owner.

2. Warranty Period: 5 years commencing on Date of Substantial Completion

3. Warranty Acceptance: Owner is sole authority who will determine acceptability of manufacturer's warranty documents.

4. Anodized Finish Warranty: 10-year warranty commencing on Date of Substantial Completion.

PART: 2 PRODUCTS

2.01 MANUFACTURERS (Acceptable Manufacturers/Products)

A. Acceptable Manufacturers:

YKK AP America Inc., Austell, GA 30168, Telephone: (678) 838-6000

1. Storefront System: YKK AP YES 45F-T MegaTherm™ Storefront System.

Oldcastle FG-3000T
US Aluminum Series IT 451

B. Storefront Framing System:

1. Description: Center set, exterior flush glazed; jambs and vertical mullions continuous; head, sill, intermediate horizontal attached by screw spline joinery.

2. Components: Manufacturer's standard extruded aluminum mullions, 0-15 degree hinged mullions, 90 degree corner posts, flexible corner posts, three-way corner posts, entrance door framing, and indicated shapes.

3. Thermal Barrier: Provide continuous thermal barrier by means of 6/6 nylon polyamide glass fiber reinforced pressure extruded bars. Systems employing non-structural thermal barriers are not acceptable.

4. Provide extruded aluminum sub-sill with weeps and integrally formed end dams at exterior storefront systems. Profiles, sizes and shape as indicated on Drawings.

5. Doorstops to be integral fin type, snap-in type not acceptable.

6. Provide internal frame reinforcements all closer locations.

2.02 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.

B. Aluminum Sheet:

1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050 inch (1.27 mm) minimum thickness.

2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080 inch (1.95 mm) minimum thickness.

2.03 ACCESSORIES

A. Manufacturer's Standard Accessories:

1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners, countersunk, finish to match aluminum color.

2. Sealant: Non-skinning type, AAMA 803.3

3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.

4. .125” prefinished aluminum bent plate sill pan.

5. Aluminum flat plates as needed for anchoring; shims, plates and anchors required for a secure installation.

2.04 RELATED MATERIALS (Specified In Other Sections)

A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

B. Metal Window Panels: Refer to Division 8 Glass and Glazing Section for metal panel materials.

2.05 FABRICATION

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

B. Fabrication Tolerance:

1. Material Cuts: Square to 1/32 inch (0.8 mm) off square, over largest dimension; proportionate amount of 1/32 inch (0.8 mm) on the two dimensions.

2. Maximum Offset: 1/64 inch (0.4 mm) in alignment between two consecutive members in line, end to end.

3. Maximum Offset: 1/64 inch (0.4 mm) between framing members at glazing pocket corners.

4. Joints (Between adjacent members in same assembly): Hairline and square to adjacent member.

5. Variation (In squaring diagonals for doors and fabricated assemblies): 1/16 inch (1.6 mm).

6. Flatness (For doors and fabricated assemblies): +/- 1/16 inch (1.8 mm) off neutral plane.

2.06 FINISHES AND COLORS

A. Anodized Finish: YKK AP AMERICA Anodized Finish

1. Clear Anodized, with protective composite coating.

B. Finishing: Prepare aluminum surfaces for specified finish; apply finish in accordance with the following:

1. Anodized Coating: Electrolytic color coating followed by an organic top coating applied to aluminum extrusions produced from quality-controlled billets meeting AA-6063-T5.

a. Exposed surfaces shall be free of scratches and other serious blemishes.

b. Extrusion shall be given a caustic etch followed by an anodic oxide treatment and sealed with an organic electrodeposition applied protective top coating.

c. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

d. Coating shall conform to Aluminum Association Standard AAM12C22A4X. A4X designation shall signify an anodic coating of 0.4 mils minimum followed by an organic top coating of a minimum 0.3 mils.

e. In addition to the Aluminum Association Standard above, finish shall conform to the following:

i. AAMA 605.2 Mortar Resistance Test Specification; Test Method per ASTM C207, 24 Hour Pat Test.

ii. CASS Corrosion Resistance Test. CASS 240/ASTM B368 Test Method.

iii. Other AAMA 605.2 Performance Tests specified in these specifications, such as: 7.3 Dry Film; 7.8.2 Salt Spray Resistance; 7.9.1.2 Color Retention, South Florida; 7.9.1.4 Gloss Retention, South Florida.

C. Finishes Testing:

1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh; Do not clean area further.

2. Submit samples with test area noted on each sample.

D. Anodized Finish Warranty: 10-year warranty commencing on Date of Substantial Completion.

PART 3: EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

3.03 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.04 INSTALLATION

A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.

1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.

2. Shim and brace aluminum system before anchoring to structure.

3. Provide .125” thick prefinished aluminum bent plate sill pans at exterior storefront systems. Provide profiles, sizes and profiles as indicated on Drawings. Extend sill pans continuous with spliced joints; set in continuous beds of waterproofing sealant.

4. Verify storefront system allows water entering system to be collected in gutters and weeped to exterior. Verify weep holes are open, and metal joints are sealed in accordance with manufacturer’s installation instructions.

5. Seal metal-to-metal storefront system joints using sealant recommended by system manufacturer.

6. All installation hardware and accessories required for a secure installation into rough openings, including shims, plates and anchors as necessary.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

B. Field Test: Conduct field test to determine water-tightness of curtain wall system. Conduct test in accordance with AAMA 501.2-03 at locations selected by Architect.

C. Perform minimum of three tests on various areas as determined by the Architect’s representative. Perform test in Architect’s presence. Field test first panels completed, then test all panels thereafter upon completion of all fixed panels. Generate and issue test report in compliance with AAMA 501.2-03 requirements.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Adjust operating items as recommended by manufacturer.

B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance, and remove construction debris from project site. Legally dispose of debris.

C. Protection: The General Contractor shall protect installed product's finish surfaces from damage during construction.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, apply to the work specified in this Section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall include all labor, materials, equipment, transportation, tools and storage required for complete installation of all finish hardware shown and electronic access control scheduled on Drawings and specified herein. Intent of this Specification is to provide complete finishing hardware requirements for entire building project excepting hardware, which is specifically mentioned hereinafter as being furnished by others. Any openings not specifically mentioned herein shall be furnished consistent with hardware specified for similar openings.

Wood doors for Project are prefit. Coordinate with wood door manufacturer in furnishing hardware templates and schedules at earliest possible time.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 0l068.

QUALITY ASSURANCE:

Manufacturers: Hardware listed in Hardware Schedule shall be supplied by one of following Manufacturers listed for each item or an equal. To establish quality of hardware required, catalog numbers of Manufacturers listed in Hardware Schedule have been used. Hardware furnished shall be of equal type, design, quality and function as that specified in Hardware Schedule.

Acceptable Manufacturers: Similar items manufactured or furnished by other manufacturers may be submitted for approval, subject to these Specification requirements and written approval received 7 days prior to bid date.

Supplier's Qualifications: Contractor shall select only supplier who has in his employ qualified personnel, who shall manage and coordinate complete hardware contract, and shall also be available to visit Project in order to solve or correct conditions affecting proper hardware installation or adjustment, as required.

SUBMITTALS:

Schedule: Submit Hardware Schedule to Architect in six (6) copies, as promptly as possible, showing quantities, types, catalog numbers and locations of various items of finish hardware required. Submit as specified for shop drawings in accordance with GENERAL CONDITIONS.

Job Completion Instructions: At completion of work turn over to Owner all tools, instructions, and maintenance information for his use in maintaining hardware. Furnish Owner also with two copies of Job Use Finish Hardware Schedule for his permanent records.

PRODUCT HANDLING:

Packing, Marking and Labeling: Deliver hardware to project site in manufacturer's original packages. Each article of hardware shall be neatly wrapped and individually packed in substantial carton or other container, properly marked or labeled to be readily identifiable with Hardware Schedule.

Storage: General Contractor shall furnish secure storage area for delivery by Hardware Supplier of finish hardware and storage of same. General Contractor shall be responsible for shortages due to theft and pilferage.

General Contractor shall provide in storage area adequate counters, shelves, and bins for assembly and grouping of hardware for distribution and installation.

PART 2: PRODUCTS

TYPES, SIZES AND DESCRIPTIONS:

Hardware shall be of types and sizes listed in this Section, applied with fastenings of proper size, quantity and finish.

Templates: Hardware for application on metal shall be made to standard templates. Furnish physical samples or templates, as required to Manufacturer of metal doors and frames for proper manufacturer and application.

Reinforcement: Reinforcing for hardware shall be furnished and installed by Door and Frame Manufacturer.

Modifications to hardware required by reasons of construction characteristics shall be such as to provide same operative or functional features. Modifications to hardware shall be made only with Architect's approval, after consultation with the Owner.

Provide hardware for fire rated openings in compliance with UL, UL 10C-1998, UBC 7-2-1997, NFPA-80 and CFR Part 36 (ADA) guidelines. Provide only hardware, which has been tested and listed by UL for types and sizes of doors scheduled. All hardware shall conform to ADA requirements. These requirements take precedence over any other requirements or specifications of this section.

Category "A" Positive Pressure Installations:

Hardware located above 40" AFF to be listed and labeled in accordance with UBC 7-2-1997 and UL 10C-1998 for use in positive pressure fire rated wood doors.
In order to meet smoke requirements, a smoke seal, listed and labeled for UBC 7-2-1997 Parts 1 and 2 positive pressure installations, must be mounted around the perimeter of the doorframe.
Flat bar type astragals only will be allowed on pairs of doors with fire ratings up to 60 minutes with concealed intumescent inside the door structure.

Door Smoke Seals: Doors in smoke partitions shall meet the requirements for a smoke and draft control assembly tested in accordance with UL 1784 for Smoke, and installed in accordance to NFPA 105-2010 Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives.

Provide strikes with extended lips as necessary.

Provide ANSI wrought strike boxes, with dust box inserts.

Provide doors to loading platforms, boiler and mechanical rooms, stages or platforms, utility stairs, and electrical closets with knurling on inside of lever.

Lockset Cores: Key cores shall be non-removable type, removable cores not allowed. Provide original Corbin-Russwin pins and Corbin nickel silver key blanks. Provide full escutcheon plates.

Provide CODE required tactile warning surfaces (knurling) for all door operating hardware for doors leading to mechanical, boiler, electrical, or chemical storage areas.

KEYING REQUIREMENTS

Keying: All locks and cylinders to be construction master keyed, and grand master keyed to the school system wide existing Corbin great grand master key system. Provide 5 keys per cylinder, stamped with keying symbol. All cylinders standard type.

Representative from the key company is required to meet with Owner's representative prior to turning cylinders and to turn all cylinders, and set up key cabinet.

Hardware supplier shall meet with the Architect and Owner to receive keying instructions before preparing schedule for approval.

One Manufacturer: Following items within each classification shall be furnished totally by one manufacturer.

Hinges	Locksets
Exit devices	Closers

Door Stops: All doors shall be provided with wall stops or overhead stops, to suit condition. For example, doors opening onto millwork or open space shall receive overhead stops. Solid wood blocking to be installed at all gypsum wallboard wall stop locations.

Fire rated openings: All fire rated openings, except classrooms, shall receive closers and ball bearing hinges, whether scheduled or not.

Coordinators: All door pairs with closers to be provided with coordinator devices as necessary for proper sequential closing operation.

Hinges: Unless otherwise noted, 3 butt hinges shall be provided each interior door to 36" width and 86" height. HD heavy duty hinges shall be provided for interior doors exceeding 36" width or 86" height.

Exterior hinges shall be heavy-duty continuous.

Materials and Finishes: (All products except closers, thresholds, weatherstripping to have brass or bronze base metal unless otherwise noted).

	Materials	Finishes
Continuous Hinges, Exterior Doors	6063 T6 Aluminum	Clear Anodized
Butt Hinges, Interior Doors	Steel	US 26 D
Pivots	Satin Chrome Plate	US 26 D
Exit Devices	Satin Chrome Plate	US 26 D
Cylindrical Lock Trim	Satin Chrome Plate	US 26 D
Dead Lock Trim	Satin Chrome Plate	US 26 D
O.H. Holders & Stops	Satin Chrome Plate	US 26 D
Door Stop and Holders	Satin Chrome Plate	US 26 D
Box Strikes	Wrought	Prime
Thresholds	Aluminum	Aluminum
Thresholders	Steel	Galvanized Steel
Weatherstrip	Aluminum	Aluminum
Flatgoods	Stainless	US 32 D

Fasteners:

Use concealed fasteners whenever possible.

Hardware to be installed on metal work shall be furnished with machine screws.

For exposed fasteners on interior in bronze or brass, use matching color and material for fasteners. For all other exposed fasteners on interior, use stainless steel except where noted specifically otherwise.

Furnish stainless steel screws for all exterior work.

Install fixed locking screw in strike plate for exterior locksets after final adjustments made during 6-Month Service and Adjustment Inspection.

HARDWARE ITEMS:

All Products shall be by one of the following manufacturers - no exceptions:

a. Butt Hinges: Hager, Stanley, McKinney

b. Spring Hinges, full mortise: Hager, Stanley, McKinney

c. Heavy Duty Continuous Gear Hinges, all exterior doors: Select Products SL24HD, or equivalent heavy duty by Markar, Hager or Pemko

d. Electric Hinges: ETW electric through wire hinge, with four continuous electric conductors, full mortise ball bearing, with Molex type connectors, by Hager.

e. Surface Closers: LCN 4040XP, Closer can mount hinge side, top jamb, or parallel arm (with PA bracket) on either right or left swinging doors. Provide metal covers with set screw anchors, in matching finish. Provide ADA rated features.

f. Locksets: Corbin / Russwin ML2000 Series Mortise Locksets, Grade 1, with LWM trim/lever; Equivalent Yale model.

g. Electrified Mortise Lockset: ML 20900 ECL Series-LWM x 626, complete assembly with power supply, and electric thru wire hinge EPT.

h. Exits Devices: Von Duprin 99 Series, each with a cylinder; Equivalent models by Yale.

i. Exit Devices at new door Electronic Access Control (Furnished and installed by the General Contractor's Division 8 Subcontractor): Von Duprin QEL, with electric butt hinges for butt hinge edge power transfers, or EPT Electric Power Supply (door frame to door wiring articulating raceway) at continuous hinge conditions. Coordinate operation with Controlled Access System components.

j. Wherever doors are equipped with exit devices, view windows shall have concealed / flush glass beads.

k. Electric Strike: Surface mounted retrofit electric door strike: HES 9600 Series, interlocked to control access system and any remote operation locations. Provide power supplies, wiring in required voltages, contactors, and all necessary accessories for a complete assembly. Coordinate operation with Controlled Access System components.

l. Removable Mullions: Von Duprin, Yale, Detex, keyed type with cylinder.

m. Overhead Holders/Stops: Glynn-Johnson, ABH Manufacturing.

n. Knox Box: (provided by GC) Where indicated, provide 3200 Series KNOX-BOX, surface/recessed mount with hinged door, with UL Listed tamper switches, 1/4" plate steel housing, 1/2" thick steel door with interior gasket seal and stainless steel door hinge. Box and lock UL Listed. Lock has 1/8" thick stainless steel dust cover with tamper seal mounting capability. Lock: UL Listed. Double-action rotating tumblers and hardened steel pins accessed by a biased cut key.

o. Thresholds: National Guard, Pemko, Hager.

p. Push/Pulls: Rockwood Manufacturing, Ives, Hager.

q. Stops: Glynn-Johnson, Rockwood Manufacturing, Ives, Hager.

r. Flush Bolts: Glynn-Johnson, Rockwood Manufacturing, Ives, Hager.

s. Silencers: Glynn-Johnson, Rockwood Manufacturing, Ives.

t. Kick Plates: Rockwood Manufacturing, Ives, Hager.

u. Automatic Flush Bolts: Glynn-Johnson, Rockwood Manufacturing.

v. Coordinator: Glynn-Johnson, Rockwood Manufacturing, Trimco

w. Weather strip & Rain Drips: National Guard, Pemko, Hager, Reese.

x. Door Bottoms: National Guard, Pemko, Hager.

y. Smoke Perimeter Door Frame Gaskets: Pemko, Hager, Reese

z. Smoke Door Bottom Sweep: Pemko, Hager, Reese

aa. Magnetic Door Holders: LCN SEM 7800 Series, with adjustable extension length.

Other items shall be as scheduled.

Provide the following hardware material as scheduled in the door schedule:

Hinges with closer	BB 1279 4 ½ x 4 ½
St/Stl hinges with closer	BB 1191 4 ½ x 4 ½
HD hinges with closer	BB 1168 4 ½ x 4 ½
St/Stl HD hinges w closer	BB 1199 4 ½ x 4 ½
Hinges without closer	1279 4 ½ x 4 ½
St/Stl hinges without closer	1191 4 ½ x 4 ½
Electric Hinges	ETW 4 ½ x 4 ½
Spring hinges	1250 4 ½ x 4 ½
HD continuous hinges	SL24HD all exterior doors
Privacy set	ML 2030-LWM x 626, with occupied indicator
Passage set	ML 2010-LWM x 626
Classroom lockset	ML 2002-LWM x 626 Classroom Intruder
Entrance lockset	ML 2051-LWM x 626
Office lockset	ML 2051-LWM x 626
Combination lock	Mortise ML 2065-LWM X 626
Electrified Mortise Lockset	ML 20900 ECL Series-LWM x 626
Exit device (interior)	99 L all interior locations (F as req'd)
Exit device (exterior)	99 NL x DT exterior doors scheduled

Exit Device at EAC	QEL with EPT where EAC (Electronic Access Control) is scheduled.
Mullion	4954 (9954 as req'd), keyed type
Electric Strike:	HES 9600 Series
Cylinder	Conventional 6-pin
Closer	4040XP, with 3049 hold-open arm at all exterior doors, metal cover
Closer with backstop	4040XP – 3077CNS, metal cover with set screws
Kick plate	1935 8 x 2 LDW
Wall stop	232 W
Floor stop	241 F
Overhead stop	9-331
Flush bolts	282 D
Threshold	Pemko 2005AV
Upper rain drip	Reese R201C
Lower rain drip/sweep	Pemko 345_V
Frame Smoke gasketing	Pemko 332CR
Door Bottom Smoke Sweep	Pemko 307AV
Perimeter gasketing	Pemko 296_R
HD Interlock gasketing	Pemko 336
Push plate	70C 4 x 16
Pull handle	107 x 70C 4 x 16
Key cabinet	Expand existing key cabinet as required for additional keys

General and Special Hardware Notes:

1. All doors to receive hinges as specified
2. All doors to receive wall or overhead stops to suit condition of use. Doors with magnetic hold opens to receive floor stops.
3. Provide closers with backstops for exterior doors and to suit condition of use.
4. All steel frames to be provided with silencers.
5. Exterior doors to be provided with weather-stripping and thresholds.
6. All exit devices to be provided with cylinders.
7. At pairs of doors, pull side, provide pull or lever right side only.
8. Provide cylinders for keyed mullions supplied by aluminum door supplier.
9. Exit devices at exterior doors to NL with pull, unless otherwise indicated.
10. Exit devices at interior doors to be classroom function with lever.

Pneumatic Automatic Door Openers:
Provide automatic, single leaf door opener, complete operational assembly, at main front entrance, and at locations indicated on Drawings. Motor and controller capacity to be sized for a single door operator, and shall meet all accessibility codes manual force requirements of 5 lbs. Full closing force shall be provided when the power or assist cycle ends.

All power operated systems shall include compatibility with key pads or card readers and have built-in supply for actuators and peripherals, power actuators, remote actuators, and be compatible with electric latch retraction, electric strikes or magnetic locks.

All units shall be covered by a 2-year warranty.

All units shall be inspected by the factory representative for proper installation and function after installation.

Interior and Exterior Wall Plate Actuators: Actuators shall be hardwired low voltage and shall have a stainless steel 4 ½" round plate with engraved blue filled accessibility symbol. At all locations the actuator box shall built into the wall construction flush, providing a box made of industrial grade components, and

providing weather resistant installation at exterior locations. When required, exterior actuator will be deactivated with adjacent key switch. LCN 956, LCN 958.

Automatic Door Opener:	LCN	4822 Reg, Auto-Equalizer, Pneumatic Operator
(hardwired)	LCN	4822-18G Drop Down Plate
	LCN	4822-3077L Long Arm (if required)
	Frame Manuf.	Set of Integral Seals
	LCN	Interior and Exterior 8310-856 Wired Actuator Pads
	LCN	868F and 868S Mounting Boxes (to suit condition)
	LCN	7982ES Controller
	LCN	925 1/8" ID Tubing
	Locknetics	(2) 653-1414-L2 Key Switch with (2) LED Lights
	Various	(2) Cylinders For (2) Key Switches
	SCE	Remote Release Actuator 701RD-AA
	Various	Wire Supplies, Conduits, Boxes and Misc. Materials for Complete Assembly

CONTROLLED ACCESS SYSTEMS

All Products shall be complete assemblies by one of the following manufacturers - no exceptions:

1. Where indicated on Drawings, provide Access Control System devices and components and accessories, fully compatible with an S2 Security access control system program, and fully compatible with an existing S2 Security access control system, including but not limited to the following components. All products shall be complete assemblies by one of the following manufacturers.

    a. S2 Access Control System Field Panel: S2 Network Node, S2-NN-E2R-WM, housing up to seven (7) S2 application blades, supporting up to 14 doors, with network drop. Provided by the Division 17 Access Control Contractor. Electrical Contractor to provide electrical power.

    b. Exterior Intercom Call Station: Aiphone IX Series or equivalent, double gang stainless steel, intercom buzz-in access system, with video camera, aluminum or stainless-steel weather resistant cover plate. Tied into and communicating through the building's IC system to the manager's desktop base station. Provided by the Division 17 Access Control Contractor. Electrical Contractor to provide electrical power.

    b. Two-Way Desktop Intercom Communication Station: Aiphone IX Series or equivalent Master Video Station with picture memory, door strike release toggle or switch, tabletop mounted at Reception desk, 4 conductor wire back to head-in unit. Electrical Contractor to provide electrical power.

    e. Access Control Program Base Station: Computer Station with program software control of connected doors. EC to provide network drop and electrical power.

    c. Card Reader Unit: HID Reader RP10 Multi-Class SE, Model S2-900PTNNEK00460-S2SEC, mini-mullion version where required. Provided by the Division 17 Access Control Contractor.

    f. Electric Strike (for retrofit applications): Surface mounted electric door strike HES 9600 Series, interlocked to control access system and the remote operation locations. Provide power supplies, wiring in required voltages, contactors, and all necessary accessories for a complete assembly. Coordinate operation with Controlled Access System components. Provided and installed by the Division 8 door hardware supplier. Verify if needed.

    g. Request-To-Exit (REX) PIR Detector: Bosch Security Model DS161. Provided by the Division 17 Access control Contractor. Electrical Contractor to provide raceway to door frame.

h. Recessed Door Contact Switch: GRI 180 Series, 195-12WG-W recessed door switch sets, by George Risk Industries. Double pole, double throw, wide gap. Provided by the Division 17 Access control Contractor. Electrical Contractor to provide raceway to door frame.

i. Surface Mount Switch Set: GRI 4460 Series, 4463A, Miniature Aluminum Commercial Surface Mount Switch Set, by George Risk Industries. Provided by the Division 17 Access control Contractor. Electrical Contractor to provide raceway to door frame.

j. Armored Door Cords (for retrofit conditions): Enforcer SD-969-S18Q Surface Mounted Cord with Die-Cast Aluminum End Caps, by SECO-LARM U.S.A. Provided by the Division 17 Access Control Contractor. Electrical Contractor to provide raceway to hinge side of door, at 36" AFF. Doors with EPT will not require armored door cords.

k. Power Supplies: PS 906-KL Schlage Power Supply with key lock, and add -on boards 900-BB Battery Backup Board & 900-4R Relay Board. Provide power supplies and add-on boards for all powered door locking hardware / exit devices, as required. Provided and installed by Division 8 hardware supplier.

m. EPT Electric Power Supply (door frame to door wiring articulating raceway at continuous hinges): Von Duprin Models EPT2, EPT10, EPT10C (as application requires), for use with Von Duprin QEL Exit Device. Provided and installed by Division 8 door hardware supplier.

n. Von Duprin Quiet Electric Latch Retraction – QEL Exit Device. Provided and installed by Division 8 door hardware supplier.

o. Von Duprin QEL Conversion Kit – Model 958003-00. Provided and installed by Division 8 door hardware supplier. Kit shall be compatible with existing exit device.

p. Von Duprin RX Switch – Model 0502521. Provided by the Division 17 Access Control Contractor. Electrical Contractor to provide raceway to door frame.

q. Electrified Mortise Lockset: ML 20900 ECL Series. Provided and installed by Division 8 door hardware supplier.

r. Electric Hinges: Hager ETW electric through wire hinge, with four continuous electric conductors, full mortise ball bearing, with Molex type connectors, by Hager. Provided and installed by Division 8 door hardware supplier.

2. Controlled access system devices proposed shall be complete assemblies with all necessary components as required to operate. Assemblies to include but not limited to: power supplies, cables, electrical power circuits in required voltages - routed to power sources, raceways, device boxes, junction boxes, transformers, contactors, relays, solenoids, electric door strikes, etc. GC is fully responsible for and shall provide complete coordination with the Electrical Contractor, the Division 8 contractor, and the Division 17 contractor for providing fully functional assemblies. Provide complete assemblies whether indicated on Drawings or not. All access control doors shall be provided with all required components and feeds, to suit conditions.

PART 3: EXECUTION

GENERAL:

Consult project drawings and details and otherwise become familiarized with work so that all items furnished will conform to openings to which applied.

Coordinate hardware with other allied trades such as carpentry, millwork, metal frames, etc.

Prepare and submit to Architect for approval as promptly as possible three (3) copies of completed detailed schedule.

Immediately after award of hardware contract, request approved shop drawings from such trades with which hardware must be coordinated.

After checking approved shop drawings, supply promptly such template information, template drawings, approved hardware schedule, etc., as may be required to facilitate progress on job.

APPLICATION:

Apply hardware in accordance with approved Shop Drawings, with fastenings of proper size, quantity, and finish, and in accordance with Manufacturer's instructions coordinate.

Operation: All items of hardware shall fit and operate properly.

HARDWARE LOCATIONS:

Door Pulls: 42" from finished floor to center of grip.

Push-Pull Bar: 42" from finished floor to center of bar of center between bars and combination.

Top Hinge: To frame Manufacturer's standard, but not greater than 10” from head of frame to centerline of hinge.

Bottom Hinge: To frame Manufacturer's standard but not greater than 12-1/2" from finished floor to centerline of hinge.

Intermediate Hinges: Equally spaced between top and bottom hinge. Doors exceeding 36” width shall be provided with 2 pair hinges.

Locks and Latches: 38” from finished floor to center of knob.

Deadlocks (with separate latch-set and/or pull): 60" from finished floor to centerline of strike.

Locate pivots in accordance with Pivot Manufacturer's requirements.

FINAL INSPECTION: After installation of all finish hardware is completed, and before building is accepted, General Contractor shall have capable representative of hardware manufacturers, minimum of an AHC, visit building to inspect and approve installation; to make all necessary adjustments; and to carefully instruct Owner in proper use, servicing, adjusting and maintaining of hardware.

SIX MONTH SERVICE AND REPORT: Six months after acceptance of each area of the project, readjust each item of hardware and restore to proper function. Install fixed locking screw in strike plate for exterior locksets after final adjustments made during 6-Month Service and Adjustment Inspection. Consult with Owner regarding recommended additions or modifications to maintenance procedures. Clean and lubricate as required. Replace items, which have deteriorated or failed due to faulty design, materials, or installation. Provide Architect with written report upon completion of above.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, apply to the work specified in this Section.

PART 1: GENERAL

SUMMARY:

Provide glass, glazing, metal panels, and special fire glass as indicated below, complete.

Work Included This Section:

Glass and Glazing For:

- Aluminum Entrances
- Steel and Wood Doors
- View Windows and Panels
- Exterior Windows
- Metal Window Insulated Panels
- Special fire glass

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

QUALITY ASSURANCE:

Provide safety glass (tempered, laminated) complying with requirements of ANSI Z97.1 - American National Standard for Glazing Materials Used in Buildings -- Safety Performance Specifications and Method of Test.

Label each piece of glass designating type and thickness of glass. Do not remove label prior to installation.

Permanently identify each unit of tempered glass. Etch or ceramic fire identification on glass; identification shall be visible when unit is glazed.

Warranty: Provide manufacturer's standard 10 year warranty, including include replacement of sealed glass units exhibiting seal failure or leakage, interpane dusting or misting.

Manufacturers:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by following manufacturers:

- American St. Gobain Corporation

- Libby-Owens-Ford Glass Company
- Mississippi Glass Company
- Pittsburg Plate Glass Company
- Technical Glass Products
- Nippon Electric Glass Co., Ltd.
- Pilkington

SUBMITTALS:

Glass and Glazing: Submit samples of each type of glass, metal insulated panel, glazing compound, sealant and tapes for Architect's approval.

Product Data: Submit copy of manufacturer's specifications and installation instructions for each type of glass and glazing material. Include test data or certification substantiating that glass complies with specified requirements and manufacturer's warranties.

Submit manufacturer's standard 10 year warranty for insulated glass units.

MANUFACTURER'S LABELS:

Labels showing Glass Manufacturer's identity, type of glass, thickness and quality will be required on each piece of glass. Labels must remain on glass until it has been set and inspected.

Containers: All glazing compounds shall arrive at project site in unopened, labeled containers.

PRODUCT HANDLING:

Sizes of glass indicated on Drawings are approximately only. Determine actual size required by measuring frames to receive glass at project site, or from guaranteed dimensions provided by Frame Supplier.

Cutting: All glass shall be cleancut. Nipping to remove flares or to reduce oversized dimensions of any type of glass will not be permitted.

Deliver glass to site in suitable containers that will protect glass from weather and from breakage. Store material in safe place to minimize breakage, but deliver sufficient glass to allow for normal breakage.

DESIGN AND PERFORMANCE REQUIREMENTS:

Watertight and airtight installation of each piece of glass is required. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials, and other defects in work.

PART 2: PRODUCTS

GLASS:

SuperGrey Tinted Solar Control Low-E Insulating Glass: 1" thick panels; 1/4" thick "deep cool-grey" low-reflective body-tinted float glass to exterior, 1/4" clear Low-E solar control glass to interior; Low-E shall be on the 3rd surface, with 1/2" space between glass panes by dessicant filled spacer and sealant device.

Pilkington SuperGrey / Energy Advantage:

Properties: Pilkington SuperGrey / Energy Advantage Low-E Glass

Glazing:	Exterior
Type:	Insulated
Total Thickness:	1" (24 mm)
Space Filler:	Dehydrated Air Space
Outboard Lite:	1/4" SuperGrey Tinted Float Glass
Inboard Lite:	1/4" Energy Advantage Low-E Glass, #3 Surface
Low-E Surface:	3rd Surface
Heat Strengthened:	Safety as required – see elevations
Tempered:	Safety as required – see elevations
Visible Light Transmittance (%):	LT 7%
Visible Lite Exterior Reflectance (%):	LRo 4%
Visible Lite Interior Reflectance (%):	LRi 13%
Total Solar Energy Direct Transmittance (%):	ET 5%
Total Solar Energy Reflectance (%):	ER 4%
U-V Transmittance (%):	UV 1%
Solar Heat Gain:	SHGC 0.15
Shading Coefficient:	TSC 0.18

Acid-Etched Obscure Glass: For all window glass at toilet rooms, shower rooms, and locker rooms, provide 1" Solargray with Solarban Low-E on 2nd surface, with acid-etched obscure glass clear (no color) lite on 3rd surface.

Provide impact resistant glass throughout where required under Chapter 24, Section 2406, North Carolina State Building Code, 2006 Edition, Category I and II, CPSC 16CFR1201.

Fire Rated Glass: Provide fire-rated impact resistant glass for protected openings as indicated, manufactured by Technical Glass Products. Conform to UL 10 C, UBC 7-2, and UBC 7-4, UL File No. R-19207, design U533. Frame tests to pass ASTM E-119, NFPA 251, UL 263, UL 9, UL 10C, UBC 7-2 and UBC 7-4.

Exterior Aluminum Entrance Doors: 1/4" "neutral tint" Low-E tempered plate glass, impact resistant as required.

Interior Doors: 1/4" clear tempered safety glass, impact resistant as required.

Interior Windows: 1/4" clear tempered safety glass, impact resistant as required.

SETTING BLOCKS AND SPACER SHIMS:

Fabricate blocks and shims from neoprene. Shape to required size and thickness. Material used for blocks and spacers must be compatible with type of compounds and sealants used and shall not cause staining or discoloration of sealant or frame.

Shore A durometer hardness of setting block and shim material shall be 70 to 90 points for setting blocks and 50 points for spacer shims, or as recommended by compound or sealant manufacturer.

METAL WINDOW PANELS

Metal window panels consist of metal skins laminated to stabilizer substrates with an insulating core material. Panels are designed to be glazed into a window system or curtain wall system.

Laminated metal faced insulated panels equivalent to “MapeShape” panel as manufactured by Mapes Industries, Inc., 1” total thickness, with formed edges for glazing into a 1” glazing pocket.

Exterior & Interior Finish:: Kynar factory paint finish on 0.032” smooth finished aluminum skin, color as selected by Architect from factory colors, minimum selection of 20. Provide 25-year finish warranty. MATCH EXISTING

Insulation Core: 2.0 lb. density polystyrene
R-Value: R-6.0 per inch

GLAZING MATERIALS:

Sealant and Compound shall be Vulkem 116 by Master Mechanics Company, Maccolastic Acrylic Compound by Macco Division, Glidden Company, Betaseal 850 by Essex Chemical Company or approved equal.

Glazing Tape shall be butyl rubber sealant type partly vulcanized, self-adhesive, non-staining, elastomeric butyl rubber tape, complying with AAMA 800.

Bestaseal 650 Tape by Essex Chemical Company
Duraribbon 1070 by PPG Industries
176 Strucsureglaze by Protective Treatments Company

Compatibility: Where combination of sealing materials is required for glazing in same frame, manufacturer shall certify that all glazing materials furnished are compatible with each other and compatible with material used for setting blocks and spacer shims.

PART 3: EXECUTION

CONDITION OF SURFACES:

Preparation: Check all frames prior to glazing. Openings shall be square, plumb, and with uniform face and edge clearances. Maintain 1/8" minimum bed clearance between glass and frame on both sides.

Clean all surfaces to be glazed with xylol, a 50-50 mixture of acetone and xylol, or other solvents recommended by compound or sealant Manufacturer. Any defects affecting satisfactory installation of glass shall be corrected before starting of glazing.

Temperature: Do not apply any compound or sealant at temperatures lower than 40 degrees F.

INSTALLATION:

Workmanship: Apply glazing compound uniformly with accurately formed corners and bevels. Remove excess compound from glass and frame. Use only recommended thinners, cleaners and solvents. Do not cut or dilute glazing compound without approval from Architect. Make good contact with glass and frame when glazing and facing off.

Cleaning: Compound shall be removed from glass before it hardens. Remove any excess sealants from glass and adjoining surfaces during working time of material, within two to three hours.

Blocks and Spacers: Where setting blocks and spacer shims are required to be set into glazing compound or sealant, they may be butted with compound or sealant, placed in position, and allowed to set firmly prior to installation of glass.

Miscellaneous Interior Glazing: Unless otherwise indicated, all interior glass shall be channel glazed with glazing compound. Apply as follows:

Apply ample back compound to rabbet so that it will ooze out when glass is pressed into position and completely cover glass in rabbet. Press glass into position.

Secure glass in place by application of stop beads. Bed stop beads against glass and bottom of rabbet with compound, leaving proper thickness between glass and stop beads. Secure stop beads in place with suitable fastenings. Strip surplus compound from both sides of glass and tool at slight angle to provide clean sight lines.

Glazing Aluminum Entrances and Window Wall System:

Glass shall be set in accordance with aluminum entrances and window walls Manufacturer's shop drawings and instructions.

Install moldings level, plumb and square. Moldings at corners shall be accurately cut, neatly fitted, and joined as recommended by Storefront manufacturer.

REPLACEMENTS AND CLEANING:

Condition: At completion of work, all glass shall be free from cracks, sealant smears and other defects.

Protection/Replacement: Protect glass surfaces and edges during the construction period. Keep glass free from contamination by materials capable of staining glass. Any glass that is defective before acceptance, or within one year warranty period, as result of manufacturing, transporting, or performance of Contractor, shall be removed and replaced with new glass without cost to Owner.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Under this Section, provide gypsum board for wall assemblies (non-fire rated and fire-rated), partitions, ceilings, ceiling access doors, fireproofing for beams and columns as indicated on drawings and as specified herein.

Note all gypsum drywall, except as noted on drawings, shall be provided with a LEVEL 4" gypsum wallboard finish.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by United States Gypsum Company.

Acceptable Manufacturers: Products of following manufacturers which meet all requirements of these specifications will be acceptable:

- U.S. Gypsum
- CertainTeed Corporation
- Georgia-Pacific
- National Gypsum Company

Source: Products for use on this Project shall be of one Manufacturer for same function, unless noted specifically otherwise herein.

SUBMITTALS:

Manufacturer's Data: Submit (in duplicate) Manufacturer's printed catalog cuts, installation instructions, and finishing instructions.

Test Reports: Submit (in duplicate) reports from Underwriter's Laboratories, Inc. or other acceptable testing agencies, on fire tests of designs referred to in Contract Documents.

Mock-up Sample: When required, fabricate a field sample mock-up of gypsum wallboard with the specified "orange peel" texture applied, for review and approval by Architect. Approved mock-up will stand on site for reference as the project standard for all orange peel textured walls.

Mock-up Sample: Fabricate a field sample mock-up of gypsum wallboard aluminum reveals, for review and approval by Architect. Approved mock-up will stand on site for reference as the project standard for all aluminum reveal walls.

PRODUCT HANDLING:

Delivery: Deliver materials in original packages, containers or bundles bearing brand name and name of manufacturer or supplier for whom product is manufactured.

Storage: Gypsum board and insulation material delivered prior to use shall be stored within completely weather tight structure, off ground, and completely enclosed within weather tight covering. Stack all board materials on 2"x 4" risers, spaced 16" o.c. Weather tight covering shall also extend completely under stacked material to prevent seepage of moisture if over uncovered ground or damp slab.

Handling: Exercise care, during handling and storage, to avoid undue sagging or damage to edges, ends, and surfaces.

ENVIRONMENTAL CONDITIONS:

Building: Application of gypsum board shall commence only after structure is completely weather -tight.

Temperature: In cold weather and during period of gypsum board application and joint finishing maintain temperatures in building uniformly within range of 55 degrees to 70 degrees F. Provide adequate ventilation to eliminate excessive moisture in building during same period.

PART 2: PRODUCTS

MATERIALS:

Gypsum Board shall be furnished in 48" widths and in lengths of at least 2" greater than height from floor to finished ceiling to permit vertical installation of all boards. Contractor shall have option to furnish boards for vertical installation full height to structure above where required in one sheet, 48" wide.

Types: Gypsum Board shall conform to following:

1. Gypsum Board shall be fire-resistive type throughout of various thicknesses indicated, equivalent to Sheetrock Brand Firecode C. Provide impact resistant gypsum wallboard at locations indicated on Drawings.

2. All 5/8" thick gypsum board shall be taper-edged, fire-resistive, conforming to ASTM C 1396.

3. Mold and Mildew Resistant Gypsum Board shall be "Sheetrock Mold Tough Gypsum Wallboard" 5/8" tapered-edge with treated manila paper finish and "Sheetrock Mold Tough Fire-code C Wallboard, 5/8" tapered-edge with treated manila paper finish for 1 hour rated partitions. Use 5/8" mold and mildew resistant gypsum board for ceilings of janitor closets, shower rooms, tub rooms.

4. Tile Backer Board: Use 5/8" tile backer board for backup of all areas scheduled to receive thin set ceramic tile. Moisture resistance silicone core reinforced with inorganic glass fiber matt. "DenShield Tile Guard" by Georgia-Pacific, or equal products by approved manufacturers.

5. Exterior Wall Sheathing Board shall be 5/8" thick fire retarding fiberglass reinforced gypsum board, with sealed and taped joints: "Dens-Glass Gold" by Georgia-Pacific, or equal products by approved manufacturers.

6. Gypsum Soffit board shall be 5/8" thick, fire coded, exterior gypsum soffit board by Bestwall, U. S. Gypsum, or equal products by approved manufacturers.

7. Wall Spray Texture: SHEETROCK Wall & Ceiling Spray Texture, SHEETROCK Wall & Ceiling Texture (TUF-TEX), SHEETROCK Wall & Ceiling Spray Texture – Ready Mixed.

8. Sheetrock Brand First Coat drywall finishing primer.

FASTENERS:

Screws for attachment of board to metal studs and metal ceiling and wall furring shall be 7/8" or 1" US Drywall Screw, Type S. All screws shall have bugle head.

METAL AND PLASTIC CORNER BEADS AND TRIM:

Interior Work:

Plastic: All external corners are to be bullnozed radius trimmed unless otherwise indicated.

Metal: Fabricate metal corner beads from galvanized steel, not lighter than 0.02" nominal thickness, in following shapes and sizes.

1. Corner Beads for all 90 degree external corners shall be equivalent to USG No. 100-Perf-A-Bead.

2. Corner Beads for all radiused external corners shall be heavy duty plastic, equivalent to No. BCB100, radiused bullnoze corner bead by Vinyl Corporation.

3. Metal Trim shall be equivalent to USG 200 Series Perf-A-Trim, sized for wallboard thickness.

4. Anodized Aluminum Reveals: Continuous anodized aluminum reveals shall be provided in profile and layout indicated on Drawings, with factory fabricated intersections. Install or provide mock-up installation samples for Architect’s review and obtaining final approval prior to proceeding with installations. Fry Reglet or equivalent.

REINFORCING TAPE AND JOINT TREATMENT (INTERIOR)

Tape shall be equivalent to "Perf-A-Tape".

Compound for embedding and fill coat application shall be equivalent to "Perf-A-Tape Joint Compound".

Compound for finishing shall be equivalent to "Perf-A-Tape Topping Compound".

ADHESIVE AND CAULKING:

Laminating Adhesive: Laminating adhesive for face layer application in double-layer systems shall be equivalent to "Perf-A-Tape Joint Compound, embedding type".

Caulking Compound: Acoustical type sealant, furnished by Gypsum Board products manufacturer.

CRACK CONTROL JOINTS:

Crack control joints shall be provided in pre-approved locations as directed by the Drawings and the Architect, at each jamb of windows exceeding 10’ in width, in walls at 40’ intervals, and in ceilings at 30’ intervals. Provide manufacturer standard metal exp/control joint material.

PART 3: EXECUTION

CONDITION OF SURFACES:

Inspection: Examine surfaces to receive gypsum board for defects, which might impair quality of finished installation. To not start work until such defects have been corrected.

Framing Spacing: Framing members to which gypsum board will be fastened shall be straight and true, and spaced as indicated on Drawings, not to exceed 16" o.c. for walls and ceilings. Framing and bridging members shall be adequate to carry design or code loading. Bridging members shall be spaced 48" o.c.

Supplemental Framing: Provide back blocking and framing as necessary for support of fixtures and all mounted equipment.

Coordination: Conduit, piping, retainers for corner guards and other items to be concealed by or penetrating, wallboard shall be installed and tested before applying wallboard.

INSTALLATION OF GYPSUM BOARD:

Cutting and Fitting:

Cut gypsum board by scoring and breaking, or by sawing. Work from face side.

Cut edges and ends of gypsum board shall be smoothed where necessary, in order to obtain neat jointing when board is erected.

Cut-outs for pipes, fixtures or other small openings shall be scored on face and back in outline before removal, or shall be cut out with saw or other suitable tools.

Where gypsum board meets projecting surfaces, scribe and cut neatly, fitting closely for caulked joint.

Application of Gypsum Board:

Apply continuous bead of Acoustical Sealant on floor at line of contact of board.

Walls: Apply gypsum board vertically, pressing into sealant, with boards in moderate contact, but not forced into place. At interval and external corners conceal cut edges of boards by overlapping covered edges of abutting boards. Arrange joints on opposite sides of partitions so as to occur on different framing members. Place long dimensions of panels parallel to furring or framing members. Panels shall be of length required to reach from 2" above ceiling line to floor line in one continuous length. Make joints over framing or furring members.

Ceilings: Apply board to ceilings with long dimension of board at right angles to furring members. At perimeters of all ceilings, edge joint shall be laid on metal trim strip against continuous bead of caulking, applied in advance of board application.

Gypsum Board End Joint at masonry walls shall be laid on metal trim strip against continuous bead of caulking, applied in advance of board application.

Corner Beads and Metal Trim: Internal corners do not require corner beads, but shall be reinforced with tape. External corners shall have corner bead fitted neatly over corner, and secured with same type fasteners used for applying wallboard.

ATTACHMENT:

Method: Space fasteners not less than 3/8" nor more than 1/2" from edge and ends of board. While fasteners are being driven, hold board in firm contact with under laying support. Application of fasteners shall proceed from central portion of board to ends and edges. If paper surface is broken by fastener in attachment, drive another fastener approximately 2" from faulty fastener.

Drive screws to provide screw head penetration just below gypsum board surface.

Spread adhesive over laminating surface of face or base layer gypsum board. Extend adhesive up to ends and edges of all board.

Spacing of Fasteners shall be as follows:

Screw Method: Space screws at maximum of 12" o.c. for ceilings and 16" o.c. for walls.

Corner Beads and Trim shall have fasteners spaced 6" o.c. driven through gypsum board into framing members.

JOINT FINISHING AND FASTENER CONCEALMENT:

Provide “LEVEL 4” gypsum wallboard finish at all areas, unless indicated otherwise.

Provide total coverage coat of Sheetrock Brand First Coat Primer or equivalent prior to paint coats. Reference 09900.

Method: Mix and use joint compound and topping compound in accordance with manufacturer's recommendations printed on bag. Apply by machine or hand tool. Allow minimum drying time of 24 hours between adhesive coats. Sand all coats as necessary after each application. Clean excess compound from surface of gypsum board as compound is applied.

Reinforcement: Reinforce wall and ceiling angles and inside vertical corner angles with tape folded to conform to adjoining surfaces, and to form straight, true angle. All gypsum board joints except joints at metal trim shall be tapered.

Embedment Coat: Apply thin, uniform layer of joint compound (embedding type) approximately 3" wide over joint to be reinforced. Center tape over joint and seat into compound; leaving sufficient compound under tape to provide proper bond. Apply skim coat of compound immediately after embedding tape.

Fill Coat: After drying, cover embedding compound with fill coat of compound. Spread evenly over and slightly beyond tapered edge area of board. Feather at edges.

Topping: Cover fill coat with topping compound. Spread evenly over and slightly beyond edge of proceeding coat. Feather with smooth, uniform finish.

Fastener Concealment: Treat dimples at fasteners (and holes where temporary fasteners are removed) with three coats of joint compound applied as each coat is applied to joints.

Conceal flanges of all corner beads and trim members by minimum of two coats of compound applied strictly in accordance with Manufacturer's directions.

Caulking:

Joints at Penetrations: Where pipes, conduits, ducts, electrical devices, etc., penetrate gypsum board, seal joint around perimeter with caulking compound.

Joints between ceilings and walls shall be sealed continuously with acoustical sealant, as specified above.

DRYWALL CEILING ACCESS DOORS: Provide 24” x 24” x 16 gauge minimum primed steel ceiling access doors each space with drywall ceiling, hinged and with key lock. Provide UL Listed fire-rated doors all locations where a rating is required. Provide USG No. 200-B metal trim on all edges of gypsum board. Finish as specified in 09900 Paint.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work under this section includes providing metal stud partition system, metal ceiling furring system, metal wall furring system and metal ceiling suspension system, for installation of gypsum board.

RELATED WORK:

Section 05400 Cold-Formed Metal Stud Framing
Section 09250 Gypsum Drywall Systems

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by United States Gypsum Company.

Acceptable Manufacturers: Products of following manufacturers, which meet all requirements of these specifications, will also be acceptable:

- ClarkDietrich Building Systems
- MarinoWARE
- Telling Industries

Source: Products for use on this Project shall be of one manufacturer for same function, unless noted specifically otherwise herein.

SUBMITTALS:

Shop Drawings: Show complete details of construction, including gauges of metal, anchors, fastenings, special fittings, and accessories. Show ceiling framing and furring, special wall framing, and framed openings.

Manufacturer's Data: Submit (in duplicate) Manufacturer's printed data on materials and installation for work specified herein. Include reports on fire tests and physical data.

PRODUCT HANDLING:

Delivery: Deliver materials to Project site in the original packages, containers or bundles, bearing brand name, and name of manufacturer or supplier for whom product is manufactured.

Storage: Store materials to prevent damage from exposure to elements.

PART 2: PRODUCTS

METAL STUD PARTITION SYSTEM: Metal stud partition system shall be USG Metal Stud System, or approved equal, designed for screw attachment of gypsum board, furnished with required fasteners and accessories for complete system.

Steel Studs shall be C-shaped, formed from not less than 20-gauge galvanized steel sheets, USG width as shown on drawings. Stud webs shall have punched holes throughout for utility lines, wiring and CRC bridging.

Provide horizontal bridging at spacing intervals required by the manufacturer's drywall system. Options include CRC bridging thru the pre-punched stud holes with framing clips, or 2" wide x 18 gauge flat straps.

Metal Floor and Ceiling Runners shall be channel-shaped, formed from not less than 25-gauge galvanized steel sheets, with minimum 1-1/4" flanges and web-sized to nest with steel studs specified.

Screws for attachment of studs to runner and other framing fastening where specified shall be 3/8" USG Drywall Screw, Type S, pinhead.

WALL FURRING SYSTEM: Wall furring system shall be USG Drywall Wall Furring System, designed for screw attachment of gypsum board furnished with required fasteners and accessories for complete system.

Furring Channels shall be hat-shaped USG Drywall Furring Channels, or equal, roll-formed from not less than 25-gauge galvanized steel, 2-3/4" wide by 7/8" deep with 1/2" minimum wing flanges and 1-3/8" minimum crown width for gypsum board attachment.

Fasteners for attachment of furring channels (or wall furring brackets) shall be as recommended by furring manufacturer.

Brackets for furred-out utility space shall be USG adjustable wall furring brackets, formed from not less than 20-gauge galvanized steel. Horizontal leg shall have serrated edges for wire-tie of carrying channels.

Carrying Channels shall not be less than 16-gauge cold-rolled channels, 3/4" web width and 1/2" flange depth, spaced 48" on center maximum. Finish with black asphaltum.

Tie Wire shall be not less than 16-gauge soft annealed carbon steel wire.

CEILING FRAMING SYSTEM: Ceiling-framing system for furred and suspended gypsum board ceilings shall be USG Drywall Ceiling System, designed for screw attachment of gypsum board, furnished with required fasteners and accessories for complete system.

Furring Channels for gypsum board applied to ceiling framing shall be hat-shaped USG Drywall Furring Channels, roll-formed from not less than 25-gauge galvanized steel, 2-3/4" wide by 7/8" deep with 1/2" minimum wing flanges and 1-3/8" minimum crown width for gypsum board attachment. Provide cross-carrying channels as specified at 48" centers.

Furring Channels for dropped ceilings, soffits, and where indicated at expansion joints shall be C-shaped studs, formed from not less than 25-gauge galvanized steel sheets, and of sizes indicated on Drawings.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

SCOPE:

Work included in this section:

- Sloped Setting Beds
- Glazed Porcelain Floor Tile
- Glazed Porcelain Wall Tile
- Tile Accessories

INDUSTRY STANDARDS:

Tile Council of North America (TCNA) Handbook for Ceramic, Glass, and Stone Tile Installation – Current Edition.

EJ171 Movement Joint Guidelines for Ceramic, Glass, and Stone - Tile Council of North America (TCNA) Handbook for Ceramic, Glass, and Stone Tile Installation – Current Edition.

Current edition of American National Standard Specifications for the installation of ceramic tile; A108 / A118 / A136.1, A137.

Current editions of ASTM C 150, ASTM C 206, ASTM C 207, ASTM C 144, ASTM C627.

Current edition of International Standards Organization (ISO) 13007; Standards for Ceramic Tiles, Grouts and Adhesives.

For listing of names of industry standard agencies mentioned by abbreviation in this Section refer to Section 01068.

QUALIFICATIONS:

Manufacturers:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured by the Dal-Tile Company, MAPEI Corporation, and Schluter Systems.

Other acceptable Manufacturers whose products are acceptable for this Project are:

- American Olean
- Crossville
- Concord Terrazzo Company

Source: Products for use on this Project shall be of one Manufacturer for same function.

SUBMITTALS:

Samples: Submit one sample each of following materials to Architect for approval.

Panels of tile approximately 6 inches square for each pattern and type of floor or wall tile.

Samples of each tile trim shape, and each metal trim shape, and each accessory specified.

Manufacturer's Data: Submit (in duplicate) Manufacturer's printed instructions on following:

Dry-set mortar for floors
Dry-Set mortar for walls
Grout for floors
Epoxy Grout for floors
Grout for walls
Epoxy Grout for walls
Finishing, edge protection and transition profiles for floors
Finishing and edge protection profiles for walls

Certificates: Furnish Master Grade Certificate bearing Certification Mark of Tile Council of America, signed by Manufacturer and Tile Subcontractor, stating type and quantity of material furnished for Project.

PRODUCT HANDLING:

Delivery: Deliver materials to Project site in Manufacturer's original packages, and with seals unbroken. Only tile which bears Certification Mark of Tile Council of America on each carton will be permitted. Maintain package seals until time for installation.

Storage:

Store cementitious material in dry building, on platforms off floor, and in area free from wetting.

Store tile and accessory material in clean, dry, covered area to prevent wetting or staining.

ENVIRONMENTAL CONDITIONS:

Temperature: Do not apply mortar to surfaces containing frost. Minimum temperature for installation of tile shall be 40 degrees F., and rising.

Ventilation: Control movement of air to prevent too rapid evaporation of moisture for mortar in place.

PROTECTION:

Traffic Restrictions: Spaces in which tile is being set shall be closed to traffic and other work during installation and for at least 48 hours after completion of tile work.

PART 2: PRODUCTS

MATERIALS:

Provide materials in compliance with current editions and up-to-date industry product standards cited.

Portland Cement: ASTM C 150 Type 1, white.

Hydrated Lime: ASTM C 206 Type S, or ASTM C 207 Type S

Sand: ASTM C 144 - washed clean and graded. Use fine sand passing 1/16-inch mesh screen when mixed for grouting; use white sand for white cement.

Pigment - Grout shall be colored; colors to be selected by Architect.

Water: Clean and potable.

Mortar Bed: ANSI A108.1A; equivalent to Topcem Premix by MAPEI Corporation.

Add mixture for Mortar Bed: ANSI A108.1A; equivalent to Planicrete AC by MAPEI Corporation.

Concrete Patch and Leveler: equivalent to Mapecem Quickpatch concrete patch with Mapei Concrete Renew or Mapei Ultra SkimCoat bu MAPEI Corporation.

Crack Isolation Sheet Membrane: equivalent to Mapeguard CI, peel-and-stick crack isolation sheet membrane for tile installations, by MAPEI Corporation, compliant with current edition of ASTM C627 Extra heavy service rating, and current edition of ANSI A118.12. Provide the applicable substrate MAPEI primers.

Crack Isolation Membrane: equivalent to Mapelastic CI, pre-mixed liquid rubber crack isolation membrane for tile installations, by MAPEI Corporation, compliant with current edition of ASTM C627 Extra heavy service rating, and current edition of ANSI A118.12.

Latex-Portland Cement Mortar: ISO 13007; C2ES2P2 and ANSI A118.4 / A118.11; equivalent to Kerabond-Keralastic System by MAPEI Corporation.

Polymer-Modified Cement, Medium Bed, Thin-set Mortar (Wall Tile): ISO 13007; C2TES1P1 and ANSI A118.4 / A118.11; equivalent to Ultraflex LFT by MAPEI Corporation.

GLASS-MESH MORTAR UNITS: Dens Shield Tile Backer by Georgia Pacific.

Unsanded Grout: ISO 13007: CG2WA, ANSI A118.6 premium pre-blended polymer modified unsanded grout, equivalent to Keracolor U Unsanded Grout. For 1/16” to 1/8” joints in floor and wall surfaces.

Sanded Grout: ISO 13007: CG2WA, ANSI A118.6 premium pre-blended polymer modified sanded grout, equivalent to Keracolor S Sanded Grout. For 1/8” to 5/8” joints in floor and wall surfaces.

Epoxy Grout: ISO 13007; RG and A118.3; equivalent to Kerapoxy IEG by MAPEI Corporation, provide epoxy grout at all food service/kitchen floor and food service wall tile areas, and shower floors and walls.

Epoxy Adhesive: ANSI A118.3 epoxy adhesive.

ACCESSORIES

Aluminum Edge Protection: Schluter – SCHIENE Model AE-100, for use with tile wall base. L-shaped aluminum profile x 1/8” thick exposed visible leg and integrated perforated anchoring leg, and grout joint spacer, with satin anodized finish. Provide with or without wall tile directly above wall tile base.

Aluminum Corner Protection: Schluter – QUADEC Model Q 100 AE, at all outside corners for use with wall tile and tile wall base. Aluminum profile with square shaped exposed surface and integrated

perforated anchoring leg, and integrated grout joint spacer, with satin anodized finish. Provide caps and termination accessories.

Aluminum Floor Transition: Schluter – RENO-U Model, for floor tile transitions to carpet, VCT, linoleum tile (LT) or terrazzo floor finishes. Aluminum profile with sloped exposed surface, ADA Compliant 1/2" Max. Transition Height x 5/32" tall leading abutment edge, and integrated perforated anchoring leg, and integrated grout joint spacer, with AEU satin anodized finish.

TILE:

All tile shall conform to current editions of ANSI A108.3, .4, .5, and .6; ANSI A137.1.

Floor Tile:

Floor tile shall be 6" x 6" nominal x 5/16" thick glazed porcelain with cushion edge, Daltile "Volume 1.0 with StepWise Technology slip resistance". Provide for all floor tile areas, with exceptions of shower areas. Provide with 3/16" grout joints. Equivalent products from American Olean or Crossville are acceptable. Architect shall choose from ten (10) available standard colors.

Shower Stalls floor tile shall be Dal-tile 2"x2"" Mosaics, mesh mounted, Grade 1 mosaic tiles.

Wall base shall be 12" x 12" floor tiles split in half to 6" high x 12" wide nominal units, installed with use of Schluter SCHIENE aluminum trim cap and QUADEC aluminum outside corners, complete assemblies. All wall base vertical and horizontal joints shall align.

Wall Tile: (Field & Accent)

Wall tile shall be nominal 12" x 24" nominal x 3/8" thick glazed porcelain tile, Daltile "Volume 1.0". Vertical joints shall align with floor and wall base joints. Provide polymer modified-medium bed thin-set mortar and 3/16" grout joints.

Terminate top horizontal and vertical edges of wall tile with a course of 3" x 12" bullnosed wall cap.

Provide all materials as necessary for providing a complete tile installation. All trim shapes shall be same size as field tile, and vertical and horizontal joints shall align.

Wall accent tile shall be nominal 12" x 24" nominal x 3/8" thick glazed porcelain tile, Daltile "Volume 1.1". Vertical joints shall align with floor and wall base joints. Accent tile, calculated as 25% of total wall tile area, shall be selected from manufacturer's six (6) standard colors, in a pattern as directed by Architect for each space. Provide polymer modified-medium bed thin-set mortar and 3/16" grout joints. Provide full range of trim shapes or profiles necessary for accent complete assemblies.

MIXES:

Bond Coat: Creamy paste made of Portland cement.

Portland Cement Mortar Setting Bed; Floors: 1 Part Portland cement to 6 parts damp sand, by volume. Add water to obtain consistency or workability to promote maximum density as evidenced by smooth, slickened appearance when stroked with trowel.

Skim Coat for Portland Cement Mortar Settings; Floors: Dust thin layer of dry portland cement, 1/32" to 1/16" thick, over setting bed and immediately before setting tile work lightly with trowel or brush until damp.

PART 3: EXECUTION:

CONDITIONS OF SURFACES:

Substrates:
Examine substrate surfaces to receive tile. Work shall not be started until all substrate surface defects and tolerances have been corrected that will adversely affect tile work.

Perform a substrate inspection for identification and location of all cracks within the substrate surfaces, and where needed, apply/install crack isolation products specified or equivalents, with required primers, in accordance with the written manufacturer's instructions, the current editions of ANSI 118.12 and ASTM C627, and the current edition of TCNA EJ171 Movement Joint Guidelines for Ceramic, Glass, and Stone.

Surfaces to receive tile shall be dry, clean, free of oily or waxy films, firm, level, and plumb.

Do not start work until completion of work of other trades, which are in or behind tile work.

INSTALLATION:

General Requirements for Installation of Tile:

Installation shall conform to all recommendations contained in the latest and current edition of Tile Council of North America Handbook for Ceramic Tile Installation:

STUD WALLS:	W244	Thin set over glass mat backer board. (Membrane in wet areas)
MASONRY WALLS:	W202I-23	Thin set over mortar bond coat.
KITCHEN MASONRY WALLS:	W202I-23	Thin set over mortar bond coat, epoxy grout
SHOWER WALLS	W2021-23	Thin set over mortar bond coat, epoxy grout
SHOWER FLOOR:	B-415	Thin set over portland cement setting bed with membrane, epoxy grout.
ELEVATED SLAB PORCELAIN TILE FLOORS	F-113A-23	Thin set over mortar bond coat.
SOG PORCELAIN TILE FLOORS:	F-112-23	Thin set over portland cement setting bed.
PORCELAIN TILE KITCHEN FLOORS:	F-114-23	Thin set over portland cement setting bed, epoxy grout.

Fitting: Cut and drill tile for proper fitting around work projecting through wall allowing for escutcheons and collars to overlap cuts. Rub exposed, cut edges.

Wall tile and wall base terminations will be provided with bullnose edged units. Cut edge or square edge terminations will not be accepted.

Pattern: Lay out tile lengthwise so that no tile of less than half size occurs. For heights stated in feet and inches, maintain full courses to nearest attainable height without cutting tile.

Base: Determine level of finish floor so that bottom lip of base will not be below finish floor level. Floor level at wall shall be at constant elevation around room.

Lines: Install tile to true, straight lines, with uniform joints, both vertically and horizontally.

Joints: Except where otherwise shown or specified, joints in wall tile shall be vertical and horizontal, and joints in floor tile be perpendicular and parallel to walls.

Tile substrate tolerances for installation in portland cement mortar shall be as follows, and as set forth by the current edition of TCNA:

For tiles with all edges shorter than 15”, surfaces shall not vary more than 1/4" above and 1/4” below in 10’-0” from the required plane in any undivided space; with no more than 1/16" variation within any 12” running foot.

For tiles with at least one edge 15” in length, surfaces shall not vary more than 1/8" above and 1/8” below in 10’-0” from the required plane in any undivided space; with no more than 1/16" variation within any 24” running foot.

Floor Tile Installations:

All SLAB-ON-GRADE (SOG) floor tile installations will be on recessed mortar setting beds, sloped to drains. Install mortar setting bed to recessed floor substrate or fill. Screed and tamp firmly. Minimum thickness of setting bed shall be minimum 1/2" at drain fixture. Level setting bed to tolerances required for finished floor.

Slope setting beds to floor drains, continuous from room perimeters to the drain fixture grate, for continual positive drainage at all areas. Shall be flood tested for positive drainage.

All elevated SLAB-ON-DECK (SOD) floor tile installations will be thin-set on elevated slab substrate, without setting beds, with concrete slab continuously sloped to floor drains. At all areas of thin set floor tile installations without setting beds, slope concrete floor slabs from room perimeters to floor drain grates for continual positive drainage. Shall be flood tested for positive drainage.

Provide polymer-modified, medium bed, thin-set mortar for wall tile bonding. All wall tile units shall be back buttered.

Grouting:

If strings are used to space tile, remove before grouting but until bond of tile to walls is complete.

Follow grout Manufacturer's directions as to whether tile joints shall be soaked prior to applying grout.

Follow grout Manufacturer's directions strictly and explicitly.

Cleaning:

Clean tile thoroughly prior to sealing, using methods approved by the tile manufacturer. Use of acid or acid cleaners to clean tile is strictly prohibited.

Curing: After installation, damp cure for at least 3 days. Keep traffic off floor during curing period.

Extra Stock: Furnish Owner with extra stock in unopened boxes, 5% of each color used.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART I GENERAL

1.1 SECTION INCLUDES

A. Acoustical wall treatments as indicated on Drawings.

1.2 PERFORMANCE REQUIREMENTS

A. Acoustical ceiling and wall treatment components meet Class A Flame Spread rating in accordance with ASTM E 84.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including product specifications, installation instructions and maintenance directions.
B. Samples: Submit 12 x 12 inch sample to show core material, edge and corner details, finish and mounting hardware, for approval by Architect.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
B. Storage: Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

1.5 PROJECT CONDITIONS

A. Do not install ceiling and wall treatment until all wet work, such as plastering, concrete, and masonry, is completely dry, building closed in with operational HVAC system.
B. Install ceiling and wall treatment at air temperature between 60 and 85 degrees F, at maximum relative humidity of 75 percent, and in an enclosed building.

PART II PRODUCTS

2.1 MANUFACTURERS

A. Tectum Acoustical Wall Panels, by Armstrong Ceiling & Wall Solutions. www.armstrongceilings.com/tectum 877-276-7876

2.2 ACOUSTICAL CEILING AND WALL TREATMENTS

A. Tectum Acoustical Wall Panels (Gymnasium):
    1. Tectum Standard Interior Wall Panels (cementitious wood fiber plank acoustical wall panel):
        a. Material: Aspen wood fibers bonded with inorganic hydraulic cement.
        b. Thickness: 1 inch.
        c. Edge: Long edge beveled.
        d. Width: 47¾ inches.
        e. Length: 96 inches.

f. Color: Factory Standard Color, selected by Architect from manufacturer's 24 standard colors. Provide extra paint material for damage repairs.
g. Mounting Style: C-40. Provide all fasteners installed flush with panel surface, 1 ½" furring strips and cavities filled solid with OCF 703 fiberglass insulation for a complete single source installation.

2. NRC Rating: .85
3. Accessories: Tectum Painted Head Drywall Screws; Steel, length as required. Color to match custom panel color.
4. Accessories: Tectum Mouldings; Plastic, type and profile to cover cut edges.
5. Accessories: Tectum touch-up paint.
6. Meet Class A flame spread of <25, and smoke developed of <50, per ASTM E84, and requirements according to current NFPA 101 Life Safety Code Requirements
7. Thirty-year warranty

PART III EXECUTION

3.1 EXAMINATION

A. Inspect areas to receive ceiling and wall treatment. Notify Architect of conditions that would adversely affect the installation or subsequent utilization of the ceiling wall treatment. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install ceiling and wall treatment at locations indicated on the drawings and in accordance with manufacturer's instructions.
B. Do not install acoustical panels until building is closed in and HVAC system is operational, and humidity is within manufacturer's specified range.
C. Install ceiling and wall treatment plumb, level, square, in alignment with adjacent work, and secure.

3.3 CLEANING

A. Clean ceiling and wall treatment surfaces in accordance with manufacturer's instruction.
B. Touch up any minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
B. Repair minor damaged surfaces as directed by Architect.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Provide acoustical ceiling systems, complete as shown and as specified herein, including exposed tee suspension systems and acoustical lay-in boards.

Coordinate work with installation of air conditioning grilles and diffusers specified in Division 15B and with installation of lighting fixtures specified in Division 16.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for work in this Section, Drawings and Specifications are based on products by following manufacturers:

Ceiling Suspension Systems shall be by one of following, or equivalent by:

- Chicago Metallic Corp.
- Eastern Products Corp.
- Donn Products, Incorporated

Acoustical Tiles shall be Rockfon (mineral wool) ASTM E1264 Class A, or equivalent products by:

- BPB
- Armstrong
- USG

Source: Products for use on this Project shall be of one Manufacturer for each function.

Shop Drawings: Indicate following:

Layout of inserts required for ceiling suspension system.

Reflected ceiling layouts for all areas to receive acoustical ceilings. Details of all connections to work of other trades.

Submit typical layout showing size and spacing of exposed grid and hangers as related to structural frame.

Samples: Submit samples of each acoustical unit, suspension system, and accessories.

Test Reports: Submit (in triplicate) copies of certificate of maximum Flame Spread Class 25 rating under requirements of SS-S-118A, required for all acoustical units on Project.

Manufacturer's Data: Submit (in triplicate) Manufacturer's printed installation instructions for suspension system.

Warranty: Provide 15 year “humidity no-sag” manufacturer’s warranty for tiles and grid system, warranted to replace tiles and damaged or defective system components at no cost to owner if tiles sag visibly within the warranty period.

PRODUCT HANDLING:

Delivery: Deliver acoustical ceiling boards to Project site in Manufacturer's original packages, with seals unbroken, with Manufacturer's name and contents legibly marked thereon and with testing laboratory labels where required.

Storage: Store ceiling tiles and boards in enclosed areas, with same temperature and humidity conditions as areas in which material is to be installed.

ENVIRONMENTAL CONDITIONS:

Building Conditions: Install acoustical materials only when normal temperature and humidity conditions approximate interior conditions that will exist when building is occupied. Building shall not be cold and damp, or hot and dry.

Glazing shall be in place and all exterior openings closed. All concrete, plastering and other wet work shall be complete and dry.

Provide heat and ventilation to maintain proper conditions before, during, and after acoustical work is performed.

PART 2: PRODUCTS

TYPES AND SYSTEMS: All acoustical materials shall be of types indicated by type numbers on Drawings, as follows:

Type 1: 24” x 24” x 5/8” Rockfon Artic 600 Square Lay-in / Chicago Metallic 200 Snap Grid 15/16”

Type 2: 24” x24” x 5/8 Rockfon Artic 660 Square Tegular / Chicago Metallic 200 Snap Grid 15/16”

Type 3: 24” x 24” x 1/2” Vinyl faced gypsum panels, with white stipple finish / Chicago Metallic 830 All Aluminum Grid 15/16”

Type 4: 5/8” Moisture resistant gypsum board on hat channels/cold-rolled channels framing system.

Type 5: 5/8” Gypsum board on hat channels/cold-rolled channels framing system.

HANGERS:

Wire: No. 12 gauge galvanized steel.

SUSPENSION SYSTEM:

Components: System shall consist of main support tees, cross tees, splice clips, wall angles, and hold down clips.

Design Loads: Suspension system shall be designed to support respective lay-in units and light fixtures with deflection of suspension members not to exceed 1/360 of span of member.

Exposed Grid System: Chicago Metallic Grid System (hot dipped galvanized steel), consisting of main tees and cross tees with 15/16" exposed flange. Wall molding shall be cold-rolled galvanized steel, channel shaped, with 1" exposed face of same finish as exposed tee surfaces.

Provide all aluminum grid at locations indicated, and food service areas.

Provide bullnosed preformed corners for bullnosed wall corners, and around steel tube columns.

Finish: Exposed surfaces of tees and of wall moldings shall be flat white, baked polyester.

PART 3: EXECUTION

INSTALLATION OF ACOUSTICAL CEILING SYSTEMS:

General Requirements:

Suspension System: Install strictly according to approved Shop Drawings layouts for spaces and manufacturer's printed instructions.

Ceiling Tile Pattern, Layout, and Type:

1. Install acoustical ceiling in patterns and types indicated on approved shop drawings and, as described in this specification.

2. Unless indicated otherwise herein or on Drawings, ceilings shall be laid out symmetrically in each space, with no less than half size panels or tiles at walls.

Installation of acoustical materials and suspension systems shall be made by experienced mechanics in strict accordance with Manufacturer's written instructions.

Fit parts neatly and accurately, true to line and plane.

Where hangers fall at structural members, install hanger clips in strict accordance with written instructions of Manufacturer of hanger clips.

Suspension system, including wall mold, shall be level to within 1/8" in 12 feet, with ceiling panels in place.

Exposed grid members shall be straight and in alignment. All exposed surfaces shall be flush and level.

General Requirements for Acoustical Ceilings:

Scribe lay-in units neatly to abutting surfaces and to penetrations or protrusions.

Exercise care to prevent soiling of ceiling tiles during installation. Leave entire system neatly and accurately fitted.

CLEANING: Following installation, clean all soiled and discolored surfaces. Remove and replace units, which are damaged or improperly installed.

EXTRA STOCK: Furnish Owner 5% of each pattern of acoustical tile installed in Project for maintenance replacements.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1 - GENERAL

DESCRIPTION

Provide cushioned wood flooring system for Gymnasiums as shown on the drawings, in colors, with images, and finished as specified herein.

RELATED SECTIONS

Section 07200 Building Insulation

QUALITY ASSURANCE

Supplier Qualifications: Supplier shall be an established firm experienced in the field; Robbins, Inc., or approved equivalent. Wood floor specifications are based on Robbins "Bio-Cushion Classic" floor system.

Acceptable equivalent products include: Connor NeoShok by Connor Sports.

Installer Qualifications: Flooring Contractor shall be a firm experienced in the flooring field and approved by the manufacturer.

Wood floor finishing specifications are based on Bona US products.

SUBMITTALS

Submit complete product data, samples, shop drawings, and certifications.

DELIVERY, STORAGE AND HANDLING

Materials shall not be delivered, stored or installed until all masonry, painting, plastering, tile work, marble and terrazzo work are completed. All overhead mechanical work, lighting, backstops, scoreboards shall be installed. Room temperature of at least 55 to 80 degrees and relative humidity of 35 to 50% are to be maintained. Installation / storage conditions shall be the same as those which will prevail when the building is occupied.

PART 2 - PRODUCTS

WATERPROOFING AND DAMPPROOFING

LIQUID MOISTURE VAPOR BARRIER (Gymnasium Floor Slab): CHAPCO DEFENDER EZ Moisture Vapor Barrier: Low Viscosity, one-part polymeric emulsion (2 coats) applied to gymnasium concrete slab substrate by the General Contractor, in compliance with manufacturer’s written installation instructions. Equivalent products by W. R. Meadows or Ardex are acceptable.

WATERPROOFING MEMBRANE: MEL-ROL, Rolled, Self-Adhering Waterproofing Membrane, manufactured by W. R. Meadows. General contractor to apply to all perimeter foundation walls at the Gymnasium wood floor.

GYM FLOORING MATERIALS (Gymnasium, Stage)

Vapor Barrier Membrane
6 mil polyethylene, lapped joints and taped

Bio-Cushion Classic System:

3/4" tall Bio-Cushion Isolator Pads
2 layers of 1/2" CD-Exterior Grade Fir or Southern Pine Plywood.

Flooring:

25/32" Thick x 2 1/4" width, third and better, T & G and EM, KD Northern Hard MFMA Maple Flooring as manufactured by Robbins and graded in accordance with MFMA standards. Exception: provide Select Southern Yellow Pine for Stage Area where scheduled, with Ebony stain prior to sealing and finishing.

Flooring shall be treated with Woodlife preservative.

Fasteners:

Subfloor

a. 1" coated staples or equivalent.
b. Construction adhesive PL 400 or equivalent.

Flooring:

a. 2" barbed cleats or staples.

Perimeter Base - Robbins 3" x 4" rubber, ventilating type, brown.

Finishing Materials:

1. Bona Oil Modified Stain
2. Bona SuperSport Seal, water based acrylic
3. Bona SuperCourt HD, two-component water based urethane finish
4. Bona SuperSport Paint, waterborne game line paint, or equivalent recommended by the finishing materials manufacturer compatible with the finish.

Aluminum Threshold Transitions: Where flat transitions to other floor finishes occur, including at doorways, provide Flat Saddle Thresholds, equivalent to Pemko 276, in mill finish 6063-T6 aluminum.

PART 3 - EXECUTION

GYM FLOORING EXECUTION

INSPECTION

Inspect concrete subfloors for proper tolerance and dryness, and report any discrepancies to the general contractor in writing.

INSTALLATION

General Contractor to apply 2 coats Liquid Moisture Vapor Barrier to gymnasium concrete slab substrate, in compliance with manufacturer’s written installation instructions.

Bio-Cushion Classic System:

1. Install polyethylene film with joints lapped and taped with a minimum of 6" overlaps and turned up 4” at the walls.
2. Install Robbins Bio-Cushion Isolator Pads 12" O.C. on lower plywood subfloor. Install the lower plywood subfloor perpendicular to the intended finish flooring direction. All joints shall be staggered and spaced 1/4" apart.
3. Install the upper plywood subfloor 45 degree diagonally to the lower subfloor panels, staggering joints and spacing 1/4" apart. Secure these panels using adhesive and 1" staples placed 6" O.C. at panel perimeter and 12" O.C. throughout interior.
4. Machine nail maple finish flooring (Select SY Pine at Stage) with end joints properly driven up and proper spacing provided for humidity conditions in specific regions, with expansion joints at regular interval spacing.
5. Provide 2" expansion voids at the perimeter and at all vertical obstructions.

Sanding:

Sand flooring with drum sander, edger, bugger and hand scraper. Use coarse, medium and fine grade sandpaper. After sanding with drum sander, buff entire floor using 100 grit screensback or equal grit sandpaper, with a heavy-duty buffing machine. Vacuum or tack floor before first coat of finish system.

Floor shall present a smooth surface without drum stop marks, gouges, streaks or shiners.

FINISHING

Gymnasiums:

1. Apply Bona Oil Modified Stain, colors as selected by the Architect.

2. Apply 1 coat of Bona SuperSport Seal.

3. Apply 1 to 2 coats of Bona SuperCourt HD finish.

4. Game Lines: Apply 2 coats Bona SuperSport Paint game lines and borders accurately after the seal coat and single coat of finish, after buffing and vacuuming. Layout in accordance with drawings. For game lines, use current rules of association having jurisdiction. Lines shall be straight with sharp edges. Colors selected by Architect, and final approved by the Owner.

5. Center Court Image: Apply center court image, as final approved by the Owner.

6. Apply 2 to 3 final coats of Bona SuperCourt HD finish.

Perimeter Molding: Install Robbins vent cove base anchored to walls with base and neatly mitered inside corner.

Clean up all unused materials and debris and remove same from the premises.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

GENERAL:

Stone Association Publications: Comply with recommendations contained in the publications indicated below:

Submittals: With manufacturer's data and installation instructions, submit samples not less than 12" x 12" for each type, color, and finish of stonework units.

PRODUCTS:

Obtain each type of stone from one quarry, with consistent color range and texture, complying with referenced ASTM standards and other references indicated, extracted from a single bed of quarry stratum.

Bluestone Slate: Where indicated on Drawings, provide blue-gray slate window stools and where indicated on Drawings, as detailed, exposed finished surfaces flat with buffed natural cleft face, one long edge sandrubbed, gauged, and slightly rounded front edge, with exposed edges true, level and square. Equivalent to Buckingham Slate Bluestone window sill stools.

Face Finish: Natural cleft face; buffed dull sheen, without reflections. Color and finish to match Architect's sample. Seal stone with manufacturer’s recommended sealer.

Outside 90 degree corners directly adjacent to pedestrian walkway areas, shall be safety bullnosed.

Grout of mortar all joints. For colored pointing mortar, use ground granite or other sound stone to match Architect's sample.

Dry Set Thin-Set Mortar: ANSI A118.1

Prepackaged dry mortar mix with re-emulsifiable powder as additive, for mixing with water only.
Anchors: Nonferrous metal, as required to suit stone installations.

Fabrication: Precut stone units to required sizes and shapes. Use powered masonry saw for cutting units at site. Avoid use of less-than-half-size units.

INSTALLATION:

General: Do not use stone units with chips, cracks, spallings, voids, depressions, stains, or other surface defects visible in finished work. Clean stone before setting by scrubbing with fiber brushes and water. Wet stone, as required, before setting. Comply with manufacturer's instructions for application of proprietary materials.

Seal exposed surfaces with manufacturer’s recommended sealer.

Installation of Interior Wall Facing and Trim: Erect interior wall facing and trim, plumb and true with joints uniform in width and accurately aligned.

Install stone to comply with requirements of referenced ANSI installation specification, and of ANSI A108.10 and TCA "Handbook for Ceramic Tile Installation", respectively, for setting bed type, TCA installation method and grout: Dry-Set Portland Cement Mortar: ANSI A108.5

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

RELATED DOCUMENTS

Section 09650 Resilient Flooring

DESCRIPTION OF WORK

Providing a new pure elastic sheet vinyl resilient athletic flooring that shall include the furnishing of materials and complete installation of a solid sheet vinyl and foam cushioned reinforced flooring to get a total thickness of 12.0 mm with a minimum 41% shock absorption. Installation work by the Flooring Contractor shall include laying, gluing and welding the flooring, and application of game lines, borders, graphics, and installation of an entire perimeter of ventilated cove base.

A 9.9 mm high point load resistant indoor resilient athletic floor will be installed under the opened and closed bleachers. This floor will match the height and finish of the 12.0 mm flooring by a layment of the 2.1 surface wear layer.

SUBMITTALS

A. Manufacturer's product data (5 copies), including physical 6” x 8” color samples showing finish texture and specified thickness.

B. Laboratory Test Results: Provide certification of testing per ASTM F2772-11 and the product being furnished complies with the ASTM Indoor Sport Floor Classification specified for this project. Third-party certification required; sales literature is not sufficient.

C. Maintenance instructions (5 copies).

D. Scaled shop drawing layout of court game lines, showing installation details and locations of borders, patterns, game lines, locations of floor inserts and seams.

E. Game line color chart and field color chart.

F. Wall base sample.

G. Floor system manufacturer’s written installation instructions.

QUALITY ASSURANCE

A. Manufacturer shall submit Athletic Performance Properties: Comply with ASTM F 2772-11 Performance Level Class 4 for force reduction, ball bounce, vertical deformation and surface friction.

B. Approved manufacturer shall have a minimum of 20 years experience in sports flooring.

C. Provide ISO 9001 and 14001 Certification.

D. Installation shall only be done by a qualified flooring Contractor approved by manufacturer.

E. Flooring contractor shall submit a list of completed projects of similar magnitude and complexity over a five-year period.

DELIVERY / STORAGE AND HANDLING

A. Flooring Contractor shall not deliver to job site until the work of other trades has been completed.

B. Material shall be stored in up-right position only.

PROJECT / SITE CONDITIONS

Environmental Requirements: The building shall be dry and enclosed. Permanent heat, light and ventilation shall be installed and operable. Flooring installation shall not begin until the installer is familiar with existing subfloor conditions. All work which would cause damage, dirt, dust or interruption of normal installation pace shall be completed at least one week prior to and during installation. The room temperature must be maintained at a minimum of 65°F. The installation area shall be closed to all traffic and activity for a period to be set by the flooring Contractor.

WARRANTY

A. Special Limited Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace sports flooring that fails within specified warranty period.

1. Material warranty must be direct from the product manufacturer.

    a. Material warranties from private label distributors are not valid.

2. Failures include, but are not limited to, the following:

    a. Material manufacturing defects.

    b. Failure due to substrate moisture exposure not exceeding 92% relative humidity (RH) when tested according to ASTM F2170

3. Warranty Period: 15 years from date of Substantial Completion.

B. Special Limited Warranty: Installer's standard form in which installer agrees to repair or replace sports flooring that fails due to poor workmanship or faulty installation within the specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2: PRODUCTS

PRE-APPROVED MANUFACTURERS

1. Taraflex sports flooring manufactured by Gerflor

    a. 12.0 mm “Taraflex – Sport M Comfort”, solid vinyl, cushioned, reinforced floor system, as manufactured by Gerflor Industries, Inc., Telephone: 800 727 7505.
    b. Uni-Turf by Advantage Sport U.S.A., Inc. for the High Point stress load underlaying material
    c. All adhesives, leveling compounds, tools, tests, and products as recommended and approved by Gerflor and Advantage Sport U.S.A.

2. Other manufacturers who can provide equivalent system shall obtain prior approval according to the General Conditions. Equivalent products by Tarkett will be accepted.

MATERIALS

A. Leveling compound: As approved by manufacturer to correct minor subfloor deviations. Ardex or pre-approved equal recommended by the manufacturer.

B. Vinyl sport flooring shall be a homogenous 2.1 mm thick wear-layer combined with a 9.9 mm three-layer closed-cell foam cushioned backing, reinforced with 2 fiber glass mesh interlayers. The total thickness shall be 12.0 mm and exhibit a Class 4 shock absorption physical property. Minimum roll length is 65 feet. A fungistatic and bacteriostatic treatment shall be incorporated throughout the thickness of the surface. The wear layer shall be treated with a photo reticulated, UV cured polyurethane, anti-dirt treatment, applied at the factory to give the surface high resistance to soiling and scuff marks.

1. Physical Properties: Pass or comply with all criteria properties of ASTM F 2772-11 Indoor Sports Floor Standard
   a. Width of Roll 4'-11" minimum
   b. Length of Rolls 86'-6" minimum
   c. Total Thickness 12.0 mm
   d. Chemical Resistance Compliance with ASTM D 543 (resistant to diluted acids, alkalis, grease, oil, and cleaning agents except for vinyl solvents)
   e. Abrasion Resistance: EN ISO 5470
   f. Sound Insulation: EN ISO 717; 18 dB
   h. Bacterial/Fungus Resistance: Gerflor Sanosol
   k. Gloss/Brightness: EN ISO 2813
   l. Organic Emissions: ASTM D 5116
   m. Vertical Deformation: Maximum 3.5 mm
   n. Surface effect/Coefficient of Friction Between 80-110
   o. Ball Bounce: Minimum 90%
   p. Force Reduction (Shock Absorption): Class C4 (46% to 57%)
   q. Fire Performance: ASTM E 648; greater than 0.45 W/cm, Class 1
   r. Surface Maintenance Requirements: No wax surface requiring only cleaning and rinsing
   s. Slab Moisture Design Tolerance: Maximum relative humidity (RH) of 92% when tested in accordance with ASTM F 2170.

2. Colors: (15) standard colors, maple, oak and other woodgrain designs.

3. Texture: Indoor texture, slightly pebbled for improved slip resistance and proper coefficient of friction.

C. High Point Load Resilient Athletic Surfacing (For use under open and closed bleachers and other high point load areas where risk of indentation of the standard indoor resilient athletic surfacing is elevated):

1. Shall consist of a 2.1 mm thick, homogeneous, over 95% pure PVC wear layer adhered to a 9.9 mm thick, homogeneous, PVC resilient backing. The total thickness of the high point load resistant indoor resilient athletic surfacing shall be 12.0 mm. Physical properties, design and appearance of the wear layer to be identical to that of the wear layer of the standard indoor resilient athletic surfacing. The backing to consist of dense, calendared, over 95% pure PVC. A fungistatic and bacteriostatic treatment shall be incorporated throughout the wear layer and backing. The wear layer shall have a slip resistant, slightly textured surface and be treated with a factory applied photo reticulated polyurethane anti-soiling treatment cured using ultraviolet rays. The high point load resistant indoor resilient athletic surfacing is designed to resist indentation and will not offer the performance characteristics of the standard indoor resilient athletic surfacing.

D. Provide single layer of manufacturer's isolation membrane over existing flooring systems to remain prior to installation of indoor resilient athletic sports flooring as indicated on drawings: Taraflex Isolsport by Gerflor or equivalent.

E. Welding Rod: As supplied by flooring manufacturer and/or supplier. Color to match sport flooring color. All seams to be welded to create a monolithic and impermeable surface.

F. Adhesive: Water resistant two-part polyurethane adhesive as approved by flooring manufacturer and/or supplier; Gerflor Gerfix TPS.

G. Game-Line and Marker Paint: Complete system including primer, compatible with flooring and recommended by flooring and paint manufacturers.

PART 3: EXECUTION

EXAMINATION

Installation temperature shall be at least 65°F (18°C) or maximum of 86°F (30°C) and the moisture content of the slab 3 lbs. per 1,000 square feet per 24 hours or lower, according to RMA testing method.

SUBFLOOR

A. Before beginning installation, verify that the subfloor is properly cured, clean and dry.

B. Verify with the general contractor, and by visual inspection, that no curing compounds and / or sealers have been applied to the concrete without prior approval of the sports flooring manufacturer / supplier.

C. Verify that there are no variations in the concrete slab that exceed +/- 1/8" in a 10' radius.

PREPARATION OF SURFACES

Fill cracks, grooves, voids and / or construction joints with leveling compound as approved by manufacturer. High spots on the floor shall be removed by grinding, then patching.

ADHESIVES

Only use adhesives approved by manufacturer.

INSTALLATION

The installation of sports flooring shall be done according to written instructions provided by manufacturer.

A. Seaming of joints (heat welding method) as recommended in installation manual.

B. Joint location: End of roll butt joints to be staggered at opposite ends of roll runs. Butt joints in alignment with adjacent roll will not be accepted.

   Wherever possible, end of roll butt joints to be located outside the playing area perimeter, minimum 65 feet apart.

C. Game lines: All court lines shall be applied using the compounded polyurethane paint as approved by manufacturer. Colors to be selected from the manufacturer's standard color chart.

D. Borders and color filled areas wider than 2” shall be laid into the floor design using the same material as the gym floor, not painted.

E. Existing floor inserts and other floor mounted devices: The Contractor is responsible for either building up new gym floor to meet present level of all floor-mounted devices or reset (reduce/enlarge) the height of each floor-mounted device, to make flush with new gym floor surface.

F. Transition strips and thresholds: The contractor is responsible for replacing existing and furnishing and installing new transition and threshold strips as deemed necessary by the Project Architect.

MAINTENANCE

Comply with manufacturer maintenance instructions. Deliver maintenance instructions to the Owner through Architect.

A demonstration shall be given to the attendants or individual responsible for upkeep of the facility, by the supplier/manufacturer or installer as recommended in the manufacturer’s maintenance instruction guide.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Provide resilient flooring systems as indicated, complete assemblies with wall base and transitions throughout, with all necessary profiles and accessories, for all conditions, as shown on Drawings and as specified herein.

Provide stair rubber tile, stair tread and nosing, riser, and stringer system complete assemblies with transitions and necessary accessories, as shown on Drawings and as specified herein.

Concrete floors are specified to be finished flat and level under Division 3 requirements.

Skim coat all areas to receive resilient flooring systems complete, with self-leveling smoothing and leveling compound and prepare for installation of finish products scheduled.

At all SOG (slab-on-grade) and SOD (slab-on-deck) areas, apply a moisture barrier primer/sealer coating to all new and existing concrete floor slab substrates complete.

INDUSTRY STANDARDS:

ASTM F 710-05

FloorScore Indoor Emissions Testing Program

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

QUALITY ASSURANCE:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products by following manufacturers or approved equal:

1. Linoleum Composition Tile (LCT):
    a. Forbo Flooring Systems
    b. Armstrong Cork Company

2. 100% Vulcanized Thermoset Rubber Base and Accessories:
    a. Roppe Rubber Company
    b. Flexco Division Textile Rubber Company
    c. Johnsonite Rubber Company

3. Rubber Tile, Stair Tread and Nosing, Riser, and Stringer system
    a. Johnsonite Rubber Company
    b. Roppe Rubber Company
    c. Flexco Division Textile Rubber Company

SUBMITTALS:

Samples: Submit following samples of materials proposed for use.

Tile: Three sample tiles of each color selected.

Accessories: Three 12" lengths of each of the following:

1. Wall Base
2. Transition Edge Strip
3. Carpet Transition Stop / Reducer
4. Stair Tread and Nosing, Riser, and Stringer system
5. Self Leveling Skim Coating Material

Manufacturer's Literature: Submit (in triplicate) Manufacturer's certificates, MSDS sheets, VOC product data, and printed installation instructions on following:

- Smoothing and Leveling Compound
- Moisture Barrier Primer/Sealer
- Adhesive
- Resilient Flooring Materials
- Rubber Base

CERTIFICATES:

Submit certification from Manufacturer of each specific resilient material assembly, listing adhesives, primers and sealers for subfloors as proposed for use in conjunction with resilient material of this Section. Manufacturer of specific resilient material shall state approval of materials to be used with his materials as listed in certification.

Submit certification from Manufacturer of adhesive for each resilient flooring assembly, approving all primers and sealers proposed for use on new and existing concrete subfloors.

Submit certification from Manufacturer of each resilient flooring material assembly, approving floor leveler and/or floor patch material proposed for use on concrete subfloors.

Submit certification from Manufacturers of each resilient flooring material assembly, approving dry-cleaner and approving non-alkaline cleaning solution proposed for use on resilient flooring.

PRODUCT HANDLING:

Store resilient flooring materials as packaged by Manufacturer, in undamaged condition, and with Manufacturer's seals and labels intact. Exercise care to prevent damage and freezing during delivery, handling, and storage. Store materials at Project site at least 24 hours to their installation.

ENVIRONMENTAL CONDITIONS:

Temperature: Materials and area in which materials are to be installed shall be maintained at following temperatures:

For at least 24 hours before installation of material, and continuing for at least 48 hours after installation, maintain temperature at not less than 70 degrees F. to not more than 90 degrees F.

Maintain minimum temperature of 55 degrees F after flooring is installed.

PROTECTION:

Close spaces to traffic in which all resilient flooring is being set and to other work until flooring is firmly set. Where solvent-based adhesives are used, provide safety spark-proof fans and operate. Natural ventilation is inadequate. Smoking shall be prohibited.

MAINTENANCE MANUALS: Provide 3 copies of maintenance manuals for all resilient flooring describing maintenance procedures.

PART 2: PRODUCTS

SMOOTHING AND LEVELING COMPOUND:

Smoothing and leveling compound, provide complete on all concrete subfloors scheduled for resilient flooring systems. Ardex SD-L or equivalent self-leveling product as approved by flooring Manufacturer.

MOISTURE BARRIER PRIMER/SEALER:

Moisture barrier primer/sealer, required for all concrete SOG subfloors, shall be as recommended by adhesives and flooring Manufacturer.

ADHESIVES:

Low emitting adhesive for cementing resilient flooring materials to sub-floors shall be as approved by flooring Manufacturer.

High moisture level rated adhesive for all existing concrete subfloors, for cementing resilient flooring materials to existing sub-floors shall be as approved by flooring Manufacturer.

Low emitting adhesive for wall base shall be as recommended by base Manufacturer.

All adhesives VOC content shall be less than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

All adhesives shall comply with requirements of the South Coast Air Quality Management District (SCAQMD) Rule #1168.

LINOLEUM COMPOSITION TILE (LCT):

Provide Linoleum Composition Tile (LCT) where indicated on Drawings.

Linoleum Composition Tile:

Provide 13 inch by 13 inch .080 inch thick, thru chip color, Marmoleum Tile manufactured by Forbo Flooring Systems. Wear layer shall be composed of linseed oil, rosin binders, wood flour, limestone, and

dry pigments, comprising a through-grain pattern and color uniformly dispersed throughout the entire thickness, on a polyester backing. Factory applied finish shall be a high performance UV cured double layer equivalent to Topshield2. Meeting or exceeding requirements set forth in ASTM F 2195 “Standard Specification for Linoleum Tile Flooring Type 1.”

Resilient tile flooring of each color and pattern selected in any one area shall be from same lot.

Colors will be selected from Manufacturer's standard colors and patterns of series specified. Up to three accent colors, selected from manufacturer’s standard colors, may be selected in a standard block pattern as directed by Architect for each space.

RESILIENT BASE:

Provide Rubber Wall Base where indicated on Drawings.

100% Vulcanized Rubber Base:

ASTM F 1861, Type TS, Group 1

Set cove type rubber base on hard surfaces and carpet flooring, 1/8" thick, 4" high at all locations. Manufactured by Roppe Rubber Co. or equivalent. Vinyl or part vinyl composition is not acceptable.

Color: Manufacturer shall offer minimum of 30 standard colors for selection by Architect.

Provide pre-molded external and internal corners.

Provide pre-molded end stops.

TRANSITION / REDUCER EDGE STRIPS:

Provide complete terminations at all type flooring transitions, to include all perimeters and terminations of all sports flooring, such as rubber or PVC sports flooring to VCT/LCT or polished concrete, carpet to VCT/LCT, VCT/LCT or carpet to sealed or polished concrete. Vinyl thickness to match resilient flooring thickness.

Provide transitions where non-level flooring surfaces meet or terminate. Must comply ADA Guidelines. Height to be coordinated with floor finishes thicknesses.

REDUCER STRIP: 1-1/4" wide with beveled edge, Johnsonite RRS-XX-D or equal. Color selected by Architect.

CARPET-TO-VCT/LCT TRANSITION STRIP: Johnsonite CTA-H adapter, color selected by Architect.

STAIR TREAD, RISER, STRINGER AND INTERMEDIATE LANDING TILE SYSTEM:

Rubber stairwell intermediate landings shall be Johnsonite or equivalent Landing Tiles with a .187 thick diamond surface, overall size 24” x 24”, color to be selected from manufacturer’s standard colors. Provide where indicated.

Where scheduled, provide raised profile one piece stair tread and riser combination, shall be Johnsonite or equivalent VIRTR (for visually impaired) with a 2” wide contrasting strip of carborundum at the nose of the tread. Treads to have a tapering thickness gauge of .210” to .153” across a 13” tread width with a 7” integral riser, with a square nose and 2” hinged drop to accommodate riser angle. Provide matching rubber stringers. Color to be selected by Architect.

STAIR TREAD NOSING:

At stair treads or floor risers receiving VCT, provide profile of nosing that applies to and conforms to the actual stair tread/riser profile, Roppe No. 1 Commercial Stair Nosing or equivalent. Apply rubber base to face of stair riser or floor to conceal face of riser surface.

Provide Roppe #5 Domestic Stair Nosing at Media Center Story Telling Bleachers carpet edge transitions.

PART 3: EXECUTION

CONDITION OF SURFACES:

Requirements: Surfaces to receive resilient flooring shall meet minimum requirements established by ASTM F 710-05 and Manufacturer of flooring. Do not start work until defects have been corrected.

Obtain Architect's representative inspection of substrate prior to application of adhesives and tiles. Do not start work or continue work until inspection items have been corrected.

Tolerances: Subfloor surfaces shall not vary more than ± 1/8" in any ten-foot dimension. Neither shall they vary at rate greater than 1/16" per running foot. Unacceptable conditions shall be corrected by General Contractor.

APPLICATION OF SMOOTHING AND LEVELING COMPOUND:

Apply to cover substrate completely, wall to wall. Pour mixed compound onto substrate and steel trowel and/or float to spread to manufacturer's product minimum thickness ranges. Upon full cure, sand off entire surface and vacuum all areas.

APPLICATION OF PRIMER:

Apply moisture barrier primer/sealer to cover substrate completely. Apply at rate recommended by Manufacturer of resilient flooring.

APPLICATION OF ADHESIVE:

Mix and apply adhesive in accordance with Adhesive Manufacturer's installation instructions. Cover surface evenly with adhesive. Area covered by one application of adhesive shall not exceed maximum working area recommended by Manufacturer. Install resilient flooring within time limits recommended by Manufacturer. If adhesive films over or dries, it shall be removed and area shall be recoated.

INSTALLATION OF RESILIENT TILE FLOORING:

Lay resilient flooring true, level; and with tight, aligned joints, roll flooring in accordance with Manufacturer's directions to assume intimate contact and proper adhesion. Cut resilient flooring to and around permanent cabinets and fixtures.

Align joints with room axis. Center tile work between walls. Except as required in irregularly shaped spaces, no tile shall be less than one half tile width. Lay tile with grain in direction or pattern as directed by Architect.

Obtain Architect's representative inspection of VCT tile installation during installation phases. Do not start work or continue work until inspection items have been corrected.

INSTALLATION OF BASE:

Cement base firmly to wall. Joints shall be tight. Base (throughout its entire length) shall have top and bottom edges in firm contact with walls and finish floors. Form 90 degree internal and external corners and end stops from preformed units. Scribe base accurately to trim.

INSTALLATION OF EDGE STRIPS:

Install edge strips as required at doors and at other locations to provide transition from all finish flooring types to other floor or surface area transitions of dissimilar materials.

CLEANING:

Immediately upon completion of stairwell rubber tile and tread system, clean floors and adjacent surfaces with cleaner approved by Manufacturer. Remove surplus adhesive and other soiling. Rinse thoroughly with clean, cold water.

EXTRA STOCK: Furnish Owner 5% quantity in unopened boxes of tile of each color and pattern installed, to be used in maintenance replacements.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Extent of painting work is shown on drawings and schedules, and as herein specified.

The work includes painting and finishing of all interior and exterior exposed items and surfaces throughout project, except as otherwise indicated.

Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.

"**PAINT**" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

Paint all exposed surfaces, unless otherwise noted, whether or not colors are designated in "schedules", except where natural finish of material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas. If color or finish is not designated, Architect will select these from standard light colors available for materials systems specified. Where indicated, "accent" colors are medium to deep shades, which shall require no more than one additional paint coat.

Following categories of work are not included as part of field-applied finish work, or are included in other sections of these specifications.

Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, miscellaneous metal, hollow metal work, and similar items. Also, for fabricated components such as architectural woodwork, wood casework, and shop-fabricated or factory-built mechanical and electrical equipment or accessories.

Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as (but not limited to) metal toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, finished mechanical and electrical equipment including light fixture, switchgear and distribution cabinets, elevator entrance frames, doors and equipment.

Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

SUBMITTALS:

Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.

Samples: Submit samples for Architect's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

On 12"x12" hardboard, provide sample of each color and material, with texture to simulate actual conditions. On CMU face shell, provide sample of each color and material, with texture to simulate actual

conditions Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved.

Wall Mockup: Paint 10'x10' section of wall with permanent lighting illumination for Architect's review and approval, prior to ordering paint materials.

Epoxy Paint Product Data: Epoxy paint manufacturer shall provide documentation that the epoxy product is tested and approved for application in such locations and for application on the surface material that is being used, and use is in compliance 2012 NC Building Code Sections 1210.2 and 1210.3; and in compliance with 2012 Plumbing code Sections 419.3 and 417.4.1 for providing smooth, hard non-absorbent surfaces adjacent to urinals and water closets and shower heads.

DELIVERY AND STORAGE:

Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

- Name or title of material
- Fed. Spec. number, if applicable
- Manufacturer's stock number and date of manufacturer
- Manufacturer's name
- Contents by volume, for major pigment and vehicle constituents
- Thinning instructions
- Application instructions
- Color name and number

JOB CONDITIONS:

Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C), unless otherwise permitted by paint manufacturer's printed instructions.

Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C), unless otherwise permitted by paint manufacturer's printed instructions.

Do not apply paint in snow, rain, fog or mist; or when relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by paint manufacturer's printed instructions.

Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

PART 2: PRODUCTS

COLORS AND FINISHES:

Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates.

Federal Specifications establish minimum acceptable quality for paint materials. Provide written certification from paint manufacturer that materials provided meet or exceed these minimums.

Provide undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

EXTERIOR PAINT SYSTEMS:

A. GALVANIZED METAL - (G60 Galvanized Steel; including Structural Steel Columns, Beams, Miscellaneous Structural Steel Members, Miscellaneous Steel Framing, Miscellaneous Stair & Ornamental Iron excluding treads, Catwalks excluding steel bar grating and treads, Fire Escapes, Hydrants). Note: G90 hot-dipped galvanized surfaces shall not be painted.

1. Acrylic Systems

a. Gloss Finish

i. Surface Preparation: Refer to Part 3 Surface Preparations of these specifications for Cleaning & Testing/Evaluations; Manufacturer's guidelines and recommendations stand as requirements of this work.

ii. 1st Coat: S-W Pro-Cryl Universal Primer, B66-310 Series (10 mils wet, 4.0 mils dry film thickness)

iii. 2nd Coat: S-W Sher-Cryl HPA High Performance Acrylic, B66-300 Series (10 mils wet, 4 mils dry film thickness)

iv. 3rd Coat: S-W Sher-Cryl HPA High Performance Acrylic, B66-300 Series (10 mils wet, 4 mils dry film thickness)

B. METAL - (Shop Primed Metal Doors and Frames/ Panels, etc.)

1. Acrylic Systems

a. Gloss Finish

i. Surface Preparation: Manufacturer's guidelines and recommendations stand as requirements of this work

ii. 1st Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series

iii. 2nd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series (4 mils wet, 2 mils dry per coat)

C. EXTERIOR BRICK WATERPROOFING - (Apply to Existing Exterior Brick Masonry where indicated on Drawings)

1. Silane/Siloxane Penetrating Water Repellant Sealer Systems

a. Transparent / No Gloss Finish

i. Surface Preparation: Manufacturer's guidelines and recommendations stand as requirements of this work

ii. 1st Coat: W. R. Meadows INTRAQUARD Silane/Siloxane Sealing compound (50 sq. ft. per gallon)

iii. 2nd Coat: W. R. Meadows INTRAGUARD Silane/Siloxane Sealing compound (50 sq. ft. per gallon)

INTERIOR PAINT SYSTEMS

A. MASONRY - (Walls & Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick or Block CMU, Cement Board)

1. Acrylic Enamel Systems

a. Semi-Gloss Finish

i. 1st Coat: Loxon Block Surfacer, LX01W0200 (tinted and rolled in to fill all pits and pores completely, 16 wet mils, 8.8 dry mils).

ii. 2nd Coat: S-W Pro-Classic Waterborne Acrylic, B31-1100 Series

iii. 3rd Coat: S-W Pro-Classic Waterborne Acrylic, B31-1100 Series (4 mils wet, 1.3 mils dry per coat)

B. WET AREAS - (All Food Service Area walls, Toilets and Restrooms CMU walls, Gypsum Board Walls and Ceilings, All Shower Wall and Ceilings, High Moisture Areas). NOTE: Epoxy paint manufacturer shall provide documentation that the epoxy product is tested and approved for application in such locations and for application on the surface material that is being used.

1. Epoxy Systems

a. Gloss Finish

i. 1rst Coat for Existing Walls Oil Based Painted: S-W Extreme Bonding Primer, B51W00150 (3.1 mils wet, 0.9 mils dry)

ii. 1st Coat New CMU: S-W Loxon Block Surfacer, LX01W0200 (tinted and rolled in to fill all pits and pores completely, 16 wet mils, 8.8 dry mils).

iii. 1st Coat Gyp. Bd.: S-W ProMar 200 Zero VOC Latex Primer, B28W02600 (4 mils wet, 1.0 mils dry)

iv. 2nd Coat: S-W Water Based Catalyzed Epoxy, B73-300 Series (8 mils wet, 4 mils dry)

v. 3rd Coat: S-W Water Based Catalyzed Epoxy, B73-300 Series (8 mils wet, 4 mils dry)

C. CONCRETE FLOORS – (Auditorium Floors, Shop Floors, Utility Equipment Platforms, Custodial Spaces, Stairwells, Electrical Equipment Rooms, Boiler Rooms).

1. Urethane Systems

    a. Gloss Finish (gray pigment)

        i. 1st Coat: Pressure wash, and SSPC prep

        ii. 2nd Coat: S-W Armorseal Rexthane I, B65-60 Series (3.0 – 4.5 mils wet, 2.0 – 3.0 dry)

        iii. 3rd Coat: S-W Armorseal Rexthane I, B65-60 Series (3.0 – 4.5 mils wet, 2.0 – 3.0 dry), (shop floors with anti-slip additive)

D. METAL – (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous Structural Steel Members, Miscellaneous & Ornamental Iron, Sashes, Doors, Door Frames, Partitions, Cabinets, Lockers, Radiators, Wall Louvers, Pumps, Motors, Machines, Convectors, Ducts [Ventilating], Electrical Raceways & Conduits, Elevator Cabs, Copper, Non-Galvanized Metal)

1. Acrylic Systems

    a. Semi-Gloss Finish

        i. 1st Coat: S-W Pro-Cryl Universal Primer, B66-310 Series (10 mils wet, 4.0 mils dry film thickness)

        ii. 2nd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series

        iii. 3rd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series (4 mils wet, 2 mils dry per coat)

2. Dryfall Alkyd Systems (EXPOSED CEILINGS; Structure, Ceilings, Ductwork, Conduits, where Scheduled)

    a. Flat Sheen Finish

        i. 1st Coat: S-W Pro-Cryl Universal Primer, B66-310 Series (10 mils wet, 4.0 mils dry film thickness)

        ii. 2nd Coat: S-W Waterborne Acrylic Dry Fall, B42BW3 (9.0 mils wet, 3.5 mils dry)

        iii. 3rd Coat: S-W Waterborne Acrylic Dry Fall, B42BW3 (9.0 mils wet, 3.5 mils dry)

E. METAL - (Galvanized)

1. Acrylic Systems

    a. Gloss Finish

        i. Surface Preparation: Refer to Part 3 Surface Preparations of these specifications for Cleaning & Testing/Evaluations; Manufacturer's guidelines and recommendations stand as requirements of this work.

        ii. 1st Coat: Pro-Cryl Universal Primer, B66-310 Series (10 mils wet, 4.0 mils dry film thickness)

iii. 2nd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series

iv. 3rd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series (4 mils wet, 2 mils dry per coat)

F. NON-TEXTURED SMOOTH DRYWALL (Walls, Ceilings, Gypsum Board, Wood Pulp Board, Plaster Board, Etc.)

1. Acrylic Enamel Systems

a. Semi-Gloss Finish (UNLESS NOTED OTHERWISE)

b. FLAT SHEEN WHITE for drywall prosceniums, bulkheads, overhead drywall ceilings

c. Base Coat: SHEETROCK Brand First Coat (drywall finishing primer for equalizing textures, coordinate with 09250)

i. 1st Coat: S-W Premium Wall & Wood Primer, B28W08111 (4 mils wet, 1.6 mils dry)

ii. 2nd Coat: S-W Pro-Classic Waterborne Acrylic, B31-1100 Series

iii. 3rd Coat: S-W Pro-Classic Waterborne Acrylic, B31-1100 Series (4 mils wet, 1.3 mils dry per coat)

G. CANVAS PIPE WRAP (exposed to view)

1. Latex Systems

a. Flat Finish

i. 1st Coat: S-W PrepRite 200 Latex Primer, B28W200 (add fungicidal agent) (4 mils wet, 1.2 mils dry)

ii. 2nd Coat: S-W ProMar 200 Latex Flat B30W200 Series (4 mils wet, 2 mils dry)

iii. 3rd Coat: S-W ProMar 200 Latex Flat B30W200 Series (4 mils wet, 2 mils dry)

J. BONDING PRIMER: (Interior Hard, Slick, Glossy Surfaces such as Existing Oil Based Wall Paint, Existing Painted CMU, PVC Piping, Plastics, Glass, Laminate, Aluminum, Varnished Woodwork, Ceramic Wall Tile, Glazed Block, Fluoropolymer Coatings)

1. Acrylic Systems

a. S-W Extreme Bonding Primer, B51W00150 (3.1 mils wet, 0.9 mils dry)

PART 3: EXECUTION

INSPECTION:

Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of manner acceptable to Applicator.

Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

SURFACE PREPARATION:

General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions, SSPC-SP, and as herein specified, for each particular substrate condition.

SSPC-SP: Steel Structures Paint Council Surface Preparation Specification

Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

Wood: Clean wood surfaces to be painted. Remove dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

Ferrous Metals: Clean ferrous surface, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

Touch-up shop-applied primed coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.

Galvanized Surfaces:

Hot-Dipped Galvanizing: Allow hot-dipped galvanized items to weather 6 months prior to surface preparations, and then steam clean per SSPC-SP 1. Do not use hydrocarbon solvents, vinegar or other mild acids for cleaning hot dipped galvanized surfaces. After cleaning, perform spot testing for any manufacturer’s pre-treatments, using the procedure from ASTM D2092, Method B201, Volume 06.01. After pre-treatments testing, apply 2’ x 2’ paint test patch for evaluation of paint surface adhesion. Evaluate the adhesion at three locations of the surface area, by performing a tape adhesion test per ASTM Method D3359. Grade the tape adhesion of the coating by following ratings as set forth in ASTM D3359-97.

Galvalume: Clean free of grease, oil, dirt, soil, and other surface contaminants with hydrocarbon free solvent cleaner. Perform a light brush blasting per SSPC-SP7 if necessary. After cleaning, apply 2’ x 2’ paint test patch for evaluation of paint surface adhesion. Evaluate the adhesion at three locations of the surface area, by performing a tape adhesion test per ASTM Method D3359. Grade the tape adhesion of the coating by following ratings as set forth in ASTM D3359-97.

Special Food Service Area Wall Preparation: Special preparation will be required to assure that required Food Service area CMU wall surfaces are pointed and patched is in strict accordance with the drawing’s CMU surface preparation General Notes for on-site approval by local Health Department. All work resulting from inspection comments and requirements are to be provided at no additional cost.

Previously Coated Surfaces:
Maintenance painting will frequently not permit or require removal of old coatings prior to repainting. However, all surface contaminants such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust,

mold, mildew, efflorescence, and sealers must be removed to assure sound bonding to the tightly adhering old paint. Glossy surfaces of old paint films must be clean and dulled, and/or sanded before repainting. Thorough washing with an abrasive cleaner will clean and dull in one operation, or wash thoroughly and dull by sanding. Spot prime any bare areas with appropriate primer. Adhesion to existing glossy surfaces may require bonding primers.

Adhesion Testing: Check for adhesion by applying a test patch of the recommended coating system, covering at least 2 to 3 square feet. Allow to dry one week before testing adhesion per ASTM D3359. If the coating system adhesion fails, report findings to Architect. Provide bonding primers where adhesion testing has failed or is in question.

Existing Stained Wood:
Wood must dry and cleaned of dirt, grease, wax, polish, and marks. Old finishes in poor condition should be completely removed and the surface treated as a new surface. Sand wood to a smooth surface with 100-120 grit paper. Remove sanding dust with a vacuum or tack cloth. Avoid sanding wood that has only stain on it, sanding will remove some of the stain creating an uneven appearance. Sand down bare spots and scratches, and stain to match adjacent color. Very lightly scuff sand between finish coats, 180 grit paper or finer, removing any raised graining. Perform adhesion testing, identifying any presence of any sanding sealer, which can prevent bonding and cause peeling.

SURFACE RESTORATIONS

Existing surfaces requiring restoration, including but not limited to existing steel door frames or existing window frame surfaces, require total surface cleaning complete, down to bare sound metal, in accordance with the applicable SSPC method required, and then surfaces immediately primed with applicable primer coats in DFT thicknesses required, prior to further ensuing work sequences; i.e. finish paint coats, re-glazings, frame preparations for hardware.

In addition to the Part 3 SURFACE PREPARATIONS specified, removal of all rust from existing surfaces may require sand blasting. Adhere to sandblasting requirements complying with 02070 Selective Demolition.

Once metal sections have been cleaned of all corrosion, small holes, depressions, and uneven areas resulting from rusting are to be filled with a patching material and sanded smooth to eliminate pockets where water can accumulate, and primed coated. Patching material shall be of high content steel fibers in an epoxy binder, similar to industrial steel repair or auto body patching materials

LEAD-BASED PAINT RENOVATION, REPAIR, AND PAINTING:

Applicators who perform painting renovations in housing or child occupied facilities built before 1978 must be certified by the Health Hazards Control Unit (HHCU). All work shall comply with requirements as published by the EPA Lead-Based Paint Renovation, Repair and Painting Rule in the Code of Federal Regulations.

Samples: For determining whether components are free of lead-based paint, certified applicators may collect paint chip samples and submit samples to a laboratory recognized by NLLAP for analysis. Required paint chip samples documentation shall be prepared and maintained by the certified applicator for three years.

MATERIALS PREPARATION:

Mix and prepare painting materials in accordance with manufacturer's directions.

Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

APPLICATION:

General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance, and complete hide. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

Special Food Service Area Wall Application: Roll-in two coats of masonry block filler coating in Food Service areas as necessary to completely fill all pits and pores prior to application of top coats. Final finished topcoat in Food Service areas to be free of all pits and pores, with a smooth completely washable surface. Apply additional coats when final coat of paint does not uniformly fill all pits and pores. Provide all work described as necessary to obtain an on-site approval by local Health Department.

Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.

Sand lightly between each succeeding enamel or varnish coat.

Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in occupied spaces.

Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

CLEAN-UP AND PROTECTION:

Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others by protection of their work, after completion of painting operations.

At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

EXTRA STOCK:

Furnish extra paint in manufacturer’s sealed shipping containers. Provide one gallon for each type and color of paint applied in the project. Containers shall only be opened by the painter

manufacturer/supplier to formulate required colors/mixes. These extra materials shall not be opened or used by the Contractor without written permission from the Owner. Place a label, protected by clear plastic on the lid of each container with the following typewritten information:

1. Paint Manufacturer
2. Product name and number
3. Mixing and color formulation
4. Painting contractor
5. Date that the paint container is put in the Owner's inventory
6. Room or area number where the paint applied was used

END OF SECTION

PRELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Extent of tackboards is shown on Drawings.

Types of tackboards specified in this section include the following:

- Vinyl Faced Natural Cork Tackboards

QUALITY ASSURANCE:

Manufacturer: Unless otherwise acceptable to Architect, furnish all tackboards by one manufacturer for entire project.

Surface Burning Characteristics: Provide tackboard surfaces which are identical in composition to those with surface burning characteristics indicated below, as determined by testing in compliance with ASTM E 84. Use only tackboards which are labeled and listed by a testing and inspection agency acceptable to authorities having jurisdiction.

Flame Spread: Not more than 25

Smoke Developed: Not more than 25

SUBMITTALS:

Product Data: Submit manufacturer's technical data and installation instructions for each material and component part, including data substantiating that materials comply with requirements.

Samples: Submit full range of color samples for each type of chalkboard, tackboard, trim and accessories required. Provide 12" square samples of sheet materials and 12" lengths of trim members for color verification after selections have been made.

Shop Drawings: Submit for each type of markerboard and tackboard. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, and installation details.

PART 2: PRODUCTS

ACCEPTABLE MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

Manufacturers Tackboards:

- Claridge Products and Equipment
- PolyVision

- Greensteel, Inc.

MATERIALS:

Vinyl Faced Tackboards:

Self-healing, mildew resistant textured vinyl over single layer 1/4" thick, seamless compressed cork sheet, face sanded for natural finish, complying with MS MIL-C15116, laminated to ¼" hardboard.

TRIM AND ACCESSORIES:

General: Fabricate frames and trim of not less than 0.062" thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units wherever possible and keep joints to minimum. Miter corners to neat, hairline closure.

Tackboard Trim: Claridge Products,5/8 " trim, or equivalent.

Retrofit Closure Trims: Claridge Products extruded aluminum closure trims, size as required to suit condition.

Aluminum Finish: Furnish exposed aluminum trim, accessories and fasteners with the following finish:

Clear Anodized Finish: Manufacturer's standard satin anodized finish with clear anodic coating complying with AIA requirements for Class II Architectural Coating (AA-A31).

Field-Applied Trim: Provide one of the following types:

- Slip-on trim, to eliminate grounds.
- Screw-on trim, with Phillips flat-head screws.

FABRICATION:

Assembly: Provide factory-assembled tackboard units unless field-assembled units indicated.

Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

PART 3: EXECUTION

INSTALLATION:

Install units in locations and mounting heights as shown on drawings and in accordance with manufacturer's instructions, keeping perimeter lines straight, plumb, and level. Provide all grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories for complete installation.

ADJUST AND CLEAN:

Verify accessories required for each unit are properly installed.

Clean units in accordance with manufacturer's instructions, breaking in only as recommended.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall include but is not limited to: provide and install all building interior and building exterior signs, exterior building letters, dedication plaques and to provide for the purchase of building equipment as determined by the Owner. Signs and equipment indicated to be purchased and installed with the allowance specified in 01056 Allowances, to include tax and freight, but not to include labor or installation, except as specifically stated below. Signs and equipment shall be installed by the Contractor in accordance with manufacturer's recommendations and instructions.

Equipment Platform egress ladder signage is not part of this allowance. Construction of masonry yard sign is not a part of this allowance. Site informational, directional and parking signs are not part of this allowance.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section, refer to Section 01068.

SUBMITTALS:

Manufacturer's Data: Submit for approval three (3) copies of folder containing complete Manufacturer's data and installation procedures for all products to be used in work of this Section.

Shop Drawings: Submit Shop Drawings in compliance with GENERAL CONDITIONS. These drawings shall be coordinated with adjacent work.

PART 2: MATERIALS

PRODUCTS: (final total list of equipment to be final approved by the Owner)

Interior Signage: Interior signage shall be solid one piece phenolic plastic materials, sand etched raised graphics, attached to walls with (4) screws each, ADA compliant. Provide Mohawk Signs Series 200A Sand Etched Format D signs or equivalent by Best Signs.

Dedication Plaque (installed): Cast aluminum.

Wood Storage Shelving: Where indicated on Drawings, provide Pre-Manufactured Wood Storage shelving for custodial and storage spaces, per Section 10445 Storage Shelving.

PART 3: EXECUTION

PRODUCT HANDLING:

Working Areas: Provide suitable areas for storage of materials and equipment.

Delivery: Deliver products to site in original sealed containers or packages bearing Manufacturer's name and brand designation.

INSPECTION

Examine all surfaces to which products are scheduled to be installed. If unsatisfactory conditions exist, report to General Contractor and do not proceed with work until conditions have been satisfactorily corrected.

INSTALLATION:

Install signs in accordance with Manufacturer's printed instructions and Shop Drawings, with four (4) screws, approved by Architect. Signs to be located with leading edge 10" from pull edge of door, center 60" above floor.

All installations shall be performed by capable workmen under direction of foreman fully qualified by experience in each respective field of installation work.

Install all equipment per processed product submittals and written manufacturer’s installation instructions.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, General Requirements, and Division 1 specifications, that apply to the work specified in this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Work of this Section shall be to provide and install all pre-manufactured wood storage shelving, and other items not specifically described, as indicated on Drawings. Purchase and install shelving with Sections 01056 and 10440 Allowances

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section, refer to Section 01068.

SUBMITTALS:

Manufacturer's Product Data: Submit for approval three (3) copies of folder containing complete Manufacturer's detailed product data and installation procedures for storage units to be used in work of this Section. Indicate unit construction including finishes.

Shop Drawings: Submit Shop Drawings in compliance with GENERAL CONDITIONS. These drawings shall be coordinated with adjacent work. Indicate locations, materials, thickness of parts, location and type of hardware, methods of assembly and jointing, and finishes.

Take measurements at the site for space where each item is to be placed.

PART 2: MATERIALS

PRODUCTS:

Pre-Manufactured Wood Storage Shelving:

Excalibur Shelving Systems by Palmetto Shelving Systems, Inc. (803) 781-9955; 84” high heavy duty wood shelving units (installed) – 16”, 18” and 24” widths, lengths as indicated on Drawings, 750 lb. load capacity.

A. Uprights: Hemlock or Douglas Fir (1-5/8" x 1-5/8")

    1. 3/8" x 5/8" deep plow entire length of stiles to receive shelf end channels with 3/16" drilled holes on 1" centers. Uprights to be sufficient height for shelving to be 7"-0" high
    2. Stiles are to be locked together with three or more cross members mortised glued and pinned into the stiles
    3. All components are to be machined smooth with all outside corners eased.

A. Shelves: Not less than 3/4" pine shelf materials are to be machined to accept roll formed steel end channels shaped to fit over each end of the shelf and to rest on the shelf support pins. Finger joints are not acceptable.

    1. Seven (7) shelves per section

C. Shelf Support Pins: Non rusting alloy, 3/16" diameter x 1-1/4" long, 5/16" diameter head.

D. "X" Braces: Two 18 gauge galvanized 3/4" steel straps with holes punched at each end. Rivet straps at centers. One "X" brace required every three (3) sections.

E. Back Panels: All back-to-back units for book storage to have 1/8" Abitibi S2S tempered hardboard back panels.

F. Kickboard: Provide a 4" pine kickboard for each unit.

F. Finish: Factory seal & lacquer (site finish is not acceptable)

G. Shelving shall be manufactured for wall-to-wall fit, as indicated on Drawings. Gaps in excess of 2” are not accepted.

H. Where dead corners are indicated on Drawings, solid end panels and closure panels will be required. Brace anchor all wall units.

I. Shelves shall not exceed 36” in length, and no less than ¾” thick.

DELIVERY, STORAGE AND PRODUCT HANDLING:

Working Areas: Provide suitable areas for storage of materials and equipment.

Delivery: Deliver products to site in original sealed containers or packages bearing Manufacturer's name and brand designation. Deliver storage units only after building is enclosed and wet operations in building are completed.

Protect finished surfaces from soiling and damage during handling and installation.

PART 3: EXECUTION

INSPECTION

Examine all surfaces to which products are scheduled to be installed. If unsatisfactory conditions exist, report to General Contractor and do not proceed with work until conditions have been satisfactorily corrected.

Field measure at site for space where each item is to be placed.

INSTALLATION:

Install shelving in accordance with Manufacturer's current printed instructions and Shop Drawings, approved by Architect.

All installations shall be performed by capable workmen under direction of foreman fully qualified by experience in each respective field of installation work.

Install all shelving per processed product submittals and current written manufacturer’s installation instructions. Brace anchor all wall units.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Provide fire extinguisher cabinets and extinguishers as shown on drawings and specified herein. Provide cabinets for all extinguishers except as noted.

QUALITY ASSURANCE:

Manufacturers: Fire extinguisher cabinets and extinguishers of following manufacturers, which meet all requirements of these Specifications and approved equal products by other manufacturers, will be acceptable for use on this Project:

- Norris Industries
- J. L. Industries
- Larsen's Mfg. Co.

SUBMITTALS:

Shop Drawings: Submit to Architect in quadruplicate Shop Drawings for approval of all items specified herein in accordance with General Conditions.

PART 2: PRODUCTS

Fire Extinguisher cabinets shall be "Clear Vu Series" model 1536G25, semi-recessed, with full clear acrylic bubble door and SAF-T-LOK feature, Fire Rated at fire-rated walls, white powder coated steel tub, stainless steel door and trim finish, as manufactured by JL Industries or approved equal. Cabinet shall accommodate and include a 10 pound, Class ABC extinguisher unless otherwise noted.

Furnish 10 pound, Class ABC extinguishers with wall mount bracket in each Custodian Room, equivalent to Cosmic 10E extinguisher.

Furnish 10 pound, Class ABC extinguishers with wall mount bracket on each Equipment Platform where indicated.

Furnish 1.8 gallon Class K extinguishers in cabinets in Kitchen, equivalent to Saturn 15 extinguisher in model 2536G25 cabinet.

Furnish one (1) 5 pound, Halon extinguisher in each Computer Lab and/or each Electronics Lab, equivalent to Mercury 5 extinguisher.

Furnish one (1) each 10 pound, Class BC extinguishers with wall mount bracket in Electrical and Boiler/Mechanical Rooms, no cabinet, equivalent to Galaxy 10 extinguisher.

PART 3: EXECUTION

INSTALLATION:

Install fire extinguisher cabinets in accordance with Manufacturer's written instructions, Catalog Cuts approved by Architect, and location pre-approved by local fire official.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: Pre-engineered and pre-finished extruded aluminum walkway covers, canopies, and sun shade awnings.

B. Related Sections:
   1. 03100-Concrete Forms and Accessories
   2. 03300-Cast-in-Place Concrete

1.2 SYSTEM DESCRIPTION

A. Design Requirements:

   1. Columns, beams, deck and trim shall be aluminum extrusions. Structural framing shall consist of heli-arc welded, one-piece rigid bents and bolt connected members] with interlocking deck sections secured by screws.
   2. Walkway canopies shall be self-draining from deck through bents to discharge point at ground level as shown on Drawings.
   3. Wall supported sun shade awnings shall be self-draining from deck out a built-in outer corner side discharge scupper or downspout, as per Drawings.
   4. Building Code: IBC and North Carolina Building code current editions.
   5. Design Loads:
      a. Comply with Building Code for site location.
      b. Collateral Loads: Additional loads imposed by other materials or systems identified in contract documents.
   4. Structural Design: Prepare complete structural design calculations and detailed design for canopy members and foundations. Provide to Architect within 45 days of Contract Award to General Contractor and coordinate structural work as required with Architect.

1.3 SUBMITTALS

A. Reference Section 01330-Submittal Procedures; submit following items:
   1. Product data.
   2. Shop Drawings: Layout and erection drawings showing roof framing, deck panels, cross sections and trim details clearly indicating proper assembly, foundation design, with Structural Design Calculations,
   3. Samples: Color selection samples consisting of actual coating material or anodizing process on aluminum extrusions.
   4. North Carolina regulatory review approval: Structural design and calculations sealed by a structural engineer registered to practice in the state of North Carolina.
   5. Quality Assurance/Control Submittals:
      a. Qualifications: Letter certifying manufacturer’s required qualifications.
      b. Structural Design: Calculations sealed by a structural engineer registered to practice in the state of North Carolina.
      c. Complete design and detail drawings for canopy and foundations.
      d. Manufacturer’s Installation Instructions.

1.4 QUALITY ASSURANCE

A. Overall Standards: Structural engineering design documents shall be certified and sealed by a structural engineer registered to practice in the state of North Carolina.

B. Qualifications:
   1. Manufacturer Qualifications: Minimum ten years experience in producing covers/canopies with welded bents and of the type specified.
   2. Installer Qualifications: Minimum five years experience in erecting covers/canopies of the type specified. Installations shall be in accordance with manufacturer's shop drawings.

1.5 DELIVERY STORAGE AND HANDLING

A. Reference Section 01660-Product Storage and Handling Requirements.

B. Follow manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Mapes Company (Super Lumideck with Flat Soffit system for canopies)

Equivalent products from the following manufacturers are acceptable. Reference AIA A701 Instructions To Bidders - Product Substitution Procedures.

Perfection Architectural Systems, Inc.
E.L. Burns Co., Inc.
Superior Metal Products
Peachtree Protective Covers

2.2 MATERIALS

A. Aluminum Extrusions: 6063 alloy, T-6 temper.

B. Grout: 1 part portland cement, 3 parts masonry sand; 2,000 psi (13.8 MPa) compressive strength.

C. Foam Block-Outs: Rigid foam blocks sized as required for column embedment depth and shape.

2.3 COMPONENTS

A. Columns:
   1. Radius-cornered aluminum tubular extrusions [of size shown on Drawings] [as required by structural engineering design].
   2. Grout Key: Provide two 1 ½ inch (38 mm) diameter holes in column base, one each in opposite sides.
   3. Provide clear acrylic protection coat on surfaces in contact with grout.

B. Beams: Open top aluminum tubular extrusions as required by structural engineering design.

C. Draining Decking with Flat Soffit: Rigid-Roll-Lock extruded aluminum, 3" extruded .078" self-flashing, interlocking sections as required by structural engineering design.
   1. Provide welded endplate water dams where sections terminate at other than drainage channels.

D. Hanger Rod Assemblies: Powder coated to match canopy awning. Sized and attached as shown in drawings and as required by structural engineering design.

E. Fascia: Provide manufacturer's standard smooth faced J-style extruded aluminum fascia and gutter sections as shown on Drawings and as required to complete the installation resulting in a neat finished appearance.

F. Flashing: Aluminum sheet, thickness as recommended by manufacturer for specific condition.

G. Concealed Drainage: Water shall drain from covered surfaces into integral fascia gutter and directed to either the front for front drainage or to the rear for ground level discharge via one or more designated downspouts or via downspout enabled columns for post supported canopies.

H. Conduit Cover: Extruded aluminum pre-finished continuous cap. Anchored down to the roof deck upper section to provide a continuous watertight enclosure for routing of electrical conduits and concealed weather protected roof deck penetrations.

2.4 ACCESSORIES

A. Fasteners:
1. Deck Screws: No. 14 x 1 inch (25 mm), self tapping, Type 18-8 stainless steel with neoprene washer.
2. Trim Screws: No. 10 x ½ inch (13 mm), self tapping, Type 18-8 stainless steel.

2.5 FABRICATION

A. Shop Assembly: Fabricate cross beams and columns for field assembled bolted connections.

2.6 FINISH

A. Finish on all exposed components shall be a Fluoropolymer Coating: 70 percent PVDF resin based fluoropolymer, AA-C-12C-42R-1, selected from manufacturer's standard factory colors by Architect, complying with AAMA605.

B. Standard Colors: Clear Anodized, Bronze Baked Enamel, White Baked Enamel

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine footings in which bents will be set and building surfaces to which canopy will connect. Verify footing locations, details and elevations comply with shop drawings.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory footings or surfaces.

C. Commencement of work by installer is acceptance of existing conditions.

3.2 ERECTION

A. Erect canopy in accordance with manufacturer's installation instructions.

B. Set bents plumb, straight and true to line, adequately braced to maintain position until grout has cured.

3.3 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from the site.

3.4 PROTECTION

A. Protect finished aluminum surfaces from damage due to subsequent operations through final acceptance by the Owner.

END OF SECTION

PART 1: GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This section shall include the furnishing of all tools, equipment, and labor necessary for the following systems:

1. Manually operated, hinged paired panels, operable wall systems - Activity Rooms.

B. Manufacturer shall furnish operable walls complete with hardware, tracks, hanger rods, stack jamb, soffits, soffit guide rails and all necessary mechanisms to provide complete operation.

1.03 WORK BY OTHERS:

A. All supporting structures and members at head and jambs; track enclosures including sound insulation, sound baffles, trim and finishing of same.

B. Any preparing of and/or punching of the support structures.

C. Preparation of the opening shall be by the General Contractor. Any changes to the project site condition, contrary to the reviewed shop drawings, shall be brought to the attention of the Architect.

1.04 SYSTEM PERFORMANCE REQUIREMENTS:

A. Acoustical Performance: Operable panel systems shall have been tested by a qualified independent testing agency in a full scale opening (14 feet by 9 feet) for laboratory sound transmission loss performance according to ASTM E90-81, determined by ASTM E413 and shall be rated:

1. Operable Partition – not less than STC 52

B. Field sound performance shall have been tested on an actual field installation by an independent certified acoustical consultant in accordance with ASTM E336 and shall have achieved no less than a 42 NIC. A written test report by the acoustical consultant shall be furnished to the Architect upon request.

1.05 SUBMITTALS:

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

Product Data on physical characteristics, durability and surface burning characteristics for each type of operable panel partitions system specified.

Shop Drawings showing location and extent of all operable panel partitions systems. Include plans, elevations, method of attachment to building structure, conditions at openings with wall thickness and materials, typical and special details of construction, location and installation requirements for hardware and operators, and all accessory items.

Template drawings prepared by the operable partition manufacturer showing location of items supported by or anchored into the building structure and wherever attachment occurs.

B. Samples for initial selection purposes in the form of manufacturers color charts showing a full range of colors, textures and patterns available for each type of panel finish indicated on the shop drawings.

C. Acoustical test report certificates indicating that the operable panel partition systems have been tested by an independent acoustical testing agency and comply with the specified minimum STC ratings.

1.06 QUALITY ASSURANCE:

A. Installer Qualifications: Engage an experienced Installer who is certified in writing by the operable panel partition manufacturer as qualified to install the manufacturer's partition systems specified herein.

B. Surface Burning Characteristics: Provide panel finish faced with the following surface burning characteristics as determined by testing identical products per ASTM E84 by UL or other testing and inspecting agencies acceptable to authorities having jurisdiction.

Flame Spread: 25 or less

Smoke Developed: 450 or less

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials to project site in original factory wrappings and containers.

B. Store panels on edge, blocked off ground to prevent sagging and warping, in original undamaged packages. Store panels in an enclosed, climatized environment. Panels shall be protected from weather, moisture, soiling, extreme temperatures and humidity.

C. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1:08 WARRANTY:

Partitions system shall be guaranteed against defects in materials and workmanship for three years. Suspension system shall be guaranteed against defects in materials and workmanship for five years.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

The operable panel partition systems are subject to complete and total compliance with this specification, the following manufacturers are acceptable:

A. Hinged Panel System:

1. Kwik-Wall "Series Model 3030, Manually Operated, Hinged Paired Panels".
2. Modernfold. Acousti-Seal Encore Paired Panel System
3. Equivalent products from Hufcor.

2.02: OPERABLE PANEL PARTITION SYSTEMS:

A. Operable Walls shall be installed by an authorized representative of the manufacturer in openings prepared by others to the approved operable wall product requirements.

B. PANELS shall be nominal 4" thick and nominally 49" wide. Steel panel faces shall be welded to minimum 14-gauge frames. Panels shall have appropriate internal insulation to achieve specified STC. The tops of the panels shall be reinforced to support suspension components. The vertical edges of the panels shall not require trim thus minimizing the appearance of the vertical joining of the panels.

C. Panel Weights: Maximum panel weight per square foot shall be 12 pounds per square foot.

D. Operation shall consist of a series of manually operated flat panels, top supported. Top and bottom seals shall be as specified in Part 2.07.

2.03 OPERABLE PARTITION SYSTEM CONFIGURATION:

A. Operable panel partition system shall have all of the features and operational characteristics specified and noted herein, end-of-wall stack operation. Panel configuration shall be comprised of panels hinged in pairs and end-of-wall stacking. Final closure shall be affected by expandable panels.

2.04 HARDWARE:

A. Manufacturer’s standard finished to match exposed hardware on the partitions.

B. Panels that are hinged together shall be hinged with manufacturer’s standard butt-type hinges.

C. Single Pass Doors, where indicated on Drawings, shall be nominally 3'-0" wide by 7'-0" high. Doors shall be manufactured of the same materials and thickness as the panels and be equipped with butt-type hinges and positive latches with drop cup and ring pulls.

2.05 SUSPENSION SYSTEMS:

A. Panels shall be supported by trolley assemblies of radial type steel or carbon fiber fill tired, steel ball-bearing wheels. Trolleys shall be attached to the panels with adjustable steel pendant bolts with locks to prevent panel misalignment

B. Track shall consist of heavy-duty aluminum alloy or steel. Track system shall be complete with overhead support features and brackets facilitating secure attachment to the building structure by means of adjustable steel hangar rods or by direct mount. The assembly shall be designed for the type, size, and weight of the partition selected and shall, in conjunction with the complementary trolley system, provide ease of operation.

2:06 SOUND SEALS:

A. Vertical seals between panels shall consist of deep nesting, universal interlocking bronze steel astragals incorporating continuous, vinyl acoustical seals. Vertical astragal vinyl seals shall be installed on the outboard edges of the panel skins in a double row with an acoustical labyrinth.

B. Horizontal TOP seals shall be continuous contact extruded vinyl shapes.

C. Horizontal BOTTOM seals shall be 2 ½" clearance-type manually actuated at waist height on panel edges. Downward pressure of all clearance- type seal mechanisms shall assure an acoustical seal and resist panel movement

2.07 FINAL CLOSURE:

Final closure shall be as indicated on the project drawings and shall be accomplished by expandable panels.

2.08 FINISHES:

Vinyl Coated Factory Fabric Finish: FS CCC-W-408A, heavy-duty Type KK, 30 oz. Per linear yard, Class A flammability per ASTM-E84, color as selected from manufacturer's available range.

PART 3: EXECUTION

3.01 EXAMINATION:

A. Examine flooring, structural support, and opening for compliance with requirements for installation tolerances and other conditions affecting performance of operable partition walls. Surfaces shall be clean and dry. Concrete surfaces shall be free of excess mortar and lumps. Wood surfaces shall be well nailed and/or glued, nail head driven flush, and wood free of voids. Metal surfaces shall be free of grease, oil, dirt, rust, corrosion and welding slag, without sharp edges. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify that rough opening is correct and has been prepared by others to conform to ASTM E557-75 Standard.

3.02 INSTALLATION:

A. Install operable panel partitions and accessories complying with ASTM E557 after other finishing operations, including painting, have been completed. Install operable panel partitions that conform to Architectural Drawings & Specifications, approved shop drawings and in strict compliance with manufacturer's written installation instructions.

B. Match operable panel partitions for color and pattern by installing partitions from cartons in the same sequence as manufactured and packaged if so numbered. Broken, cracked, chipped or deformed panels are not acceptable.

C. Apply perimeter caulking and trim and required.

3.03 ADJUSTING:

A. Lubricate all system components, bearings and sliding parts, adjust to ensure smooth easy operation.

B. Adjust locking hardware for accurate fit.

3.04 CLEANING

A. Clean all wood, metal, vinyl, and plastic laminate surfaces to remove soil without using abrasive cleaners or solutions containing corrosive solvents.

B. Remove debris from worksite.

3.05 DEMONSTRATION:

A. Provide the services of factory-authorized service representative to demonstrate and train Owner's representatives. Test operation and safeties. Replace damaged equipment. Train Owner's representative on procedures and schedules related to operation, troubleshooting, servicing and preventative maintenance.

B. Deliver all operation and maintenance manuals to the owner.

END OF SECTION

RELATED DOCUMENTS:

The General Provisions of the Contract, including General and Supplementary Conditions, and General Requirements, apply to the work specified in this Section.

DESCRIPTION OF WORK:

Gym divider curtain complete assembly shall be bottom roll up type and shall be manufactured in one continuous section as manufactured by Draper, or equivalent products by Porter Athletic Equipment Company. Complete assembly to include but is not limited to: Support framing, curtain and net sections, motors, switches, and operating hardware.

Lower section of curtain shall be 8'-0" high, a heavy vinyl coated polyester material with a weight of 22 oz. per square yard. Material shall be flame retardant meeting the requirements of UL-214 and NFPA-701. Architect shall select from manufacturer's standard colors, four minimum.

Upper net section shall be open polyester type interlocking grid weave coated with polyvinyl chloride with an approximate 45 to 50% open area. Weight to be 9 oz. per square yard, color - white, flame retardant (California Fire Marshal Reg. No. F102.4).

Top of curtain shall be fabricated with a pocket to conceal a continuous 1-5/1 6' O.D. steel tube extending the full length of the fabric to insure proper support. Steel tube shall be supported from special support assemblies with threaded rods or support chains as required to insure curtain is level and plumb during installation.

Divider curtain shall be neatly and compactly railed on a 3-1/2" diameter batten tube concealed in the bottom section of the vinyl fabric. Rolling action shall be accomplished by means of multiple hoist belts not to exceed 20'-0" on center. Belts shall be of a heavy individual grade polyester fabric, 5' in width with a tensile strength of 5,000 pounds per belt. One side of hoist belts shall be provided with a special PVC coating to provide rolling friction against the vinyl fabric to facilitate the rolling action of the bottom batten to roil compactly and eliminate wrinkles.

Hoist belts shall terminate in special roller drum assemblies supported from the building structure by means of special support assemblies. Roller drum assemblies shall be furnished with special belt tensioning devices, to insure proper wrap of belt and minimize friction and wear. Roller drum shall be supported and driven by means of a 1" diameter steel line shaft operating in self-aligning bronze bearings. Line shaft shall be supported between roller drum supports by intermediate bearing support assembly not to exceed 10'-0" centers.

Finish: Unit metal parts and framing shall be factory prime coated and factory pre-finished in manufacturer's top coat of powder coated **WHITE** enamel. Manufacturer to provide necessary matching touch-up paint supplies.

Line shaft shall be driven by a heavy duty 3/4 H.P., 115 V., double output shaft C-faced, double reduction (75 to 1) gear motor furnished with integral 6 ft. lb. brake mechanism and automatic overload protection. Gear reducer shall be filled with oil and equipped with high quality Buna-N lip seals for long life and maintenance free service. (Operators incorporating V-Belt drives will not be approved as equal.) Special rotary counting limit switches shall be an integral part of the operator.

Adjustment of said limit switches designed to be easily made without the use of tools. Operator shall be pre-wired with a 54' long rubber covered cable with polarized plug attached; cover plate and box by others. Key switch shall be furnished complete with a stainless steel cover plate for flush mounting into a 4' square by 3-1/2" deep wall junction box (Steel City No. GW-235-C or equal) which is to be provided by the Electrical Contractor. For safety, key switch to be located so that the operator has full view of the curtain while being operated. Wiring of all electrical components shall be in accordance with local codes

and in accordance with manufacturers instructions. All conduit, wiring, junction boxes and components not specified herein shall be furnished and installed by the Electrical Contractor.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Provide toilet and bath accessories as shown on drawings and as specified herein.

Provide blocking for Owner furnished/Owner installed items.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this section refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

For purpose of designating type and quality for work under this Section, Specifications are based on products manufactured by the Bobrick Co. and catalog numbers scheduled are Bobrick numbers. Equal items by McKinney/Parker, American Specialties, Inc. or Bradley will be acceptable.

SUBMITTALS:

Shop Drawings: Submit shop drawings or catalog cuts of each item required by this Section in accordance with General Conditions.

PART 2: PRODUCTS

Refer to Drawings Schedule for toilet accessory product descriptions.

PART 3: EXECUTION

INSTALLATION:

Items shall be securely anchored in place at heights and locations shown on drawings. In some areas heights and locations are not shown and accessories shall be located as directed by Architect.

Upon completion of work under this Section accessories shall be cleaned and polished in accordance with manufacturer's written instructions.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 - GENERAL

DESCRIPTION OF WORK:

Furnish and install the following:

1. Stainless Steel Corner Guards
2. Stainless Steel End Wall Protector
3. Stainless Steel Column Covers

RELATED SECTIONS

Section 05400 - Cold-Formed Metal Framing System
Section 09250 – Gypsum Drywall Systems
Section 09260 – Gypsum Drywall Framing
Section 09300 - Tile

QUALITY ASSURANCE:

Manufacturers:

Standard: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by Manufacturers listed with products.

SUBMITTALS:

Manufacturer's Data: Submit for approval three (3) copies of folder containing complete Manufacturer's data and installation procedures for all items to be furnished in work of this Section of Specifications.

Shop Drawings: Submit for each specialty item specified in accordance with General Conditions.

PART 2 - PRODUCTS

MATERIALS:

1. Corner Guards: Provide Stainless Steel Flush Mount Corner Guard, full height 90-degree corner guards with 3” double exposure, Model SSEW-FM, as manufactured by InPro Corporation, or equivalent products by CS Group.

   Provide full floor-to-ceiling height corner guards at outside corners, as indicated on Drawings.

   Exposed face of corner guard, stainless steel satin finish material with wall thickness of at least .060 inch thick, 1/8” radius corners, manufactured from Type 430, 16 gauge stainless steel.

   Finish: No. 4 satin finish

   Attached with manufacturer’s Phillips head screw fasteners through pre-drilled beveled holes.

Furnish Architect one 6" sample complete with selected color for approval.

2. End Wall Protector: Provide Stainless Steel Flush Mount End Wall Protector for wall protection, full height wall protectors with 3 1/8" double exposure x custom width, Model SSEW-FM, as manufactured by InPro Corporation, or equivalent products by CS Group.

   Provide full floor-to-ceiling height corner guards at outside corners, as indicated on Drawings.

   Exposed face of end protector, stainless steel satin finish material with wall thickness of at least .060 inch thick, 1/8" radius corners, manufactured from Type 430, 16 gauge stainless steel.

   Finish: No. 4 satin finish

   Attached with manufacturer's Phillips head screw fasteners through pre-drilled beveled holes.

   Furnish Architect one 6" sample complete with selected color for approval.

3. 24" Stainless Steel Column Cover: Provide Model E Column Cover by Frye Reglet, or equivalent products by Americlad or MOZ Designs. Round 24" diameter, satin stainless steel finish, complete assembly with internal concealed structural bracing with vertical attachment posts, and post foot tops and bottoms. Provide hairline butt joint EX splice Series "E" attachment spring clips.

   Provide 4" high x ¾" deep reveal toe space at floor with matching closure, material matching cover skin material.

   Provide Fry Reglet Wall Angle Column Ring with taping flange for drywall ceiling termination/transition.

PART 3 - EXECUTION

INSTALLATION:

Install products in strict accordance with manufacturer's printed instructions. General Contractor shall coordinate requirements by other prime contractors.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

1.1 SECTION INCLUDES

A. Solid high density polyethylene (HDPE) toilet compartments, consisting of:

1. HDPE Floor mounted overhead braced toilet compartments.

2. HDPE Floor mounted overhead braced urinal screens.

B. Compartment installation hardware.

C. Compartment door hardware.

1.2 RELATED SECTIONS

A. Section 10800 - Toilet and Bath Accessories.

1.3 SUBMITTALS

A. Submit under provisions of Section 01050.

B. Product Data: Manufacturer's printed literature indicating typical panel, pilaster, door, hardware and fastening.

C. Shop Drawings: Submit five sets of the following:

1. Dimensioned plans indicating layout of toilet compartments.

2. Dimensioned elevations indicating heights of doors, pilasters, separation partitions, and other components; indicate locations and sizes of openings in compartment separation partitions for toilet and bath accessories to be installed in partitions; indicate floor and ceiling clearances.

3. Details indicating anchoring components and methods for project conditions; indicate components required for installation, but not supplied by toilet compartment manufacturer.

D. Samples: Two manufacturer's color cards representing manufacturer's full color palette.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store compartment components until installation in unopened cartons laid flat, with adequate support to ensure flatness and to prevent damage to prefinished surfaces.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not deliver materials or begin construction activities of this section until building is enclosed, with complete protection from outside weather, and building temperature maintained at a minimum of 60 degrees Fahrenheit.

1.6 SEQUENCING

A. Obtain accessory manufacturer's installation instructions and installation templates for toilet and bath accessories to be installed in compartment separation partitions; supply instructions and templates to installer before beginning construction activities of this Section.

1.7 WARRANTY

Provide manufacturer standard 15 year warranty.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: ASI Accurate Partitions, Global Partitions

B. Other manufacturers meeting the requirements of these specifications.

2.2 HDPE TOILET COMPARTMENTS

A. Shall meet NFPA 286 Criteria Test results, and ASTM E-84 / UL 723 CLASS C flame spread rating.

B. Panel:

1. Nominal thickness: 1”.

2. Core: Panels shall be solid polymer resin, High Density Polyethylene (HDPE), which is waterproof, non-absorbent and resists marking, in colors that extend throughout the surface.

3. Edges: Finished smooth.

C. Floor Mounted Overhead Braced Pilasters:

1. Nominal thickness: 1”.

2. Core: Pilasters shall be solid polymer resin, High Density Polyethylene (HDPE), which is waterproof, non-absorbent and resists marking, in colors that extend throughout the surface.

3. Edges: Finished smooth.

4. Pilaster installation hardware preparation: Two holes, diameter to accept 3/8 inch threaded rod, drilled into core at pilaster base end, parallel to pilaster vertical axis, intersecting centerlines of two holes, diameter to accept Plug-Loc® installation hardware, drilled through pilaster perpendicular to pilaster face and 1 inch from pilaster base end.

D. Doors:

1. Nominal thickness: 1”.

2. Core: Doors shall be solid polymer resin, High Density Polyethylene (HDPE), which is waterproof, non-absorbent and resists marking, in colors that extend throughout the surface. .

3. Edges: Finished smooth.

E. Finish / Texture: Vandal resistant anti-graffiti texture, equivalent to black colored Tough Texture (TT) raised profile dimple texture by ASI Accurate.

F. Colors: Black

2.3 ACCESSORIES

A. Pilaster Shoes: Heavy-Duty stainless steel pilaster shoes. Furnish shoes at each pilaster.

B. Pilaster Anchors: Manufacturer's standard floor anchor with leveling adjustment assembly, concealed by pilaster shoe after installation.

C. Pilaster, Wall Panel and Urinal Screen Brackets: All wall terminations and intersections are to be manufacturer's heavy duty, bright finish anodized aluminum continuous bracket, pre-drilled at minimum 12” o.c. and prepared for fastening hardware. Bracket to be full height, length equal to the total length of partition, screen and pilaster less pilaster shoe height.

D. Overhead Bracing: Continuous heavy duty .125” thick extruded aluminum head rail with anti-grip device profile, with integral reinforcing channel and curtain track. Bright anodized finish and 2” minimum height.

Provide head rail double eared female corner brackets, wall brackets, and head rail end caps, in bright polished finish.

E. Door Hardware: (Heavy-Duty Cast Stainless Steel, unless otherwise noted)

1. Door hinge: Heavy-duty 14 gauge stainless steel continuous hinge, self closing gravity type. All hinges shall be mounted a 1” thick stile member.

2. Slide Latch: Heavy-duty, non-ferrous, cast stainless steel slide latch, satin finish, through-bolted.

3. Strike and Keeper: Permitting emergency access by lifting the door until latch is clear of keeper; heavy-duty cast stainless steel, satin finish; through-bolted.

4. Pull Handles: Heavy duty cast stainless steel with satin finish.

5. Door Stops: Heavy duty cast stainless steel with satin finish.

6. Coat Hook and Bumper: Non-ferrous, heavy-duty cast stainless steel, with black rubber tip for doorstop.

7. Fastening Hardware: Manufacturer's heavy-duty, No.304 stainless steel, No.4 satin finish, through-bolts and attachment fasteners with tamper-resistant heads.

8. Hardware of chrome-plated “Zamac” is unacceptable.

F. Toilet and Bath Accessories for Installation in Compartment Separation Partitions: Specified Section 10800.

PART 3: EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Measure areas to receive compartments; verify area dimensions are in accordance with shop drawings.

2. Verify built-in framing, anchorage, bracing, and plumbing fixtures are in correct location.

B. Installer's Examination:

1. Have installer of this section examine conditions under which construction activities of this section are to be performed, then submit written notification if such conditions are unacceptable.

2. Transmit two copies of installer's report to Architect within 24 hr of receipt.

3. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.

4. Beginning construction activities of this section indicates installer's acceptance of conditions.

3.2 PREPARATION

A. Surface Preparation:

1. Prepare openings in compartment separation partitions for toilet and bath accessories to be installed in partitions; marring of partition finish is prohibited.

2. Locate openings in accordance with shop drawings and accessory manufacturer's installation instructions and templates.

3.3 INSTALLATION

A. Install compartments to specified tolerances in accordance with shop drawings and manufacturer's printed installation instructions.

B. Attach components to adjacent materials and to other components using purpose-designed fastening devices.

C. Adjust pilaster anchors for floor variations; conceal anchors with pilaster shoes.

D. Equip each compartment door with top and bottom hinges, and door latch.

E. Install door strike keeper on pilasters in alignment with door latch.

F. Equip each compartment door with one coat hook and bumper.

G. Installation Tolerances:

1. Maximum variation from plumb or level: 1/8 inch.

2. Maximum displacement from indicated position: 1/8 inch.

3. Clearance between wall surface and panels or pilasters: 1-1/2 inch maximum.

3.4 ADJUSTING

A. Adjust door hardware for uniform clearance between doors and pilasters.

B. Adjust door hinges to attain free movement, to locate in-swinging doors in partial open position when unlatched; and to return out-swinging doors to closed position.

C. Adjust door hardware to align door strike keeper on each pilaster with door latch.

3.5 PROTECTION OF INSTALLED PRODUCTS

A. Prevent damage to product finishes by subsequent construction activities.

B. Replace components having damaged finish.

C. Remove factory protective coverings and clean finish surfaces in accordance with manufacturer's instructions before final inspection.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 - GENERAL

DESCRIPTION OF WORK:

Work of this Section shall be to provide new basketball goals, volleyball equipment, and athletic equipment as shown on Drawings and specified in this Section.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section, refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers Standard: For purpose of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured by Translux Fair-Play, Performance Sports Systems, Inc., and OnCourt OffCourt. Other Manufacturers who can furnish equivalent products or systems of same materials specified will also be acceptable.

SUBMITTALS:

Manufacturer's Data: Submit for approval three (3) copies of folder containing complete Manufacturer's data and installation procedures for all products to be used in work of this Section.

Shop Drawings: Submit Shop Drawings in compliance with GENERAL CONDITIONS. These drawings shall be coordinated with adjacent work.

PRODUCT HANDLING:

Working Areas: Provide suitable areas for storage of materials and equipment.

Delivery: Deliver products to site in original sealed containers or packages bearing Manufacturer's name and brand designation.

PART 2 – PRODUCTS

ELECTRONIC SCOREBOARDS

Gymnasium Scoreboards (wireless controlled): Provide one pair for Gym, Translux Fair-Play Model BB-1660-4 standard LED scoreboard complete assembly with a BB-1600-4 slave LED scoreboard unit, for Basketball, Volleyball, and Wrestling events, complete with MP-70 wireless programmable controller each pair. Provide complete with all wiring and accessories (hookup box, control carrying case) required for operation.

Provide the following options and accessories complete:

1. Shot Clock Set: Pair of Model: ST-1410-4 - shot clocks with 12 inch digits, backboard mounted. Include HS-70 hand switch and optional operation by MP-70 control. Provide complete with all

wiring and mounting accessories (including SJ 18/3 power cord from backboard to scoreboards) required for operation.

2. Goal Light Sets: Provide one pair of backboard mounted goal lights for the competition court, one each for the competition courts goal backboards. Translux Fair-Play illuminated Model Basketball goal strip GL-7248. Provide complete with all wiring and mounting accessories (including SJ 18/3 power cord from backboard to scoreboards), and controls/operator accessories required for proper operation.

3. Directional Arrows: Model 4505 - Directional arrow possession indicator. Provide complete with all wiring and mounting accessories, including necessary power cords required for operation.

4. Gym Scoreboard and Timer Wiring: Electrical Contractor roughs in and routes all raceways and power cabling to scoreboards and goal backboard mounted accessories, and extends electrical power from wall rough-in to scorers table power outlet mounted in the front floor level bleacher riser with retractable cables. Scoreboard installer to make final connections.

Scoreboards Warranty: Provide 5-Year Warranty, for any and all components of the entire assemblies.

BASKETBALL GOALS

Main and Side Court Folding Goals: Provide folding goals where indicated, Performance Sports Systems, Inc. Model 3103 Ceiling Suspended, forward folding goal with tempered glass backboards Model 942. Backboards to have painted targets and bolt-on safety cushion edges Model 1330. Provide breakaway goals Model 830. Provide each with electric winch Model 1194, with key switch and switch cover. Provide each with manual height adjuster Model 1130, Adjust-A-Goal Series, featuring height adjustment from 8'-0" to 10'-0" with hand held removable crank.

Main vertical mast shall be 6 5/8" O. D. pipe. Anti-sway braces shall be 2 3/8" O. D. pipe. All pipe shall meet or exceed ASTM A513 structural steel specifications. Main mast shall be offset 4" for positive locking.

Backstop shall have a rigid, hinged front brace attached to the main mast at approximately 12" to 18" above backboard. Folding brace shall be of jackknife design constructed of 1 7/8" O. D. pipe. The entire assembly shall be self-aligning and so designed as to be self-locking and self-releasing. The backstop shall be manufactured to accommodate one backboard.

Backstops shall be raised and lowered by means of 1/4" galvanized aircraft cable with a 7000 lbs. breaking strength.

Finish: Backstop units and framing shall be factory prime coated and factory pre-finished in manufacturer's top coats of powder coated **WHITE** enamel. Manufacturer to provide necessary matching touch-up paint supplies.

Volleyball Equipment: Provide Model 6000 Series Volleyball Systems, complete system set of three as manufactured by Performance Sports Systems, Inc., complete with 3 ½" O.D. anodized aluminum posts, heavy duty net tensioner winch, net with antennas, vinyl covered foam pads for uprights in minimum of 14 colors, cable covers. Provide in-floor base No. 6423 with 6405 cover plates. Install per manufacturers recommendations. Provide accessory storage cart.

Portable Pickleball Net System: Provide (6) six sets of portable pickleball net systems, "Deluxe PickleNet Portable Net System", by OnCourt OffCourt. Features include: 1.5" x 3"and 4" oval steel and aluminum tubing frame, a 34" x 22' long net, 4" locking wheels, duffel bag with wheels, meeting standard pickleball regulations of USA Pickleball.

PART 3 - EXECUTION

INSPECTION

Examine all surfaces to which products are scheduled to be installed. If unsatisfactory conditions exist, report to General Contractor and do not proceed with work until conditions have been satisfactorily corrected.

All wall mounted and overhead mounted equipment locations shall be fully coordinated with all adjacent systems, including mechanical, electrical, lighting and flooring, prior to installations.

INSTALLATION:

Install all specified systems in accordance with Manufacturer's printed instructions and Shop Drawings, approved by Architect.

All installations shall be performed by capable workmen under direction of foreman fully qualified by experience in this field of installation work.

Provide Owner with training sessions and demonstrations, performed by fully qualified manufacturers representatives certified in this field of installation work.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, apply to the work specified in this section.

PART 1: GENERAL

DESCRIPTION OF WORK:

Flat screen TV/Video monitors and mounting brackets shall be provided under the cash allowance listed in Section 01056. Provide mechanical mounting brackets designed to support the video display monitors, where indicated on Drawings and specified in this Section.

TV/Video Monitors (installed): Provide where indicated in the Drawings. After final purchase approval from Owner, purchase video monitors with mounting brackets and install with the cash allowance under Section 01056 Allowances.

INDUSTRY STANDARDS:

For listing of names of industry standard agencies mentioned by abbreviation in this Section, refer to Section 01068.

QUALITY ASSURANCE:

Manufacturers:

TV/Video Monitor Mounting Brackets Standard: For purpose of designating type and quality for work under this Section, Drawings and Specifications are based on Sanus VisionMount products manufactured by Sanus Systems (800) 359-5520. Other Manufacturers who can furnish products or systems of same materials specified and equal in all respects will also be acceptable, such as Da-Lite, and Peerless.

WARRANTY:

The mounting bracket used shall be supplied with a warranty against defects in workmanship and materials for five (5) years.

SUBMITTALS:

Manufacturer's Data: Submit five (5) copies of folder containing complete Manufacturer's data and installation procedures for all products to be used in work of this Section.

Shop Drawings: Submit Shop Drawings in compliance with GENERAL CONDITIONS. These drawings shall be coordinated with adjacent work.

PRODUCT HANDLING:

Working Areas: Provide suitable areas for storage of materials and equipment.

Delivery: Deliver products to site in original sealed containers or packages bearing Manufacturer's name and brand designation.

PART 2: PRODUCTS (final total list of equipment to be final approved by the Owner)

FLAT SCREEN TV/VIDEO MONITOR MOUNTING BRACKETS: (provide under 01056 allowance)

The flat screen TV/Video monitor wall bracket shall be Sanus Systems Premium Series Tilt-Mount Wall Mount, Model VLT5 (for 42" to 90" flat screens), or equivalent. Model shall be coordinated with the TV/Video monitors. Load capacity: 175 lbs. Tilt-mount screen adjustment capable. UL listed. Provide with security device: horizontal lock bar mechanism for padlock. Provide a universal fastener pack of all necessary screen attachment hardware, with mounting capabilities to wood studs/gypsum wallboard, concrete, CMU block, or metal studs/gypsum wallboard. Provide all necessary accessories for a complete installation and operable assembly.

The TV/Video Monitor wall bracket assemblies shall be of sufficient strength to support the weight of the flat screen TV/Video Monitor for which is designed, with an adequate safety factor. It shall be installed with a wall attachment device capable of supporting the weight of the TV/Video Monitor, the bracket itself. Confirm and coordinate bracket capabilities with the TV monitor size and weight. The TV monitor bracket shall wall mount and hold flat screen TV 1.25" from wall. Bracket shall be adjustable in both height and width to ensure proper fit. A locking mechanism shall hold TV securely in position.

Materials: Construction of the bracket shall be of heavy gauge steel with MIG welds, in scratch-resistant Satin Black powder coated finish.

PART 3: EXECUTION

INSPECTION

Examine all surfaces to which products are scheduled to be installed. If unsatisfactory conditions exist, report to General Contractor and do not proceed with work until conditions have been satisfactorily corrected.

INSTALLATION

Brackets for Video Display Monitors shall be installed where indicated on the plans. All fasteners and components for complete assembly of the bracket shall be furnished by the manufacturers.

Provide wood wall blocking for drywall wall mounted brackets. Reference Section 06100 Rough Carpentry for wall blocking requirements.

All CMU wall brackets to be through bolted through walls with plates, nuts and washers.

Install in accordance with Manufacturer's printed instructions and Shop Drawings, approved by Architect.

All installations shall be performed by capable workmen under direction of foreman fully qualified by experience in each respective field of installation work.

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

PART 1 - SCOPE OF WORK

Furnish and install new electromechanically propelled telescoping gymnasium seating complete assemblies with full power operation as indicated on plans and drawings.

Furnish and install new fixed gymnasium seating as indicated on plans and drawings.

Clean area and leave seating operational. Site and seating to be left in a ready for use condition.

PART 2 - PRODUCT DESCRIPTION

These specifications are based on Hussey Seating Company's Model Maxam 24. The standard Hussey Seating Company's specification shall apply as if written in full and will be the standard for comparison.

Include the “Flex Row” ADA seating system for compliance for compliance the wheelchair and companion layout indicated by the Drawings.

Other interested suppliers must provide detailed list of any deviations from these specifications.

Telescoping bleachers to be furnished in heights, lengths, widths, and number of rows as indicated on drawings, plans, and elevations. Bleachers are to be wall attached, each separate bank power operated, closed deck design, and must meet requirements set forth in NFPA 102, ICC Section 300, and the current IBC.

Fixed bleachers to be furnished in heights, lengths, widths, and number of rows as indicated on drawings, plans, and elevations. Bleachers are to be attached to steel framing, closed deck design, and must meet requirements set forth in NFPA 102, ICC Section 300, and the current IBC.

Seat spacing to be 24" back to back with a 11 5/8” rise. Seat depth to be 10" minimum and seat height to be 16" minimum.

These manufacturer’s products are minimum acceptable standard products and shall incorporate all requirements of these specifications:

“Maxam” with Courtside Seat & Clear Wood Decking by Hussey Seating Company (Basis of Design)

“Universal Bleacher” with CSM Seat by Interkal LLC

“5000 Series” with seats utilizing Back Covers, End Caps, by Irwin Telescoping Seating Co.

PART 3 - MATERIALS

Seats shall be 18" long x 10” wide, high density polyethylene contoured modules with all reinforcing ribs to be the internal, non-exposed type. Seats shall be provided in up to three colors, to be selected by Architect, and configured to read “HC” or similar on each bank, with shadow effect.

Decking to be 5/8" nominal thickness, 5-ply exterior plywood, A-C Grades with plugged solid cross bands. Joints shall be glue tongue and groove or recessed metal spliced. Finish to be 2-coats high solids clear polyurethane both sides to seal decking. Laminated, painted finish or single side polyurethane finishes are not acceptable.

Nosing and rear riser shall be continuous formed galvanized (G-60) steel members. Painted risers are not acceptable.

Understructure structural steel shall be finished with an epoxy resin based, textured powder coat, rust inhibitive finish.

Wheels to be a minimum of 5" diameter with 1 1/4" wide soft rubber face. A minimum of eight wheels per moving row, and not less than 4 wheels per column is required.

Structural fastening shall be vibration proof, and done with nuts and bolts. Self-tapping bolts or screws are not acceptable.

Each bank is to be power operated. Electrical Contractor shall provide a 208 volt, 3 phase, 20 amp service for each bank of seating. Final coordination and confirmation of required electrical service is required of electrical contractor, general contractor, and bleacher manufacturer.

Seating manufacturer shall provide all wiring within seating bank including pendant control and coil contactor.

Frames to be of varying sizes to accommodate load requirements and to be of channel design to allow through-bolting of brackets and finishing of frame material on all surfaces.

Lower riser deck support to be steel with Silver Gray zinc alloy plating. Painted or laminated surfaces are not acceptable.

PART 4 - OPERATION

Bleachers to operate on the telescopic principle with a locking system which permits the use of one or more rows.

Frames to have positive interlock at both the top and bottom.

The first moving row to be secured with both friction and mechanical locks. The front skirt board (friction lock) is to have a cylinder lock to prevent unauthorized use of bleachers.

Upper and lower track are to be designed to allow for field adjustment of row spacing, if necessary.

PART 5 - ACCESSORIES

Provide manufacturer’s standard scorer’s table, extended fit over bleacher bench row type, with enclosed undercounter leg space. one 8' x 18" x 30” scorer's table. Table top shall be Gray textured blow molded polymer 2” in thickness with eased edges for reduced pressure points and improved ergonomics. The Integral 16 Ga. cantilevered comfort C-style leg design provides ample clear space and stability during use and folds for ease of storage on the seating deck. The structure is finished in a speckled gray. The table is portable and may be used on any seating row or flat floor surface.

Full power operation: Individual tractors connected to a single power source provided by others and controlled by a pendant switch.

Provide end closures with access hatches to allow for servicing of power system, as required.

Provide filler panels and / or cutouts as indicated on drawings or as required by field conditions.

Provide aisles as required by code and as shown on drawings.

Front Aisle Steps: Provide at each vertical aisle location front aisle step. Front steps shall engage with front row to prevent accidental separation or movement. Steps shall be fitted with four non-skid rubber feet each 1/2" [13] in diameter. Blow molded end caps shall have full radius on all four edges.

Intermediate Aisle Steps: Intermediate aisle steps shall be of boxed fully enclosed type construction. Blow molded end caps shall have full radius on all four edges. Step shall have adhesive-backed abrasive non-slip tread surface.

Provide self-storing end rails to be 42" height above seat, with tubular supports and intermediate members designed with 4" sphere passage requirements, powder coated tubular steel. Furnished as required by the current IBC and as shown on drawings.

Intermediate Folding Aisle Handrails: Provide single pedestal mount handrails 34” high with terminating mid rail. Handrail to be permanently mounted to a rotating socket for rail storage on the intermediate aisle step.

Colored Safety Rail Systems; choose from 15 Standard colors.

Provide row letters and seat numbers. Letter and number system to be approved by Architect.

PART 6 - INSTALLATION, SERVICE, INSURANCE, AND WARRANTY

Installation is to be done by Factory Certified Installers. Proof of factory training and certification must be supplied to the Architect's office prior to installation.

The Bleacher Contractor must be able to show proof of full time service capability by the Contractor's employees. Such service personnel must be employed on full-time basis.

The Bleacher Contractor must be able to provide proof of completed products liability insurance coverage of at least two million dollars ($2,000,000.00).

Manufacturer's Product Warranty: Submit manufacturer's standard warranty form for telescoping bleachers. This warranty is in addition to, and not a limitation of other rights Owner may have under Contract Documents. Warranty Period: Five years from Date of Acceptance.

END OF SECTION

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-l Specifications sections apply to work specified in this section.

PART 1 - GENERAL

DESCRIPTION OF WORK:

Extent of pre-engineered buildings work is shown on drawings.

Manufacturer's standard components may be used, providing components, accessories, and complete structure conform to the specific architectural design, dimensions, and appearance shown and to specified requirements.

Manufacturer is responsible for design of complete system and conformance to the current North Carolina Building Code, and the current North Carolina Energy Conservation Code

Related Work Specified Elsewhere:

Concrete floor and foundations, and installation of anchor bolts are specified in Division 3.
07200 Building Insulation
07210 Pre-Engineered Building Roof Insulation
07610 Metal Roofing

QUALITY ASSURANCE:

Design Criteria:

For structural steel members, comply with AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings".

For light gage steel members, comply with AISI "Specification for the design of Cold-Formed Steel Structural Members".

Design primary and secondary members and covering for applicable loads and combination of loads in accordance with the 2012 North Carolina Building Code.

For welded connections, comply with AWS "Structural Welding Code".

Design Loads: Basic design loads, as well as auxiliary and collateral loads, are indicated on drawings.

Design each member to withstand stresses resulting from combinations of loads that produce maximum percentage of actual to allowable stress in that member, as prescribed in MBMA "Recommended Design Practices Manual".

Provide thermal insulation as required for compliance with the 2012 North Carolina Energy Conservation Code.

Fabrication Criteria: Provide prefabricated metal buildings as produced by a manufacturer who is regularly engaged in fabrication of pre-engineered metal structures of type and quality indicated.

Clearly and legibly mark each piece and part of assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

SUBMITTALS:

Product Data: Submit manufacturer's product information, specifications and installation instructions for building components and accessories.

Building Design and Certification of Drawings: Submit complete drawings showing building structure design, in compliance with Drawings, including anchor bolts settings, sidewall, end wall, and roof framing, transverse cross sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of building components. Building structure design drawings shall be prepared and sealed by a Professional Engineer, registered to practice in the State of North Carolina, and shall state that the building design meets the indicated loading requirements and codes of authorities having jurisdiction.

Provide roof thermal blocks, roof thermal insulation and vapor barrier product data and manufacturer's specification indicating compliance with the current North Carolina Energy Conservation Code, coordinated with 07200 and 07210.

Shop drawings showing locations and layout of steel support strapping for roof insulation.

Load and reaction reports for all frame members for all load cases.

Samples: Submit samples of the following:

12" long by actual width of roofing and trim panels, with required finishes.

Fasteners for application of roofing and trim panels. Sealants and closures.

Vapor Barrier: 12" x 12" sample vapor barrier fabric, painted support strapping

Maintenance Stock: Furnish at least 1% excess over required amount of nuts, bolts, screws, washers, and other required fasteners for each building. Pack in cartons and store on site where directed.

WARRANTY:

Provide manufacturer's standard warranty for:
1. Standard warranty on materials and workmanship: 3 years
2. Roof Panel paint film finish: 20 years NDL (No Dollar Limit) Manufacturer's warranty. Reference 07610.
3. Roof Panel perforation: 20 years NDL (No Dollar Limit) Manufacturer's warranty. Reference 07610.
4. Roof Weathertightness: Manufacturer's NDL (No Dollar Limit) written roof weathertightness warranty - twenty (20) years. Reference 07610.

DELIVERY, STORAGE AND HANDLING:

Deliver and store prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weather tight ventilated covering. Store metal sheets or panels so that water accumulations will drain freely. Do not store sheets or panels in contact with other materials which might cause staining.

PART 2 - PRODUCTS

MATERIALS:

Hot-Rolled Structural Shapes: ASTM A 36 or A 529.

Tubing or Pipe: ASTM A 500, Grade B; ASTM A 50l; or ASTM A 53.

Members Fabricated from Plate or Bar Stock: 42,000 psi minimum yield strength; ASTM A 529, A 570, A 572 or A 36 modified.

Members Fabricated by Cold Forming: ASTM A 607, Grade 50.

Galvanized Steel Sheet: ASTM A 446 with G 90 coating; "Class" to suit building manufacturer's standards.

STRUCTURAL FRAMING COMPONENTS:

Rigid Frames: Hot rolled structural steel. Factory welded and shop painted built-up "I". shape or open web rigid frame consisting of tapered or parallel flange beams and tapered columns. Furnish complete with attachment plates, bearing plates, and splice members. Factory drilled for bolted field assembly.

Length of span and spacing of frames as indicated except slight variations acceptable to meet manufacturer's standard.

Where indicated on Drawings, rigid frames profiles to be inside of and flush with exterior wall.

End Wall Columns: Factory welded, built-up "I" shape or cold formed sections. Fabricate of minimum 14 ga. material. Shop painted.

Where indicated on Drawings, rigid frames profiles to be inside of and flush with exterior wall.

Tube Steel Wind Beams: ASTM A 500, Grade B; ASTM A 50l; or ASTM A 53. Concealed above ceilings.

Wind Bracing: Adjustable, threaded steel rods, 1/2" diameter minimum; ASTM A 36 or A 572, Grade D.

Secondary Framing: Purlins, girts, eave struts, tube steel wind beams, end wall beams, flange and sag bracing; minimum 16 ga. rolled formed sections. Shop painted.

Base channel, sill angle, end wall structural members (except columns and beams), purlin spacers; minimum 14 ga. cold formed steel, galvanized.

Any members required for door or window openings shall be accounted for in bid.

Any members required for the mounting of specified basket ball goal backboards from the roof framing.

Bolts: ASTM A 307 or A 325 as necessary for design loads and connection details. Shop painted, except provide zinc-or cadmium-plated units when in direct contact with panels.

Fabrication: Shop fabricate to the indicated size and section, complete with base plates, bearing plates, and other plates as required for erection, welded in place, and with all required holes for anchoring or connections shop drilled or punched to template dimensions.

Shop connections power riveted, bolted, or welded.

Field connections bolted.

Shop Painting: Clean surfaces to be primed of loose mill scale, rust, dirt, oil, grease, and other matter precluding paint bond.

Follow procedures of SSPC-SP3 for power tool cleaning, SSPC-SP7 for brush-off blast cleaning, and SSPC-/SPI for solvent cleaning.

Prime structural steel primary and secondary framing members with manufacturer's standard rust-inhibitive primer having over 50% rust-inhibitive pigment, such as red-lead mixed pigment alkyd varnish (FS TT-P-86, Type II) or zinc chromate iron-oxide alkyd (TT-P-636).

PANELS:

ROOFING PANELS: Provide factory formed 24 gauge prefinished galvalume steel panel with Kynar 500 finish roofing panels, equal to 16″ wide panel with striations and 2″ high ribs equivalent to Varco Pruden SLR II standing seam roof panels, attached with UL 90 Rated panel clips at 5'-0" o.c. Provide flashings, closers, fillers, metal expansion joints, ridge covers, fascias, and other sheet metal accessories, factory formed of same material and finish as roofing and siding. Roofing system shall meet UL 580: Class 90 Uplift rating and Class A. Roofing system shall have been tested in accordance with ASTM E-1592.

Make connection of roof panels to structural members, except at eaves, with clips with movable stainless steel tabs, seamed into standing seam side lap.

WALL PANELS: Corrugated wall panels where indicated on Drawings shall be fabricated from 24 gauge Galvalume AZ50 ASTM A 792 galvalume steel, PVDF fluoropolymer Kynar 500 factory applied paint system with a 20-year finish warranty, formed to provide a weathertight closure assembly. Panel shall be a 1 ½" deep ribs x 30" wide panel, exposed fastener type, smooth finished, corrugated profiled. Provide all accessories, corrosion resistant color matching fasteners, trims, channels and flashings for a complete weathertight assembly. Provide "T10-B Wall Panel" by Metal Sales Manufacturing Corporation, or approved equivalent.

SOFFIT PANELS: Metal soffit panels and trim where indicated to be 22-gauge galvalume steel, flat profile and smooth textured, with a factory KYNAR 500 finish, selected from standard colors. Provide 12 inch wide solid non-vented panels, unless otherwise noted. Soffit system shall be equivalent to Metal Roofing Systems (MRS) Flush Seam panel, or equivalent products by MBCI. Provide soffit panels in compliance with ASTM 1592, and the Architectural Aluminum Manufacturers Association (AAMA) Specifications 1402-86 Standard Specifications for Aluminum siding, soffit, and fascia. Provide all necessary accessories and trims for complete assemblies.

SHEET METAL ACCESSORIES:

Coordinate with requirements of Section 07600 – Flashing and Sheetmetal.

General: Unless otherwise indicated, provide coated aluminum accessories and trim with coated steel roofing. Provide Kynar 500 prefinished coating, colors to match existing.

THERMAL INSULATION:

Foundation Insulation: Coordinate with Section 07200 Building Insulation.

Wall Insulation: Coordinate with Section 07200 Building Insulation.

Roof Insulation: Coordinate with Section 07210 Pre-Engineered Building Roof Insulation.

Roof Insulation Vapor barrier: Coordinate with Section 07210 Pre-Engineered Building Roof Insulation.

Roof Insulation Retainer Strips: Coordinate with Section 07210 Pre-Engineered Building Roof Insulation.

Roof Purlin Thermal Blocks: Coordinate with roof panel system and 07210 Pre-Engineered Building Roof Insulation.

Locations: Coordinate with Section 07210 Pre-Engineered Building Roof Insulation, Section 07200 Building Insulation, and Drawings.

PART 3 - EXECUTION

ERECTION:

Framing: Erect structural framing true to line, level and plumb, rigid and secure. Level base plates to a true even plane with full bearing to supporting structures.

Purlins and Girts: Provide rake or gable purlins with tight fitting closure channels and fascias. Locate and space wall girts to suit door and window arrangements and heights. Secure purlins and girts to structural framing and hold rigidly to a straight line by sag rods.

Bracing: Provide diagonal rod or angle bracing in both roof and sidewalls as indicated.

Movement resisting frames may be used in lieu of sidewall rod bracing, to suit manufacturer's standards.

Where diaphragm strength of roof or wall covering is adequate to resist wind forces, rod or other forms of bracing will not be required.

Framed Openings: Provide shapes of proper design and size to reinforce opening and to carry loads and vibrations imposed, including equipment furnished under mechanical or electrical work. Securely attach to building structural frame.

ROOFING:

Manufacturer’s standard erection guidelines meeting UL 90 requirements.

Sheet Metal Accessories: Install gutters, downspouts, ventilators, louvers, and other sheet metal accessories in accordance with manufacturer's recommendations for positive anchorage to building and weather tight mounting. Adjust operating mechanism for precise operation.

Thermal Insulation: Install in accordance with manufacturer's published directions, performed concurrently with installation of roof panels and roof purlin thermal blocks . Install blankets straight and true in one-piece lengths and both sets of tabs sealed to provide a complete vapor barrier. Install retainer strips at each longitudinal joint straight and taut, nesting with roof rib to hold insulation in place.

END OF SECTION

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, and North Carolina for Automatic Sprinkler Systems, apply to this Section.

1.2 SUMMARY

A. This Section provides the basic information needed to design and install a Wet-Pipe Sprinkler System for the project building.

1.3 SYSTEM DESCRIPTION

A. System to provide coverage for the entire new addition or building. See plans for areas as indicated to be sprinkled.

B. Interface system with building fire and smoke alarm system.

C. Provide system to NFPA 13 Light or Ordinary hazard, Group 1 occupancy or as required for the type occupancy if other than Light/Ordinary hazard. See architectural plans for occupancy and construction types.

D. Provide Fire Department connections as indicated. See Civil – Site plans.

E. Provide and install a standard pre-manufactured water storage tank as indicated on plans and as necessary to meet flow and pressure requirements of the new sprinkler system.

1.4 SYSTEM PERFORMANCE AND DESIGN REQUIREMENTS

A. Wet pipe sprinkler subcontractor is fully responsible for the design of a complete and compliant system, certified by an North Carolina Professional Engineer or registered NICET Level III Sprinkler Designer, and responsible to obtain approval from authorities having jurisdiction for the Fire Protection Systems specified. Storage tank size, pump size, and main line sizes are indicated as basis of bid only. Subsequent to award of contract, Sprinkler contractor shall perform all necessary investigative hydraulic work and final costs / sizes of the aforementioned will be adjusted with cost credits or adds in accordance with the general and supplemental conditions of the contracts.

The Sprinkler contractor is responsible for providing the main line piping to the site contractor for installation. The Site Contractor shall install the main line piping. All parts, pieces, assemblies, and items for a complete and compliant system shall be provided.

B. Contact local utilities for fire hydrant flow tests results, as required to prepare design for hydraulically calculated systems.

C. Design installation to conform to NFPA 13, N.C. State Building Codes, and the latest issue of the "Requirements for Automatic Sprinkler Systems" and all subsequent Amendments to date, as published by the North Carolina Department of Insurance.

D. Designer is responsible for reviewing information on the plans and verifying, adjusting, or correcting sizes as necessary to meet NFPA 13 requirements and flow rates at the actual

pressures available from the local utility lines at no additional cost to the contract.

1.5 SPECIAL CONDITIONS

A. Horizontal sprinkler mains and branches shall be located as high as possible above the ceiling and heads dropped down into ceiling where ceilings are indicated on architectural reflected ceiling plans..

B. All horizontal sprinkler pipes shall be located above the finished ceiling. If the ceiling is higher then the specified mounting height then provide the required risers and offsets to locate the pipe above the ceiling.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL Fire Protection Equipment Directory and FM Approval Guide and that conform to other requirements indicated.

B. Listing/Approval Stamp, Label, or Other Marking: On equipment, specialties, and accessories made to specified standards.

C. Comply with requirements of authority having jurisdiction for submittals, approvals, materials, hose threads, installation, inspections and testing.

D. Installer's Qualifications: Firms qualified to install and alter fire protection piping, equipment, specialties, and accessories, and repair and service equipment. A qualified firm is one that is experienced (minimum of 10 previous projects similar in size and scope to this Project) in such work, familiar with precautions required, and in compliance with the requirements of the authority having jurisdiction. Submit evidence of qualifications to the Architect upon request.

1.7 SUBMITTALS

A. Submit shop drawings and product data that includes detailed pipe layout, hangers and supports, components and accessories.

B. Submit shop drawings and hydraulic calculations to authority having jurisdiction and Architect/Engineer for approval. Submit Proof of Approval to Architect/Engineer.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit manufacturer's Operation and Maintenance Data.

B. Include written Maintenance Data on components of system, Servicing requirements and Record Drawings.

1.9 DELIVERY, STORAGE AND HANDLING

A. Provide temporary inlet and outlet caps.

B. Maintain caps in place until installation.

1.10 EXTRA STOCK

A. Provide extra sprinkler heads under provisions of NFPA 13.

B. Provide suitable wrenches for each head type.

C. Provide metal storage cabinet in location designated.

PART II - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Central Sprinkler Corporation
B. Star Sprinkler Corporation
C. Viking Corporation

2.2 PIPING MATERIALS

A. Buried Piping: Ductile iron, Class 50

B. Above Ground Inside Building Piping: Steel, Schedule 10 black. Schedule 5 or thin wall threadable pipe is not acceptable.

C. Woven mesh stainless steel flexible hose is acceptable for drops to individual sprinkler heads.

2.3 PIPING SPECIALTIES

A. Automatic Sprinkler Valve: Flow detector with alarm circuits, pressure switch, pressure retard chamber.

B. Alarm Gong: Electric type, see Fire Alarm plans.

C. Fire Department Connection: Wall type; chrome plated finish; thread size to suit fire department hardware; two way threaded dust cap and chain of same material and finish, identification plate to match finish, indicating "AUTO SPKR".

2.4 SPRINKLER HEADS

A. Suspended Ceiling Type: Standard recessed pendant type with chrome plated finish and the matching escutcheon.
B. Exposed Area Type: Standard upright type
C. Sidewall Type: Recessed chrome plated finish with matching escutcheon.
D. Fusible Link: Temperature rated for specific area hazard.

2.5 STORAGE TANK

A. Provide a premanufactured corrugated steel round storage tank assembly with internal liner meeting NSF-61. Provide tank with access ladder, hatch, over-flow piping, etc. as required for a full, complete and integrated part of the sprinkler system. Tank shall have a minimum Warranty duration of 20 years. Provide a tank as manufactured by Pioneer Tanks of America or Equal. See plans for suggested size, sprinkler designer responsible for final tank sizing. Verify pad dimensions with General Contractor prior to pad being poured.

PART III - EXECUTION

3.1 WATER SUPPLY CONNECTION

A. Connect fire protection piping to water service piping of size and in location indicated on drawings.

3.2 PREPARATION

A. Coordinate all work with other trades.

B. Refer to Architectural Plans for ceiling heights and types.

3.3 INSTALLATION

A. Install sprinkler piping in accordance NFPA 13.

B. Install sprinkler piping with drains for complete system drainage.

C. Provide hangers and supports in accordance with NFPA 13.

D. Install specialty sprinkler fittings according to manufacturer's written instructions.

E. Provide alarm devices for connection, by others, to fire alarm system.

F. Locate Fire Department connection as indicated on Drawing. Provide sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of Fire Department wrench handle.

G. Locate outside alarm gong on building wall.

H. Place pipe runs to minimize obstruction to other work.

I. Place piping in concealed spaces above finished ceilings.

J. Center heads in two directions in ceiling tile and provide piping offsets as required.

3.4 SYSTEM TESTS

A. Hydrostatically test entire System.

B. Test shall be witnessed by authority having jurisdiction.

3.5 FIELD QUALITY CONTROL

A. Flush, test and inspect sprinkler piping systems according to NFPA 13 Chapter "System Acceptance".

B. Replace piping system components that do not pass test procedures specified, then re-test to demonstrate compliance. Repeat procedure until satisfactory results are obtained.

3.6 CLEANING

A. Clean dirt and debris from sprinklers.

3.7 DEMONSTRATION

A. Demonstrate equipment, specialties and accessories. Review Operating and Maintenance information.

END OF SECTION 13900

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SCOPE OF WORK:

The scope of work consists of the furnishing and installing of complete plumbing (exterior and interior) and HVAC systems including miscellaneous systems. The Mechanical Contractor (hereafter referred to as "the Contractor", either Plumbing or HVAC) shall provide all supervision, labor, materials, equipment, machinery, and any and all other items necessary to complete the systems. The Contractor shall note that all items of equipment are specified in the singular; however, the Contractor shall provide and install the number of items of equipment as indicated on the drawings and as required for complete systems.

It is the intention of the Specifications and Drawings to call for finished work, tested and ready for operation.

Any apparatus, appliance, material, or work not shown on the drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered, and installed by the Contractor without additional expenses to the Owner. Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the Contractor's estimate, the same as if herein specified or shown.

With submission of bid, the Contractor shall give written notice to the Architect of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules, and any necessary items or work omitted. In the absence of such written notice, it is mutually agreed that the Contractor has included the cost of all required items in his proposal, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensation.

NOTICE TO BIDDERS, INSTRUCTIONS TO BIDDERS, SUPPLEMENTARY INSTRUCTIONS, GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, SPECIAL CONDITIONS, GENERAL REQUIREMENTS bound in the front of this document are included as a part of the specifications for this work.

MECHANICAL DRAWINGS AND SPECIFICATIONS:

The mechanical drawings are diagrammatic and indicate the general arrangement of fixtures, equipment, and work included in the contract. Consult the architectural, structural and electrical drawings and details for exact location and dimensions of fixtures and equipment; where same are not definitely located, obtain this information from the Architect.

The Contractor shall follow drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Architect shall be notified before proceeding with installation. If directed by the Architect, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

The plans and these specifications are intended to describe, imply and convey the materials and equipment as well as necessary labor, required for the installation as outlined in the paragraph entitled "Scope of Work". Any omissions from either the drawings or these specifications are unintentional, and it shall be the responsibility of this Contractor to call to the attention of the Architect or Engineer any pertinent omissions before submission of a bid. The drawings which accompany these specifications are not intended to show in complete detail every fitting which may be required; however wherever reasonable implied by the nature of

the work, any such material or equipment shall be installed by this Contractor as a part of his contract price. In no case will any extra charge be allowed unless authorized in writing by the Architect or Engineer.

The Contractor shall arrange with the General Contractor for required concrete and masonry chases, openings, and sub-bases so as not to delay progress of work. Work shall be installed sufficiently in advance of other construction to conceal piping and to permit work to be built in where required.

It shall be understood and agreed by all parties that where the words "Furnish", "Install", and / or "Provide" appear, the following definitions apply:

Furnish - to supply or give
Install - to place, establish or fix in position
Provide - to furnish and install as defined above

CODES, PERMITS, AND FEES:

The Contractor shall give all necessary notices, including electric and telephone utilities, obtain all permits, and pay all government taxes, fees, and other costs, including utility connections or extensions in connection with his work file all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Architect before request for acceptance and final payment for the work.

The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings (in addition to contract drawing and documents) in order to comply with all applicable laws, ordinances, rules, and regulations, whether or not shown on drawings and / or specified.

Work and materials shall conform to the latest rules of the National Board of Fire Underwriter's Code and Regulations of the State Fire Marshall, and, or guarding of any moving parts, or otherwise hazardous conditions. Nothing in these specifications shall be construed to permit work not conforming to the most stringent of applicable codes.

The State Plumbing and Mechanical codes, and the mechanical requirements as established by the State and Local Fire Marshall, and rules and regulations of the local utilities serving the project are hereby made part of this specification. Should any changes be necessary in the drawings or specifications to make the work comply with these requirements, the Contractor shall notify the Architect.

VERIFICATION OF DIMENSIONS, DETAILS, EXISTING FIELD CONDITIONS:

The Contractor shall visit the premises prior to bidding, and thoroughly familiarize himself with all details of the work, working conditions, verify dimensions in the field, provide advice of any discrepancy, and submit shop drawings of any changes he proposes to make in quadruplicate for approval before starting any work. The Contractor shall install all equipment in a manner to avoid building interference. No Change Order for extra work will be considered for items that were evident during a site visit.

The locations of existing underground utilities are shown in an approximate way only and have not been independently verified by the Owner or its representative. The Contractor shall determine the exact location of all existing utilities before commencing work and agrees to be fully responsible for any and all damages which might be occasioned by the Contractor's failure to exactly locate and preserve any and all underground utilities.

ACCEPTABLE MANUFACTURERS:

Acceptable manufacturers, as specified in the Contract Documents, implies that the specified manufacturer may produce acceptable products equal in quality of materials and performance to such item specified. The

Contractor will be required to provide products meeting or exceeding the "Standard of Quality and Performance" as dictated by the product selection noted.

SHOP DRAWINGS AND EQUIPMENT SUBMITTALS:

The Contractor shall submit minimum of five (5) and maximum of seven (7) copies of the shop drawings to the Architect for approval within thirty (30) days after the award of the general contract. If such a schedule cannot be met, the Contractor may request in writing for an extension of time to the Architect. If the Contractor does not submit shop drawings in the prescribed time, the Architect has the right to select the equipment.

Shop drawings shall be submitted on all major pieces of mechanical equipment. Each item of equipment proposed shall be a standard catalog product of an established manufacturer. Certain major groups of equipment shall be provided from a singular manufacturer. The shop drawing shall give complete information on the proposed equipment. Each item of the shop drawings shall be properly labeled, indicating the intended service of the material, the job name, and the MC's name.

The shop drawings shall be neatly bound in five (5) sets and submitted to the Architect with a letter of transmittal. The letter of transmittal shall list each item submitted along with the manufacturer's name.

Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications.

AS-BUILT DRAWINGS:

The Contractor shall maintain accurate records of all deviations in work as actually installed from work indicated on the drawings. On completion of the project, two (2) complete sets of marked-up prints shall be delivered to the Architect.

MAINTENANCE AND OPERATING MANUALS:

Upon completion, the MC shall turn over to the Architect three (3) sets of complete maintenance manuals and parts list for all mechanical equipment used on the job. Manuals shall include equipment data, manufacturer's recommended maintenance, parts list, assembly drawings, warranties, and name, address, and phone numbers of suppliers of equipment. Indicate project name on cover and binder side.

COORDINATION WITH OTHER TRADES:

Coordinate all work required under this section with work of other sections of the specifications to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings and shall make sure that proposed equipment can be accommodated. If interferences occur, Contractor shall bring them to attention in writing, prior to signing of contract; or, Contractor shall at his own expense provide proper materials, equipment, and labor to correct any damage due to defects in his work caused by such interference.

INSPECTION AND CERTIFICATES:

On the completion of the entire installation, the approval of the Architect and Owner shall be secured, covering the installation throughout. The Contractor shall obtain and pay for Certificate of Approval from the public authorities having jurisdiction. A final inspection certificate shall be submitted to the Architect prior to final payment. Any and all costs incurred for fees shall be paid by the Contractor.

EQUIVALENTS:

When material or equipment is mentioned by name, it shall form the basis of the Contract. When approved by the Architect in writing, other material and equipment may be used in place of those specified, but written application for such substitutions shall be made to the Architect as described in the Bidding Documents. The difference in cost of substitute material or equipment shall be given when making such request. Approval of substitute is, of course, contingent on same meeting specified requirements and being of such design and dimensions as to comply with space requirements.

WORKMANSHIP AND MATERIALS:

All workmanship shall be of the best quality, and all equipment and materials incorporated in the work under this Contract shall be new and equal to or better than the grade specified. Deviations in workmanship or materials will be corrected by the Contractor at his expense.

WARRANTY:

The Contractor shall submit upon completion of the work, a warranty by his acceptance of the contract, that all work installed will be free from defects in workmanship and materials. If, during the period of one year, or as otherwise specified from date of Certificate of Completion and acceptance of work, any such defects in workmanship, materials, or performance appear, the Contractor shall, without cost to the Owner, remedy such defects within reasonable time to be specified in notice from the Architect. In default, the Owner may have such work done and charge cost to Contractor.

CUTTING AND PATCHING:

The Mechanical Contractor (both Plumbing and HVAC) shall furnish sketches to the General Contractor showing the locations and sizes of all openings and chases, and furnish and locate all sleeves and inserts required for the installation of the mechanical work before the walls, floors, and roof are built. The Mechanical Contractor shall reimburse the General Contractor for the cost of cutting and patching, and shall be responsible for the cost of cutting and / or patching where any mechanical items were not installed or where incorrectly sized or located. The Contractor shall do all drilling required for the installation of his hangers. See also Section 01050, Cutting and Patching.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Basic methods and requirements for Division 15, MECHANICAL, applies to all sections of Division 15.
B. Definitions:
   1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
   2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK

H. Section 15250, INSULATION.

K. Section 15980, TESTING, ADJUSTING, AND BALANCING.

L. Section 16400, SERVICE AND DISTRIBUTION.

1.3 QUALITY ASSURANCE

A. Section 15980, TESTING, ADJUSTING, AND BALANCING.

B. Equipment Vibration Tolerance:

   1. The allowable vibration tolerance shall be in accordance with 1999 ASHRAE Applications Handbook, Table 1, 46.3. Equipment specifications require factory balancing of equipment to this tolerance.
   2. After air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

C. Products Criteria:

   1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
   2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.
   3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
   4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
   5. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
   6. Asbestos products or equipment or materials containing asbestos shall not be used.

D. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

E. Warranty: Section 01001, GENERAL CONDITIONS.

1.4 SUBMITTALS

A. Submit in accordance with General Provisions.

B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
   1. Submit belt drive with the driven equipment.
   2. Submit electric motor data and variable speed drive data with the driven equipment.
   3. Equipment and materials identification.
   4. Fire-stopping materials.
   5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
   6. Wall, floor, and ceiling plates.

C. Coordination Drawings; provide where required in accordance with Section 01001, GENERAL CONDITIONS, Article, SUBCONTRACTS AND WORK COORDINATION. Provide:
   1. Mechanical equipment rooms.
   2. Interstitial space.
   3. Hangers, inserts, supports, and bracing.
   4. Pipe sleeves.
   5. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

D. Maintenance Data and Operating Instructions:
   1. Maintenance and operating manuals in accordance with Section 01010, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
   2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

E. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):
   FF-S-325 ..... Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)

C. Air Conditioning and Refrigeration Institute (ARI):
   430-89 ..... Central Station Air-Handling Units

D. American National Standard Institute (ANSI):
   B31.1-98 ..... Power Piping

E. Rubber Manufacturers Association (ANSI/RMA):
   IP-20-88 ..... Drives Using Classical V-Belts and Sheaves - Cross Sections A, B, C, D, and E
   IP-21-91 ..... Drives Using Double-V (Hexagonal) Belts (AA, BB, XX, DD Cross Sections)
   IP-22-91 ..... Drives Using Narrow Multiple V-Belts (3V, 5V, and 8V Cross Sections)

F. Air Movement and Control Association (AMCA):
   410-96 ..... Recommended Safety Practices for Air Moving Devices

G. American Society of Mechanical Engineers (ASME):
   Boiler and Pressure Vessel Code (BPVC):

SEC IX-98 ..... Qualifications Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators

H. American Society for Testing and Materials (ASTM):
A36/A36M-97 ..... Carbon Structural Steel
A575-96..... Steel Bars, Carbon, Merchant Quality, M-Grades
E84-98 ..... Surface Burning Characteristics of Building Materials
E119-98..... Fire Tests of Building Construction and Materials

I. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
SP-58-93 ..... Pipe Hangers and Supports-Materials, Design and Manufacture
SP-69-96 ..... Pipe Hangers and Supports-Selection and Application

J. National Association of Plumbing - Heating - Cooling Contractors (NAPHCC):
1996 ..... National Standard Plumbing Code

K. National Fire Protection Association (NFPA):
90A-96..... Installation of Air Conditioning and Ventilating Systems
101-97 ..... Life Safety Code

PART 2 - PRODUCTS

2.1 BELT DRIVES

A. Type: ANSI/RMA standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

B. Dimensions, rating and selection standards: ANSI/RMA IP-20 and IP-21.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ANSI/RMA service factor (not less than 20 percent) in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact.

D. Maximum Speed: 5000 feet per minute.

E. Adjustment Provisions: For alignment and ANSI/RMA standard allowances for installation and take-up.

F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.

F. Multiple Belts: Matched to ANSI/RMA specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:
1. Material: Pressed steel, or close grained cast iron.
2. Bore: Fixed or bushing type for securing to shaft with keys.
3. Balanced: Statically and dynamically.
4. Groove spacing for driving and driven pulleys shall be the same.

I. Drive Types, Based on ARI 435:
1. Provide adjustable-pitch or fixed-pitch drive as follows:
   a. Fan speeds up to 1800 RPM: 7.5 horsepower (10 kW) and smaller.
   b. Fan speeds over 1800 RPM: 2.2 horsepower (3 kW) and smaller.
2. Provide fixed-pitch drives for drives larger than those listed above.
3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

2.2 DRIVE GUARDS

A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive

guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.

B. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.

C. Access for Speed Measurement: 1” diameter hole at each shaft center.

2.3 ELECTRIC MOTORS

A. Section 15170, MOTORS, specifies the applicable requirements for electric motors. Provide special energy efficient motors as scheduled. Unless otherwise specified for a particular application use electric motors with the following requirements.

B. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).

C. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. Provide a time-delay (20 seconds minimum) relay for switching from high to low speed.

D. Rating: Continuous duty at 100 percent capacity in an ambient temperature of 104 degrees F; minimum horsepower as shown on drawings; maximum horsepower in normal operation not to exceed nameplate rating without service factor.

E. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

2.4 VARIABLE SPEED MOTOR CONTROLLERS

A. Removed

2.5 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 3/16” high of brass with black-filled letters, or rigid black plastic with white letters permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less that 3/16” high riveted or bolted to the equipment.

D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

2.6 FIRESTOPPING

See Sheet FP – 001. FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer also to Section 15250, INSULATION, for firestop pipe and duct insulation.

2.7 GALVANIZED REPAIR COMPOUND

Mil. Spec. DOD-P-21035B, paint form.

2.8 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Vibration Isolators: see drawing details.

B. Supports For Roof Mounted Items:
   1. Equipment: Equipment rails shall be galvanized steel, 8 gauge, with integral baseplate, continuous welded corner seams, factory installed 2 by 4 treated wood nailer, 18 gauge galvanized steel counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 11 inches. For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.
   2. Pipe/duct pedestals: Provide a galvanized unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.

D. For Attachment to Concrete Construction:
   1. Concrete insert: Type 18, MSS SP-58.
   2. Self-drilling expansion shields and machine bolt expansion anchors: Fed. Spec. FF-S-325, permitted in concrete not less than four inches thick. Applied load shall not exceed one-fourth the proof test load listed in Fed. Spec. FF-S-325.
   3. Power-driven fasteners: Permitted in existing concrete or masonry not less than four inches thick when approved by the Resident Engineer for each job condition. Applied load shall not exceed one-fourth the proof test load listed in Fed. Spec. FF-S-325.

F. For Attachment to Steel Construction: MSS SP-58.
   1. Welded attachment: Type 22.
   2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 7/8-inch outside diameter.

F. Attachment to Metal Pan or Deck: As required for materials specified in Division 5.

G. For Attachment to Wood Construction: Wood screws or lag bolts.

H. Hanger Rods: See Section 15060.

J. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 1-5/8 inches by 1-5/8 inches**,** No. 12 gauge, designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.
   1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
   2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

K. Pipe Hangers and Supports:
   1. Convertor and Expansion Tank Hangers: May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers.
   2. Plumbing Piping (Other Than General Types):
      a. Horizontal piping: Type 1, 5, 7, 9, and 10.
      b. Chrome plated piping: Chrome plated supports.
      c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
      d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.

L. Pre-insulated Calcium Silicate Shields:
   1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
   2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
   3. Shield thickness shall match the pipe insulation.
   4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.

a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 1 inch past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

M. Seismic Restraint of Piping:
1. Design criteria is as follows:
a. Piping resiliently supported: 120 percent of the weight of the systems and components and contents.
b. Piping not resiliently supported: 60 percent of the weight of the system components and contents.
c. Except as noted above, meet the more severe requirements of the Local Code and the latest Uniform Building Code for determining seismic force Fp.
2. Provide one of the following options:
a. Design and installation to meet the criteria listed above, and meet requirements of the latest Sheet Metal and Air Conditioning Contractors National Association (SMACNA), Seismic Restraint Manual Guidelines for Mechanical Systems for the prescribed Seismic Hazard Level
b. Design and installation to meet the criteria listed above, and meet the most current requirements of the National Uniform Seismic Installation Guidelines (NUSIG). Contractor shall submit all design tables and information for the design force levels, stamped and signed by a professional engineer registered in the State where project is located.
c. Where SMACNA or NUSIG requirements are not met completely, submit proposed alternate details and calculations to completely address seismic bracing requirements. Such designs shall use more severe of the Local Code and the Uniform Building Code requirements for determining seismic forces, and be performed, stamped and signed by a professional engineer registered in the State where project is located. Revise if necessary any details shown on the contract drawings for vertical support and lateral bracing, and submit for the approval of the Owner to meet the design criteria listed above.

2.9 PIPE PENETRATIONS

A. Install sleeves during construction for other than blocked out floor openings for risers in chases.
B. To prevent accidental liquid spills from passing to a lower level, provide the following:
1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from this requirements must receive prior approval of Resident Engineer.
D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms and similar. Except in mechanical rooms, connect sleeve with floor plate.
G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
J. Sealant and Adhesives: Shall be as specified in Section 07920, SEALANTS AND CAULKING.

2.10 TOOLS AND LUBRICANTS

A. Furnish, and turn over to the Owner special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
C. Tool Containers: Hardwood or metal, permanently identified for in tended service and mounted, or located, where directed by the Owner.
D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.11 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.
B. Protection and Cleaning:
   1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Owner. Damaged or defective items in the opinion of the Owner, shall be replaced.
   2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
C. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03300, CAST-IN-PLACE CONCRETE.
D. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
E. Install steam piping expansion joints as per manufacturer’s recommendations.
F. Work in Existing Building:
   1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01010, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).

2. As specified in Section 01010, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Owner. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Owner for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Owner's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.

G. Exterior: Seal all pipe and duct penetrations with silicone sealant to prevent entrance of insects.
H. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.
I. Inaccessible Equipment:
   1. Where the Engineer / Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Owner.
   2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the Owner.
B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.
C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.
D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-69. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.
E. HVAC Vertical Pipe Supports:
   1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
   2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.
F. Plumbing horizontal and vertical pipe supports, refer to the State Plumbing Code.

3.3 MOTOR AND DRIVE ALIGNMENT

A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.
B. Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.4 LUBRICATION

Field check and lubricate equipment requiring lubrication prior to initial operation.

3.5 STARTUP AND TEMPORARY OPERATION

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01010, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.6 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests as specified in Section 01010, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Owner.
B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner.
C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART I: GENERAL

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Submittals: Provide Product Data for each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

PART II: PRODUCTS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory fabricated components.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive strength insulation, encased in sheet metal shield.

1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellant-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
2. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
3. For Clevis or Band Hanger Insert and shield cover lower 180 degrees of pipe.
4. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

D. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

E. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

F. Grout ASTM C 1107, Grade B, factory-mixed and -packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Non-staining, non-corrosive, and non-gaseous.

PART III: EXECUTION

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
2. -Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
4. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).

D. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Tumbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

E. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1 . Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. C-Clamps (MSS Type 23): For structural shapes.
6. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb. (340 kg).
   b. Medium (MSS Type 32):1500 lb. (675 kg).
   c. Heavy (MSS Type 33): 3000 lb. (1 350 kg).
7. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
8. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

F. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1 . Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.

G. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

1. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

L. Insulated Piping: Comply with the following:

1 Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.9.
2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
4. 'Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90):12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

M. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations. Comply with AWS Dl.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1 Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

N. Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

O. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

P. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

Q. Install all hangers and supports prior to application of fire-proofing by GC. Any fire-proofing damaged by this Contractor shall be repaired by this Contractor.

END OF SECTION

GAS SERVICE:

HVAC Contractor shall contact gas utility company to determine the extent of service provided and pay all fees from specified utility allowance. The HVAC Contractor is responsible for coordinating gas service, meter installation, and locations of equipment provided by others. The Plumbing Contractor is responsible for installing specified gas pipe to water heaters and other equipment furnished under his contract from point of connection indicated on the drawings.

GAS PIPING BELOW GRADE:

Buried gas pipe shall be Schedule 40 black steel with welded fittings, primed and wrapped with approved wrap or tape, and buried a minimum of 18" below finish grade. If approved by local Inspector and Utility Company, Polyethylene Plastic Pipe (PE) conforming to ANSI / ASTM D 2104 standards, as manufactured by Phillips 66 Driscopipe or approval equal, may be substituted. Provide 6" wide utility warning tape, "Warnoline" by Safety Sign Co., or approved equal, 12" below finish grade during backfill operation.

GAS PIPING ABOVE GRADE AND TESTING:

Gas pipe above finish grade or floor, 2” or less, shall be Schedule 40 black steel pipe with 150 malleable screwed fittings. Pipe 2 1/2” and over, shall be schedule 40 black steel pipe with welded fittings conforming to ANSI/AWS D 1.1. Gas piping shall be air tested at 60 psig for a minimum of 4 hours or 40 psig for 24 hours and shall be witnessed by Engineer and Building Inspector.

Clean, prime, and paint all exposed gas piping yellow using following paint system:

1st Coat: Red lead pigmented primer (TT-P-86, Type III)
2nd Coat: Semi gloss alkyd enamel (TT-E-529, Class A)
3rd Coat: Semi gloss alkyd enamel (TT-E-529, Class A)

GAS VALVES:

Gas valves shall be tested and certified by AGA and conform to ANSI 221.15B for natural and for LP gas-air mixtures. Gas valve body shall be semi-steel, with a bolted cover, and flanged ends. Acceptable manufacturers are Nibco, Rockwell or Powell.

INSTALLATION:

Installation shall be in accordance with current NFPA Bulletin, American Gas Association, and N. C. State Building Code, Volume VI. Provide shut-off valve, dirt leg, and union at each piece of equipment. Provide pipe hangers at specified intervals in NCSBC Volume VI.

CONNECTIONS TO EQUIPMENT:

Provide gas piping and final connections to all equipment furnished under this contract. Provide rough-ins with shut-off valve to gas-fired equipment as per manufacturer’s directions and dimensioned drawings.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1 - GENERAL

DESCRIPTION OF WORK:

This section contains the requirements relating to the materials and methods used to identify items described in Division 15.

PART 2 - PRODUCTS

ENGRAVED PLASTIC-LAMINATE SIGNS:

Provide engraving stock melamine plastic laminate, in the sizes and thickness indicated, engraved with engraver's standard letter style of the sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Plastic laminate thickness shall be 1/16" for units up to 20 square inches or 8" length; 1/8" for larger units. Provide self-tapping stainless steel screws.

PART 3 - EXECUTION

INSTALLATION REQUIREMENTS:

A. COORDINATION:

Coordinate new labeling with existing labeling through Project Manager. Where identification is to be applied to surfaces that require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, identification shall be installed after completion of covering and painting. Identification is to be installed prior to installation of acoustical ceilings and similar removable concealment.

B. DUCTWORK IDENTIFICATION:

1. General: Provide for identification of air supply, return, exhaust, intake, and relief ductwork with stenciled signs and arrows, showing ductwork service and direction of flow, in black and white.

2. Locations: Ductwork shall be identified every 20’ in spaces with removable ceilings and at each access door in spaces with hard ceilings. Exposed ductwork shall be identified every 20’ in mechanical rooms. As described above, ductwork shall be labeled on both sides of floor and wall penetrations.

C. MECHANICAL EQUIPMENT IDENTIFICATION:

Provide for engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices.

2. Air conditioning indoor and outdoor units.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

GENERAL:

Furnish and install complete building potable water supply system from connection provided by Sitework Contractor unless indicated otherwise on the drawings. Include utility tap fee allowance specified Section 01056-1 in bid.

WATER SERVICE PIPING:

Water service piping 4" and larger from utility main tap to point designated on drawings outside building shall be AWWA Standard C-900 PVC. The pipe joints shall be integral bell type with elastomeric gaskets. The pipe shall be pressure rated for 150 psi with dimension ration of 18 between wall thickness and bell. Pipe shall be supplied in 20 ft. lengths.

Water service piping 3" and less outside building shall be IPS rated SDR 21 PVC water pipe conforming to material requirements of ASTM D-2241 in accordance with ASTM D-1781.

BUILDING WATER SUPPLY PIPING AND FITTINGS:

Building water main buried in earth under concrete slab and, where indicated on the plans, shall be seamless hard drawn type K copper tubing, ASTM B-88, with wrought copper ASA B-16.22 fittings and silver type solder brazed joints. Water piping above ground shall be seamless hard drawn annealed type L copper tubing, ASTM B-88, with wrought copper ASA B-16.22 fittings, and 95/5 soldered joints (lead-free solder).

Unless indicated otherwise on the drawings, contractor is responsible for water meter and utility tap fees. Coordinate building ground to copper pipe with Electrical Contractor as required. Refer to Section 15150 for excavating and backfilling.

All exposed water piping to plumbing fixtures, except piping noted to be run exposed in utility areas shall be IPS chrome-plated yellow brass pipe with polished chrome-plated 125-pound screwed brass fittings. Any joints leaking shall be reconstructed with new materials. Flexible pipe or hose is not acceptable for final connection to any fixture on this project.

PIPING INSTALLATION:

Water piping in building and above grade shall be accurately cut to measurements established at the site, worked into place without springing or forcing, and shall satisfactorily clear all window, door, and other openings and obstructions. Excessive cutting or other weakening of the structure to facilitate piping installation will not be permitted. Sleeves shall be provided for pipe penetrating floors, walls, and roofs. Access doors and panels shall be provided as specified.

Piping shall generally run level with all changes in direction made with fittings. Branch connections shall be made with fittings. Branch lines may be taken off top of main, bottom of main, or side of main using such crossover fittings as may be required by structural or installation conditions. All service pipe, valves, and fittings shall be kept a sufficient distance from other work to permit finished covering not less than ½” from such other work and not less than ½” between finished covering on the different service.

No water piping shall be buried in floors unless specifically indicated on drawings or approved; when buried, pipe shall be corrosion and mechanically protected. Eccentric reducers with top level shall be provided where changes in size are made.

Soldered joints shall be made up with 95-5 (tin-antimony) solder (for piping 1-1/2" and less; joints for tubing larger than 1-1/2" shall be silver brazed with "Sil-fos," "Easyflo" or "Phos-copper"). Surfaces to be joined shall be thoroughly cleaned with steel wool and paste type flux shall be applied evenly to fitting and tube. Tubing shall be inserted to shoulder in fitting and heat applied evenly to fitting until solder starts to flow into socket by capillary action. Excess solder starts to flow into socket by capillary action. Excess solder shall be wiped off before joint cools. All joints between dissimilar materials shall be provided with insulated fittings. All piping showing leaks on test shall be taken down and the joints shall be remade.

Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges having metal parts separated to prevent current flow between dissimilar metals.

Piping shall have burrs removed and shall be rattled and cleaned of loose dirt and scale before erection. Open ends of piping and equipment connections shall be plugged or capped during erection. Temporary strainers shall be provided in systems and removed after flushing operation is performed. Low points of the systems shall be provided with hose end adapters for draining systems.

The Plumbing Contractor shall have a journeyman present at all times while General Contractor is either pouring concrete or constructing masonry walls to insure proper installation of work in this Contract.

VALVES:

Valves shall be provided at risers and main branches at point of takeoff from their supply or return mains, at inlets and outlets of individual equipment units, and where indicated and/or specified. Valves shall not be installed with stem below the horizontal. Install shut-off valves on all hot and cold water branches serving more than one fixture.

Ball valves shall be used in piping up through 2". Acceptable ball valve manufacturers are Apollo (No. 70-200), Watts (No. B-6001), Nibco (No. S580), and Grinnell. Ball valves shall have brass or bronze body and ball, lever handle, teflon seats and seal, and rated up to 200 psig at 250°F.

Gate or Butterfly valves shall be used in piping 2-1/2" and larger. Acceptable valve manufacturers are Grinnell, Jenkins and Hammond. Gate valves submitted for approval shall comply with MSS Standard SP-80 for bronze valves.

UNIONS:

Unions shall be bronze 150 lb. type for copper pipe applications manufactured by Mueller, Crane, Northern Indiana Brass, or approved equivalent. Unions shall be installed at each valve and at frequent intervals in each main run of pipe to facilitate removal and repair of pipe, fixtures and appurtenances.

WATER HAMMER ARRESTORS:

The flow velocity of the water distribution system shall be controlled to reduce the possibility of water hammer. A water hammer arrestor shall be installed where quick-closing valves are utilized and where indicated on the drawings. The arrestor shall be located within an effective range of the quick-closing valve. Water hammer arrestors shall conform to AWWA, ASME A112.26.1 or ASSE 1010 listed in chapter 19. Access shall be provided to water hammer arrestors. Approved manufacturers are Watts, Smith, and Zurn.

PIPE SLEEVES:

Install pipe sleeves and properly secure in place at all points where pipes pass through floors, walls, or ceilings. Pipe sleeves shall be of sufficient diameter to provide approximately 1/4 inch clearance around insulation. Pipe sleeves in walls, floors, and partitions shall be Schedule 40 black steel . Caulk annular space between pipes and insulation and sleeves, both sides, with an elastic fire-resistant compound.

PIPE HANGERS AND SUPPORTS (see also Section 15060):

Pipe hangers and supports shall be of a size to support water filled piping with a safety factor of 5 based on hanger or support ultimate tensile strength. Hangers and supports shall be manufactured by PHD, Grinnell, B-Line Systems, or Pipe Shields, Inc. Size hangers for all insulated piping to fit over insulation with an acceptable clearance.

Hangers for hot water piping shall be equal to Grinnell Fig. 181. Vertical pipes shall be supported by wall brackets equal to Grinnell Fig. 261. Piping hanger and support installation shall allow for uniform expansion and contraction at all times. Provide 8" long 16 gauge sheet metal saddles extending 120° around bottom of insulated pipe.

PIPE INSULATION:

Insulate all hot and cold water piping. Insulation shall be a jacketed glass fiber pipe covering, 1” thick for pipe sizes 2” & less, 1½" thick for pipes 2½” & above, with flame resistant vapor barrier jacket meeting ASTM E84 and UL 723. Insulation shall be Knauf 850 or equal by Owens-Corning or Schuller. Provide PVC pre-formed jacket covers over insulated fittings such as elbows, tees, valves, etc. and over all domestic water piping in boiler room.

INSULATION INSTALLATION:

Install insulation per manufacturer’s recommendations. All insulation shall be installed in a workmanlike manner by qualified workers in the regular employ of the Contractor.

All insulation shall be applied to clean, dry surfaces butting all sections firmly together and finishing as specified hereinafter. All vapor barriers shall be sealed, and shall be continuous throughout. No staples shall be used on any vapor barrier jacket. All vapor barriers shall be of the fire retardant type.

Insulation of all insulated lines shall be interpreted as including all pipe, valves, fittings, and specialties comprising the lines, except flanged unions and screwed unions on hot piping. Insulation over fittings shall be of equal thickness as the adjoining pipe insulation . Unless otherwise specified or directed, insulation for fittings and flanges shall be of the permanent type.

Support of pipe shall be on the outside of the insulation. The insulation at each support shall be rigid and of an equal thickness and finish as the adjoining pipe insulation; the length to coincide with the saddles.

CLEANING:

All surfaces on metal, pipe, insulation covered surfaces, and other equipment furnished and installed under this section of the specifications shall be thoroughly cleaned of grease, scale, dirt and other foreign materials, and new equipment shall have a coat of first-class primer.

CHLORINATION:

Before Owner occupies building, all water piping installed under this section including shall be sterilized with chlorine. This shall be accomplished by the introduction of a chlorinating material into the lines in such quantity that the water in the lines shall contain not less than 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or sodium hypochlorite solution, and shall be introduced into the system in an approved manner. The sterilizing solution shall be allowed to remain in the system for a period of two hours during which time all valves and faucets shall be opened and closed several times. After sterilization, solution shall be flushed from the system with clear water until no residual chlorine remains, after which a sample shall be collected for bacterial analysis.

The entire sterilization procedure shall be in strict accordance with the requirements of the State Board of Health and, upon completion of the sterilization, the potability of the water in the system shall be checked and approved by the County Health Department.

Prior to final Payment Application, provide Engineer two copies of the Bacteriological Analysis Report for water samples taken at source and at a general tap and tested for coliform and chlorine residuals.

PRESSURE TESTING:

Test all piping and connections installed under this contract. Do testing prior to painting, backfilling, insulating or concealment within building construction. Trenches may be backfilled prior to pressure tests, but not before work has been visually inspected by the Owner. If pressure tests indicate leaks in piping, it shall be the Contractor's responsibility to determine location of leaks, excavate as required, repair leaks, and backfill at his expense.

Perform each test as specified hereinafter and continue or repeat until the lines under test are proven tight to the satisfaction of the Owner. Furnish all materials, pumps, gauges, plugs, etc., required for tests. Notify the Engineer in advance of tests so he may witness same.

Sections of the system may be tested separately, but when so tested, any defect which may develop in a section already tested and accepted shall be corrected and that section re-tested. Devices or equipment which may be harmed by test pressures shall be removed or protected during tests. After testing, test systems for complete drain-ability by draining all water from piping using permanent caps, plugs, drain valves, etc. Test building water piping at 125 psig for a minimum of 4 hours before it is witnessed by Engineer, then for an additional 24 hours. Water test all exterior water mains at 125 psig.

ACCESS PANELS AND ENCLOSURES:

Provide access panels and / or enclosures at all locations required to service inaccessible valves, hair interceptors, filters, cleanouts, etc. Access panels in finished spaces shall be stainless steel. Acceptable manufacturers include Karp, Elmdor or approved equal.

HEAT TRACING:

Furnish and install UL approved self-regulating heat tracing cable for freeze protection of all water piping outside insulation envelope including backflow preventer systems. The heat trace cable shall consist of two (2) 16 AWG nickel plated copper bus wires embedded parallel in a self-regulating polymer core that varies its power output in response to temperature along its entire length. The heat trace jacket shall be a radiation cross linked polyoelefin dielectric rated at 300 VAC at 105°F with a VW-1 flame resistance and shall have a outer braid of tinned copper for a ground path.

Heat trace shall be installed in strict accordance with manufacturer’s instructions after pressure testing and immediately before pipe insulation. The heat trace shall be resistance tested by a licensed Electrician at the expense of the Plumbing Contractor. Trace system shall be connected to GFCI protected power by the Electrical Contractor, at the expense of the Plumbing Contractor.

Domestic water heat trace cable shall be Model HSX-A-120V manufactured by Thermon or equal by RayChem.

PIPE AND VALVE IDENTIFICATION:

Furnish and install flexible, permanent, color-coded, plastic-sheet pipe markers that comply with ANSI A13.1 on all exposed piping (including piping above lay-in ceiling) not to exceed 10' o.c., equal to Seton SetMark pipe markers.

Furnish and install brass valve tags with 1/4" high letters identifying operation / maintenance of piping system, equal to Seton No. M4506.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

GENERAL:

Furnish and install a complete sanitary drain, waste and vent system as shown on the drawings and as specified herein.

No waste or vent piping buried below slab shall be smaller than 2". Make any change in flow direction or grade gradually with proper curbed fittings. Make all junctions with wye branches or wye and eighth bend. Sanitary tees may be used for vertical junctions. Size pipe per drawings.

Keep piping clean during construction. Seal all clean-outs and fixture connections. Remove all earth or foreign matter. Bed, fill and compact all line trenches according to Section 15150 or as detailed on the plans to prevent strain on joints, damage or settling.

Set all water closet fittings, floor drains, clean-outs, etc., carefully, using a spirit level. Confirm final floor elevations. The Plumbing Contractor shall have a journeyman present at all times while General Contractor is pouring concrete to insure proper installation of work in this Contract.

Install all piping with 1/4" per foot slope wherever possible but with minimum slopes as follows: 3" and less - 1/4" per foot; 4" and larger - 1/8" per foot.

DRAIN, WASTE AND VENT PIPING BELOW SLAB:

Construct all building sewers and building drain lines below floor slabs and outside of building walls, unless indicated otherwise on the drawings, with Schedule 40 PVC-DWV Pipe, ASTM D-2665, marked to indicate that it complies with this standard. Pipe shall be manufactured by Charlotte Pipe and Foundry or equivalent. All installations shall conform to installation instructions of the Plastic Pipe Institute, manufacturer, and/ or local ordinances. In all cases, approved cleaner, primer and solvent cement designated for the specified material shall be used.

DRAIN, WASTE AND VENT PIPING ABOVE FLOOR SLAB:

All waste and vent piping above the floor slab shall be Schedule 40 PVC-DWV in accordance with Commercial Standards CS272-65, or CS270-65, or ASTM Standards D2665-68 or D2661-67. All plastic pipe and fittings shall bear the NSF Seal of Approval, and such other markings as required by the aforementioned standards. Fittings shall be molded, fully recessed, socket type designed for solvent welded joints. All plastic piping shall be installed and joined in strict accordance with the pipe manufacturer's instructions. Plastic waste and vent pipe shall not be used in any return air plenum unless it is fully encased in a fireproof covering or as required by any code.

TRAPS:

Provide each fixture with a trap when connection to drainage system is required. Place each trap as near to fixture as possible. No fixture shall be double trapped.

PIPE STORAGE:

If possible, pipe should be stored inside. Otherwise, store pipe on dry, level ground free from sharp objects. Protect stored pipe from ultraviolet exposure as required. Refer to manufacturer’s recommendations for rack or pallet storage and freezing temperatures.

PIPE HANGERS AND SUPPORTS:

Support Schedule 40 PVC- DWV pipe with carbon steel adjustable clevis-type hangers, 5’ o.c. with 3/8” threaded rod. Chain, strap, perforated bar, or wire hangers will not be permitted. Where required, provide suitable concrete inserts in masonry or concrete during laying or placing of those materials. Acceptable manufacturers are B-line, PHD, Gulf State Hangers, and Grinnell.

PIPE SLEEVES:

Provide pipe sleeves where all pipe passes through floors, utility platforms, walls, roofs, etc. Size sleeves for insulated pipe to accommodate both pipe and insulation. Sleeves for piping masonry or concrete walls, floors, beams, or roof, shall be of black steel pipe of standard weight, unless otherwise specified or shown. Vertical sleeves through floors shall extend at least 1" above finished floor (4” through utility platforms).

ROOF VENT FLASHING:

Vents through roof shall be flashed with 4 lbs. lead or 16 oz. copper extending 12" each way from the vent. Provide lead collar, soldered to, and extending from flashing up, around, and turned down a minimum of 1" into top of vent.

CLEAN-OUTS:

Provide clean-outs at the base of all plumbing stacks, 2'-0" above finish floor if required by local codes; at all changes in direction of all sewers; and wherever indicated on the drawings.

All cleanouts shall be as manufactured by Smith, Josam, or equal by Zurn.

FLOOR, WALL, AND CEILING PLATES:

Where pipes pass through floors, finished walls or ceilings, fit with chromium plated cast brass plates or chromium steel plates as specified hereinafter. Plates shall be large enough to completely close hole around pipes, and shall be square, octagonal , or round, with least dimension not less that 1.5 times larger than diameter of pipe. Secure plates in an approved manner. Plates shall be Beaton-Caldwell No. 3A for floor and No. 40 for walls and ceilings.

PRESSURE TESTS:

The engineer shall be notified several days before testing is to be conducted and all tests shall be conducted in presence of engineer. Prior to notifying the engineer, the Contractor shall have successfully tested the piping. The Contractor shall bear the expense of the engineer's services if the tests prove unsuccessful after the engineer has been summoned by the Contractor to observe the test.

Water test all interior soil, waste, vent, and drain piping with 10' head pressure before connecting to exterior sewers and before connecting to fixtures. Water shall remain in each system for at least 4 hours. Leaks shall be repaired and tests repeated until system fulfills this test. Systems may be tested in sections, but each joint between sections shall be tested. Do not exceed 25' head pressure on any joint.

Water test all exterior sanitary sewers with 4'-0" minimum head (above the invert) at the highest point of the sewer. Infiltration or exfiltration shall not exceed 50 gallons per inch diameter per mile per 24 hours.

Contractor shall use video camera to detect installation deficiencies such as excessive deflections, damaged pipes, leaking joints, etc. Engineer’s and / or Owner’s representative shall be on site to witness videotaping of all sewer piping. Contractor shall provide two (2) video tapes with corresponding diagrams for Owner’s record.

END OF SECTION

PART I: GENERAL

RELATED DOCUMENTS

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

SUMMARY

A. This Section includes plumbing fixtures and trim, faucets, other fittings, and related components.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 7 Section "Joint Sealants" for sealing between fixtures and walls, floors, and counters.
2. Division 15 Section "Valves" for general-duty valves used as supply stops.
3. Division 15 Section "Plumbing Specialties" for backfiow preventers and other specialties not specified in this Section.

DEFINITIONS

A. Accessible: Plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped, disabled, and elderly people.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, showerheads and tub spouts, drains and tailpieces, traps and waste pipes. Pipe fittings, tube fittings, and general-duty valves are included where indicated.

SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each plumbing fixture category and type specified. Include selected fixture, trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

C. Provide wiring diagrams from manufacturer for electrically operated units.

D. Maintenance data for plumbing fixtures and components to include in the operation and maintenance manuals specified in Division 1.

QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category from one source and by a single manufacturer. Exception: Where fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for this category.

B. Regulatory Requirements: Comply with requirements of CABO A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act'; and Public Law 101-336, "Americans with Disabilities Act"; regarding plumbing fixtures for physically handicapped people.

C. Regulatory Requirements: Comply with requirements of Architectural and Transportation Barriers Compliance Board's (ATBCB) "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" regarding plumbing fixtures for physically handicapped people.

D. Energy Policy Act Requirements: Comply with requirements of Public Law 102-486, "Energy Policy Act," regarding water flow rate and water consumption of plumbing fixtures.

E. Listing and Labeling: Provide electrically operated fixtures and components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing fixtures and are based on specific types and models indicated. Other manufacturers' fixtures with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

DELIVERY, STORAGE, AND HANDLING

A. Deliver plumbing fixtures in manufacturers protective packing, crating, and covering.

B. Store plumbing fixtures on elevated platforms in dry location.

PROJECT CONDITIONS

A. Field Measurements: Coordinate roughing-in and final fixture locations and verify that plumbing fixtures can be installed to comply with original design and referenced standards.

PART II: PRODUCTS

PLUMBING FIXTURE STANDARDS AND ACCESSORIES

A. Comply with applicable standards below and other requirements specified.

1. Refer to the Specifications and Drawings for specific catalog numbers and required fittings.
2. Fixture Manufacturers:
   a. Vitreous China Fixtures: Kohler, American Standard, or Crane.
   b. Stainless Steel Sinks: Elkay, Just Mfg. Co., or Moen.
   c. Electric Water Coolers: Oasis, Sunroc, or Halsey-Taylor.
   d. Janitor’s Receptor: Fiat, Stern-Williams, or Creative Industries.
   e. Kitchen Stainless Steel Sinks: Elkay, Just or Moen.
3. Fittings Manufacturers:
   a. Flush Valves: Sloan, Zurn or Delany.
   b. Water closet Seats: Water closet manufacturer, Olsonite or Church.
   c. Faucets: Delta, Zurn or Kohler.
   d. Supplies and Stops (Loose Key): McGuire Mfg. Co., Dearborn, EBC or T&S.
   e. Traps: McGuire Mfg. Co., EBC, Central Brass, or Dearborn.
   f. Shower Controls: Symmons, Leonard or Acorn.

PART III: EXECUTION

EXAMINATION

A. Examine roughing-in for potable, hot- and cold-water supply piping systems; soil, waste, and vent piping systems; and supports. Verify that locations and sizes of piping and locations and types of supports

match those indicated, before installing and connecting fixtures. Use manufacturers roughing-in data when roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Do not proceed until unsatisfactory conditions have been corrected.

PLUMBING FIXTURE INSTALLATION

A. Assemble plumbing fixtures and trim, fittings, faucets, and other components according to manufacturers' written instructions.

B. Install fixtures level and plumb according to manufacturers' written instructions, roughing-in drawings, and referenced standards.

C. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals. Install wall-hanging, back-outlet water closets with carrier and support manufacturers tiling frame or setting gage.

F. Install wall-hanging, back-outlet urinals with gasket seals.

G. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for handicapped people to reach.

H. Fasten Wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated. Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls. Fasten recessed, wall-mounted fittings to reinforcement built into wall. Fasten wall-mounted fittings to reinforcement built into walls. Fasten counter-mounting plumbing fixtures to casework.

M. Set mop basins in leveling bed of cement grout.

N. Secure supplies to supports or substrate within pipe space behind fixture.

O. Install an individual loose key stop valve in each water supply to fixture. Install loose key water-supply stop valves in accessible locations. Turn loose keys over to owner at project close out.

Q. Install faucet, laminar-flow fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required. Install supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

S. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.

T. Install shower, flow-control fittings with specified maximum flow rates in shower arms.

U. Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes, except where otherwise indicated.

V. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.

W. Seal joints between fixtures and walls, floors, and counters using sanitary-type, 1 -part, mildew-resistant, silicone sealant according to sealing requirements specified in Division 7 Section "Joint Sealant." Match sealant color to fixture color; provide white, unless noted on drawings otherwise.

PART IV: COMMISSIONING

CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

   1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other Division 15 Sections.

B. Supply and Waste Connections to Plumbing Fixtures: Refer to plumbing fixture schedules at the end of this Section for fitting sizes and connection requirements for each plumbing fixture.

C. Supply and Waste Connections to Equipment Specified in Other Sections: Connect equipment with supply inlets, supply stops, supply risers, and traps specified in this Section. Use fitting sizes required to match connected equipment. Connect fittings to plumbing piping.

D. Ground equipment.

   1. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. Where manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Arrange for electric power connections to fixtures and devices that require power. Electric power is specified in Division 16 Sections.

FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized and demonstrate proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust disposers, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at drinking fountains, electric water coolers, faucets, shower valves, and flushometer valves having controls, to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Include the following:

   1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
   2. Remove sediment and debris from drains.

PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities, except when approved in writing by Owner.

END OF SECTION

PART I - GENERAL

RELATED DOCUMENTS

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

SUMMARY

A. This Section includes Plumbing Specialties for water distribution systems; and soil, waste and vent systems.

SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Submit product data including rated capacities of selected models and weights (shipping, installation, and operation). Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections.

PART II - PRODUCTS

MANUFACTURERS

A. Acceptable Manufacturers:

a. Backflow Preventers:

i. Ames Co., Inc.
ii. Hersey Products, Inc., Grinnell Corp.
iii. Watts Regulator Co.
iv. Wilkins Regulator Div., Zurn Industries, Inc.

b. Water Pressure Regulators:

i. Spence Engineering Co., Inc.
ii. Watts Regulator Co.
iii. Wilkins Regulator Div., Zurn Industries, Inc.

c. Specialties:

i. Josam Co.
ii. Smith by Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
iii. Watts Regulator Co.
iv. Woodford Manufacturing Co. Div., WCM Industries, Inc.
v. Zurn by Hydromechanics Div., Zurn Industries, Inc.

CLEANOUTS

A. Exterior Surfaced Areas: Round cast nickel-bronze access frame and non-skid cover.

B. Exterior Un-Surfaced Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover.

C. Interior Finished Floor Areas: Lacquered cast iron, two piece body, round with scoriated cover in service areas and round with depressed cover to accept floor finish in finished floor areas.

D. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

WATER HAMMER ARRESTORS

A. ANSI A112.26.1; sized in accordance with PDI WH-201, pre-charged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psig working pressure.

TRAP SEAL PRIMER VALVE:

A. ASSE 1018; water supply fed type, fully automatic 125psig minimum working pressure, Bronze body with atmospheric vented drain chamber, ½ inch threaded or solder joint inlet and outlet connections, Chrome plated, or rough bronze finish. Unit shall be capable of being located on any active water line.

BACKFLOW PREVENTERS

A. Reduced Pressure Back-flow Preventers: ANSI/ASSE 1013; bronze body with bronze and plastic internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve which opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

PART III - EXECUTION

PREPARATION

A. Coordinate construction areas to receive drains to the required invert elevations.

INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer's instructions to permit intended performance.

B. Extend clean-outs to finished floor. Lubricate threaded clean-out plugs Teflon pipe dope. Ensure clearance at clean-out for rodding of drainage system.

C. Encase exterior clean-outs in concrete flush with grade.

D. Install water hammer arrestors complete with accessible isolation valve.

END OF SECTION 15430

PART I - GENERAL

DESCRIPTION:

Domestic water heater system complete, ready for operation including water heaters, thermometers and all necessary accessories, connections and equipment.

1.2 RELATED WORK:

A. Section 15000, GENERAL PROVISIONS (MECHANICAL).

B. Piping, Fittings, Valves and Gages: Section 15400, PLUMBING FIXTURES.

C. Preparation and finish painting Section 09900, PAINTING.

D. DIVISION 16

1.3 QUALITY ASSURANCE:

A. Comply with American Society of Heating, Refrigerating and Air- Conditioning Engineers (ASHRAE) for efficiency performance,
ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings, ”for commercial water heaters.”

1.4 SUBMITTALS:

A. Submit manufacturer’s literature and data pertaining to the water heater in properly bound package, in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS. Include the following as a minimum:

1. Water Heaters.
2. Pressure and Temperature Relief Valves.
3. Steam Control Valves.
4. Thermometers.
5. Pressure Gages.
6. Vacuum Breakers.

1.5 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standard Institute (ANSI):

Z21.10.1-98..... Gas Water Heaters

Z21.18-95..... Gas appliance Pressure Regulators

Z21.20-93..... Automatic Gas Ignition Systems and Components

Z21.21-95..... Automatic Valves for Gas Appliance

Z21.22-99..... Relief Valves for Hot Water Supply systems

C. American Society Of Mechanical Engineers (ASME):

B1.20.1-83(R 1992) ..... Pipe Threads, General Purpose

B16.5-96 ..... Pipe Flanges and Flanged Fittings

B16.24-91(R 1998) ..... Cast Copper Alloy Pipe Flanges

PTC 25.3-94..... Pressure Relief Devices

Section IV-98 ..... Heating Boilers

Section VIII-98 ..... Pressure Vessels Division 1

D. National Fire Protection Association (NFPA)

54-99 ..... National Fuel Gas Code

70-99 ..... National Electric Code

E. Underwriters Laboratories, Inc. (UL):

174-1996 ..... Household Electric Storage Tank water Heaters

1453-1994 ..... Water Heaters, Electric Booster and Commercial Storage Tank

.

PART 2 - PRODUCTS

2.1 ELECTRIC WATER HEATERS:

A. Tank Construction: Steel shell, glass lined, and ASME-Code construction with 1035 kPa (150 psig) working pressure rating.

B. Tapping (openings): Factory fabricated of materials compatible with the tank and in accordance with appropriate ASME standards for piping connection, pressure and temperature relief valve, pressure gauge, thermometer, drain valve, anode rods and controls as required.

C. Insulation: Comply with ASHRAE 90.1.
   1. 2 inch and smaller: Threaded ends according to ASME B1.20.1.
   2. 2 1/2-inch and Larger: Flanged ends according to ASME B16.5 for steel and stainless steel flanges, and according to ASME B 16.24.

D. Heating Element: double element, immersion type, thermostatically adjustable. Set thermostat for maximum water temperature of 130 degrees F. Phase and voltage as shown on the drawings.

E. Combination Pressure and Temperature Relief Valves: ASME rated, constructed of all brass or bronze with a self-closing reseating valve. Pressure setting shall be less than water heater working pressure, and relieving capacity shall not be less than heat input.

F. Electrical power requirements: Field coordinate power connect requirements with E.C. prior to ordering equipment. Provide 120/208/240V or 277/480V as required to match electrical feeders.

G. Provide water heat as manufactured by: Rudd, Rheem, State, A.O. Smith or equal. See schedule on plans for specific heater requirements.

2.1 GAS WATER HEATERS:

A. Comply with ANSI Z21.10.1

B. Tank Construction: Steel, glass lined, with 1035 kPa (150 psig) working pressure rating.

C. Tapping (Fittings): Factory fabricated of materials compatible with the tank and in accordance with appropriate ASME standards for piping connection, pressure and temperature relief valve, pressure gauge, thermometer, drain valve, anode rods and controls as required, unless noted otherwise:

   1. 50-mm (2 inch) and smaller: Threaded ends according to ASME B1.20.1.
   2. 65-mm (2 1/2-inch) and larger: Flanged ends according to ASME B16.5 for steel and stainless steel flanges, and according to ASME B 16.24.

D. Burner: Natural or LP gas-fired:

   1. Thermostatically adjustable.
   2. High temperature limit and low water cutoff devices for safety controls.

3. Automatic ignition in accordance with ANSI Z21.2.
4. Automatic damper in accordance with ANSI Z21.66.

E. Flue: Provide each heater with number 0.85 mm thick (22 gage) galvanized iron flue of same size as heater outlet, extending from heater to chimney, unless detailed otherwise .

F. Temperature Setting: Set thermostat for a maximum water temperature of 130 degrees F.

G. Insulation: Comply with ASHRAE 90.1.

H. Combination Pressure and Temperature relief Valve: ANSI Z21.22 rated, constructed of all brass or bronze with a self-closing reseating valve.

2.2 THERMOMETERS:

Gas and Electric Water Heaters: Straight stem, iron case, red reflecting mercury thermometer approximately 175 mm (7 inches) high, 4 to 115 degrees C (40 to 240 degrees F). Install in hot water pipe close to outlet of tank.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install water heaters on concrete base.

B. Install water heaters level and plumb.

C. Install and connect water heaters in accordance with manufacturer's written instructions.

D. Pipe all pressure and temperature relief valves discharge to nearby floor drains.

E. Install thermometers on water heater inlet and outlet piping.

F. Provide and install thermal heat traps as required by current NC Energy Conservation Code.

G. Provide electric power connections to fixtures and devices that require power using licensed electrician as specified in Division 16 Sections.

H. Ground equipment - tighten electrical connectors and terminals according to manufacturers published torque-tightening values. Where manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B

G. Set the thermostats for a maximum setting of 130 degrees F unless noted otherwise.

3.2 LEAKAGE TEST:

Before piping connections are made, test water heaters with hydrostatic pressure of 200 psi.

Correct any leakage or replace water heater and retest at no additional cost to the Owner.

3.3 PERFORMANCE TEST:

Ensure that all of the remote water outlets will have a maximum of 120 degrees F and a maximum of 130 degrees F water flow at all times. If necessary, make all correction to balance the return water system or reset the thermostat to make the system comply with design requirements.

END OF SECTION

PART I: GENERAL

Furnish and install insulation for refrigerant and air distribution systems where shown on plans and specified below.

REFRIGERANT PIPE INSULATION:

Install insulation on piping per the NC Energy Conservation Code, the Refrigerant Piping Specification and as described below.

DUCTWORK INSULATION:

Furnish and install all-service faced duct wrap consisting of a blanket of glass fibers factory-laminated to a reinforced foil / kraft (FRK) vapor retarder facing on all supply, ventilation, and non-lined return air ductwork.

Duct wrap shall comply with the current NC Energy Conservation Code and NFPA 90 performance standards. Duct wrap insulation shall be Knauf Multi-purpose, 2" thick, 1.0 lb/cf density with installed R-value = 6, or approved equal by Owens-Corning or Schuller.

PART II: EXECUTION

Install system according to manufacturer's written instructions. Drawings indicate only general arrangement of piping, fittings, and specialties

PIPE INSULATION INSTALLATION:

The Contractor shall provide all insulation as required on all piping as specified hereinafter and/or as indicated. All insulation shall be installed in a workmanlike manner by qualified workers in the regular employ of the Contractor.

Install insulation according to manufacturer’s instructions, North Carolina Energy Conservation Code and other piping related sections in this specification.

All insulation shall be applied to clean, dry surfaces butting all sections firmly together and finishing as specified hereinafter. All vapor barriers shall be sealed, and shall be continuous throughout. No staples shall be used on any vapor barrier jacket. All vapor barriers shall be of the fire retardant type.

Insulation of all insulated lines shall be interpreted as including all pipe, valves, fittings, and specialties comprising the lines, except flanged unions and screwed unions on hot piping. Insulation over fittings shall be of equal thickness as the adjoining pipe insulation. Unless otherwise specified or directed, insulation for fittings and flanges shall be of the permanent type.

PIPE INSULATION PROTECTION:

Support of pipe shall be on the outside of the insulation. The insulation at each support shall be rigid and of an equal thickness and finish as the adjoining pipe insulation; the length to coincide with the saddles.

DUCT SEALANT:

Prior to insulating, all duct joints (except gasketed joints), seams and connections shall be sealed with brush-on type water-based sealant equal to United-McGill Duct Sealant. Apply in accordance to manufacturer's instructions and / or recommendations.

DUCT INSULATION INSTALLATION:

Before applying duct wrap, sheet metal ducts shall be clean, dry, tightly sealed at all joints and seams as specified, sealant applied and inspected by Engineer.

Duct wrap insulation shall be cut to "stretch-out" dimensions as provided in instructions, and a 2" piece of insulation removed from the facing at the end of the piece of insulation to form an overlapping staple and tape flap.

Install duct wrap insulation with facing outside so that tape flap overlaps insulation and facing at other end of piece of duct wrap. Insulation shall be tightly butted. If ducts are rectangular or square, install so insulation is not excessively compressed at duct corners. Seams shall be stapled approximately 6" on center with outward clinching staples. Where a vapor barrier is required, seal with pressure-sensitive tape matching the facing, either plain foil or PRK backing stock.

Where rectangular ducts are 24" in width or greater, duct wrap insulation shall be additionally secured to the bottom of the duct with mechanical fasteners such as pins and speed clip washers, spaced on 18" centers (maximum) to prevent sagging of insulation. Adjacent sections of duct wrap insulation shall be tightly butted with the 2" tape flap overlapping. Where a vapor barrier is required, seal all tears, punctures, and other penetrations of the duct wrap insulation facing with tape or mastic to provide a vapor tight system.

DUCT LINER:

Removed from Spec, not allowed on this project.

PART III: WARRANTY

Manufacturer shall guarantee all insulation as installed to be free from manufacturing defects for a period of one year from startup not to exceed twenty-four months from shipping to job site under normal use.

PART IV: COMMISSIONING

Prior to pre-final construction review, Contractor shall repair all insulation tears and damage.

END OF SECTION

HEAT PUMP & A/C CONDENSING UNITS:

Furnish and install outdoor condensing units (HP/CU) indicated on plans. Units shall be rated in accordance with ARI Standard 210/240-89 and 270-84, have CSA approval, and UL listed.

Unit casing shall be constructed of 18 gauge zinc coated heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather-resistant baked enamel finish. Unit cabinet shall be capable of withstanding Federal Test Method Standard No. 141 (Method 6061), the 500 hour salt spray test. Units shall have removable end panels which allow access to all major components and controls.

Units shall have dual refrigeration circuits. Each refrigeration circuit has an integral subcooling circuit. A refrigeration filter drier, expansion valve and check valves shall be provided as standard. The units shall also have both a liquid line and suction gas line service valve with gauge port.

The units shall have direct drive scroll compressors with centrifugal oil pump providing positive lubrication to moving parts. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of nameplate voltage. Crankcase heater, temperature and current-sensitive motor overloads shall be included for maximum protection. shall have internal spring isolation and sound muffling to minimize vibration transmission and noise. External high and low pressure cutout devices shall be provided. Evaporator defrost control provided in indoor blower coil unit shall prevent compressor slugging by temporarily interrupting compressor operation when low evaporator coil temperatures are encountered.

Condenser coil shall be internally finned or smooth bore 3/8” copper tubes mechanically bonded to configured aluminum plate fin as standard. Coil shall be factory pressure and leak tested to 425 psig air pressure. Provide metal grilles with PVC coating for coil protection.

Condenser fan and motor(s) shall be direct-drive, statically and dynamically balanced propeller fan(s) with aluminum blades and electro-coated steel hubs shall be used in draw-through vertical discharge position. Either permanently lubricated totally enclosed or open construction type motors shall be provided and shall have built in current and thermal overload protection. Motor(s) may be either ball or sleeve bearing type.

Condenser units shall be completely factory wired with necessary controls and contractor pressure lugs or terminal block for power wiring. Control wiring shall be 24-volt control circuit which includes fusing and control transformer. Units shall provide external location for mounting a fused disconnect device. Time delay timers to prevent compressors in dual compressor units from simultaneous start-up and anti-recycle timers are available as optional accessories. Defrost controls shall be electronic timed initiated, temperature terminated defrost system with choice of 50, 70, or 90 minute cycle. Timed override limits defrost cycle to 10 minutes. Standard units shall start and operate to approximately 35 F when matched with Trane air handlers and coils.

Time delay relay shall prevent compressors in dual compressor unit from coming on line simultaneously. Timer shall be 24-volt, 60 cycle, with four-minute timing period. Anti-short-cycle timer shall prevent rapid on-off compressor cycling in light load conditions by not allowing compressor to operate for 5-7 minutes upon shutdown. Timer shall consist of a solid-state timing device, 24-volt, 60 cycle with either 5 or 7 minute fixed-off timing period. Provide condenser coil guard with PVC coating shall be provided to alleviate coil damage.

Unit safety devices shall include 5-minute short-cycle protection delay, high pressure cut-out, low suction pressure cut-out, condenser fan overload protection and others as specified on the drawings. Electrical power shall be single point connection.

Equipment shall be manufactured by Trane. Units as manufactured by Carrier or Daikin are acceptable, provided they meet all conditions of the specifications.

WARRANTY:
Unit shall have five year non-prorated compressor warranty and one year on all parts. Provide liquid line solenoid valve for installations with over 50 equivalent feet of refrigerant piping as per manufacturer.

AIR HANDLER EQUIPMENT:
Furnish and install air handler unit (AHU) as indicated on plans. Protect coil from construction dust and debris before project closeout with high efficiency filters.

Air handler units shall be completely factory assembled including coil, condensate drain pan, fan motor, filters and controls in an insulated casing that can be applied in either vertical or horizontal configuration. Units shall be rated and tested in accordance with ARI standard 210. Units shall be UL listed and labeled in accordance with UL 1995 for indoor blower coil units.

Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather-resistant baked enamel finish. Casing is completely insulated with fire-retardant, permanent, odorless glass fiber material. Knockouts shall be provided for unit electrical power and refrigerant piping connections. Captive screws shall be standard on all access panels.

The units shall have dual refrigeration circuits. Each refrigeration circuit is controlled by a factory installed thermal expansion valve.

Evaporator coil shall be configured aluminum fin surface and shall be mechanically bonded to 3/8” internally enhanced copper tubing and factory pressure and leak tested at 375 psig. Coil shall be arranged for draw-through airflow and shall provide condensate drain pan constructed of PVC plastic and provide external connections on either side of the unit.

Evaporator fan shall be a double inlet, double width, forward curved, centrifugal-type fan(s) with adjustable belt drive shall be standard. Thermal overload protection shall be standard on motor. Fan and motor bearings shall be permanently lubricated.

Unit controls shall include magnetic evaporator fan contactor, low voltage terminal strip, check valve, and single point power entry. All necessary controls shall be factory-installed and wired. Evaporator defrost control shall be included to prevent compressor slugging by temporarily interrupting compressor operation when low evaporator coil temperatures are encountered.

Filters shall be accessible from the side coil access panel. Provide with 2 complete sets of 2” disposable filters per unit in addition to what is in the unit at time of job completion.

Provide mounting subbase for vertical floor mount configurations. Subbase shall be constructed of heavy gauge, zinc coated galvanized steel with baked enamel finish to match air handler unit.

Air handler units shall be manufactured by Trane. Units manufactured by Carrier or York are acceptable provided all specifications are met or exceeded.

VIBRATION ISOLATION:
Provide all equipment noted to have vibration isolation with vibration isolation bases. Insulation mounting shall be Vibration Mounting and Controls, Inc. (VMC), and shall be installed in strict accordance with manufacturer's instructions. Submit arrangement of isolators for approval. Arrangement shall be in accordance with applicable details on drawings.

For floor mounted equipment, provide neoprene-in-shear mounts, VMC no. R-2, rated for load. For suspended equipment, provide neoprene-in-shear hangers VMC no. R4-2, rated for load.

END OF SECTION

SINGLE PACKAGE OUTDOOR GAS HEAT / ELECTRICAL COOLING UNITS:

Furnish and install single package outdoor unit utilizing a scroll compressor for cooling and gas combustion heating as specified on the drawings. Unit shall be capable of supplying air vertically. The rooftop unit shall be a factory assembled, single-piece heating and cooling unit. Contained within the unit enclosure shall be all factory wiring piping, controls, refrigerant charge and special features required prior to field start-up.

Unit shall be rated in accordance with ARI standard 360, designed to conform with ANSI/ASHRAE 15 and UL Standard 465, and certified by UL or ETL as a total package. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

The exterior cabinet shall be constructed of pre-painted and bonderized galvanized steel with a baked enamel finish on all exterior surfaces. Unit casing shall be capable of withstanding Federal test method Standard No. 141 (Method 6061) 500-hour salt spray test. Indoor blower compartment interior surfaces shall be insulated with a minimum 1/2-in. thick fiberglass insulation coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the gas heat compartment. Cabinet panels shall be easily removable for servicing. Unit shall have a factory-installed internal condensate drain connection and a sloped condensate pan.

The compressor(s) shall be scroll type equipped with crank-case heaters, and spring-type vibration isolators. Units of 10 ton capacity and greater shall utilize dual compressors with dual independent refrigeration circuits. The refrigerant system shall include strainer assembly, fixed orifice feed system, service gauge connections on suction line, liquid line and compressor discharge line, loss of charge protection, and internal high pressure relief. Factory-installed crankcase heater prevents refrigerant dilution of oil.

The condenser coils shall have aluminum plate fins mechanically bonded to seamless copper tubes with all joints brazed, leak tested @ 150 psig and pressure tested @ 450 psig. The condenser fan shall be direct-driven propeller type with permanently lubricated bearings and shall discharge air vertically.

The evaporator fan shall be dynamically balanced double-inlet centrifugal type with belt drive, adjustable pitch motor pulley and sealed permanently lubricated ball bearings. Fan wheel shall be made from steel with a corrosion resistant finish. It shall be a dynamically balanced, double-inlet type with forward-curved blades. The evaporator coil shall have aluminum plate fins mechanically bonded to seamless copper tubes with all joints brazed.

The heat exchanger shall be of tubular section constructed of 20 gauge (minimum) steel coated with a nominal 1.2 mil aluminum-silicone alloy for corrosion resistance. The burners shall be constructed of aluminum coated steel. The burners shall be the in-shot type. The combustion system shall be an induced-draft type with direct-spark ignition and redundant main gas valve. All gas piping shall enter the unit at a single location.

The filter access shall be through panel. Provide Owner with one year’s supply of factory 2” disposable fiber glass filters. Contractor shall label filter access with plastic laminate white letter on black labels indicating filter number and size.

Gas package units shall be manufactured by Trane as specified on the drawings. Units meeting or exceeding specified equipment performance data manufactured by Carrier or Daikin shall be considered equivalent.

ECONOMIZER:

Furnish & install Integrated Enthalpy based Economizers and controllers on units 10 ton and greater. Integrated type economizer capable of simultaneous economizer and compressor operation to provide cooling with outdoor air. Economizer shall be equipped with low-leakage dampers not to exceed 3%

leakage, at 1.0 in. wg pressure differential. Unit shall be capable of introducing up to 100% outdoor air and equipped with dry-bulb temperature control to govern economizer changeover. Provide a barometric relief damper for vertical flow units with economizer to control over pressurization of building. Provide a differential enthalpy sensor: capable of comparing heat content (temperature and humidity) of outdoor air and indoor air and controlling economizer cut-in point at the most economical level.

ROOFTOP UNIT SAFETIES:

A. Unit shall incorporate a solid-state compressor lockout which provides reset capability at the space thermostat, should any of the following safety devices trip and shut off compressor:

   1) Compressor overtemperature, overcurrent.
   2) Low-pressure switch.
   3) Freezestat (evaporator coil).
   4) High-pressure switch.

B. Supply-air thermostat shall be located in the unit

C. Heating section shall be provided with the following minimum protections:

   1) High-temperature limit switch.
   2) Induced-draft motor speed sensor.
   3) Flame rollout switch.
   4) Flame proving controls.
   5) Redundant gas valve.

ROOF CURBS:

Roof curbs shall be NRCA approved. Roof curbs shall be of prefabricated galvanized steel construction with counter-flashed wood nailer, insulated deck pan, and insulated vertical members. Installation shall be in strict accordance with manufacturer's instructions to insure a water-tight system. Provide vibration isolation rails where indicated on the drawings and equipment schedules. Roof curbs shall be supplied by package unit manufacturer or by Plenums, Inc.

END OF SECTION

RELATED DOCUMENTS:
Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

REFRIGERATION PIPING:
Refrigeration piping shall be seamless ACR hard drawn tempered copper refrigeration tubing, cleaned and capped in accordance with ASTM B-280, with wrought copper long radius fittings manufactured specifically for refrigeration service. Soft copper tubing will be permitted only below grade or inside inaccessible chases.

REFRIGERATION PIPING INSTALLATION:
Refrigeration piping shall be sized in accordance with the H.V.A.C. equipment manufacturer's recommendations. Provide calculations of hot gas discharge and suction line sizing approved by manufacturer with shop drawing submittal. All piping shall be run straight and true as possible with the building structure to prevent compressor lubricating oil from trapping in system.

Braze joints with silver alloy type refrigeration filler rod with 15% silver, 80% copper composition. All joints shall be made with filled with nitrogen. Brazing shall be done by workman certified under ASME "WELDING AND BRAZING QUALIFICATIONS" section IX. All open refrigerant piping shall be capped with plastic seals at ALL times. See Specification Section 15600 for field installed accessories.

TESTING:
Test refrigerant piping using dry nitrogen at 1-1/2 times the operating working pressure for 24 hours without leakage. Brush connections with soap solution for visible bubble test. If no leaks are found, Contractor shall charge system with 20% refrigerant and 80% nitrogen mixture to 200 psig, and perform halide lamp test at all fittings and system connections. System pressure shall be maintained for 24 hours. Upon successful completion of above tests, evacuate system using vacuum pump capable of at least 500 microns mercury absolute and hold for four hours without rise in pressure (with allowable compensation for change in temperature). Apply heat to elbows, loops and low spots during evacuation. Re-charge system in strict accordance with manufacturer's instructions.

If a system leak is discovered, Contractor shall first reclaim existing refrigerant using a refrigerant recovery unit. Venting refrigerant to atmosphere will not be permitted on this project.

INSULATION:
Insulate refrigerant suction pipe with 1-1/2" thick insulation or larger as required by the current North Carolina Energy Conservation Code. Insulation shall be closed cell rubber pipe insulation Armstrong AP Armaflex or equivalent. Fabricate mitered covers over elbow fittings. Insulation sections shall be jointed using Armstrong 520 Adhesive. Follow all manufacturers' installation instructions in strict accordance. Splitting insulation or the use of duct tape to join insulation sections will not be permitted on this project. All exterior exposed insulated refrigerant pipe shall be wrapped with 0.016 inch thick embossed aluminum jacketing with longitudinal slip joints, secured with 3/8" wide bands.

REFRIGERATION PIPE SUPPORT:
Provide clevis-type hangers on 10' centers and within 12" of elbows. Liquid line shall be attached to the insulated suction line with nylon clamps or ties at 6' intervals.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

CONDENSATE PIPING:

Condensate piping shall be 1-1/4” diameter minimum PVC pipe and fittings installed in strict accordance with the Plastic Pipe Institute guidelines unless noted otherwise on the drawings. Provide copper or cast iron piping above corridor ceilings below utility platforms or in similar fire-rated assemblies. Slope pipe a minimum of 1/4” per foot and support with clevis-type hangers at 5’-0” o.c.

INSULATION:

Insulate pipe with 3/8” wall white Polymer foam insulation by IMCOA or 1/2” thick closed cell rubber pipe insulation, Armstrong AP Armaflex or equal by Rubatex, prior to making joints. Fabricate mitered covers over elbow fittings. Insulation sections shall be jointed using Armstrong 520 Adhesive. Follow all manufacturers’ installation instructions in strict accordance. Splitting insulation or the use of duct tape to join insulation sections will not be permitted on this project.

PIPE SUPPORT:

Provide clevis-type hangers on 10' centers and within 12" of elbows.

TESTING:

Fill fan coil and air handler condensate pans from utility sinks, and allow to flow into storm sewer prior to ceiling installation and pipe insulation. Repair all observed leaks as required.

PIPE IDENTIFICATION:

Furnish and install permanent color-code plastic sheet pipe markers with directional arrows. See also section 15740-4.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

DUCTWORK:

Material and thickness: Ducts shall be rectangular and fabricated of prime quality, re-squared, tight-coat-galvanized, steel sheets. All duct construction shall equal or exceed SMACNA "'Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure.

DUCT CONSTRUCTION:

All ductwork shall be fabricated from prime, number one grade galvanized sheet metal conforming to ASTM A-924-94, G-90. Gauges for duct sizes shall be minimum as follows:

Low Pressure, <1" ESP		Medium Pressure, <2" ESP	
26 Ga.	Up to 30 inches	26 Ga.	Up to 26 inches
24 Ga.	Up to 40 inches	24 Ga.	Up to 30 inches
22 Ga.	Up to 54 inches	22 Ga.	Up to 36 inches
20 Ga.	Up to 96 inches	20 Ga.	Up to 84 inches

Standard flat slips and drives shall be used on ductwork with long dimensions not exceeding 18". On ductwork over 18" standing S cleats, Ductmate angles or equivalent reinforcing shall be used.

Ducts shall have supplemental stiffening as required to prevent drumming and to provide a structurally sound assembly. All ducts except those to which rigid board type insulation is to be applied shall have all sides cross-broken. All duct dimensions shown on drawings are "inside clear". The sizes of acoustically lined ducts shall be increased accordingly. Ducts shall be smooth on inside.

Fabricate all ductwork to prevent seams or joints being cut for installation of grilles, diffusers, or registers. All duct joints and seams shall be fabricated and installed with joints and seams made air tight.

HANGING DUCTS:

Support ducts from building structure in accordance with SMACNA "Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure.

OBSTRUCTIONS AND RESTRICTIONS:

Where possible, avoid locating any pipe, wire, structural member or other obstruction inside of duct. Take particular care to avoid obstructions in elbows. Where obstruction cannot be avoided, the rules specified by SMACNA "Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure, shall apply. Where ducts pass through non-rated walls, protect ducts and/or insulation from contact with wall by 1/2 inch filler of noncombustible material and flange perimeter of wall opening with sheet metal.

CHANGE IN DUCT SHAPE & DIRECTION:

Where the area at the end of the transformation results in an increase in area from the beginning of the transformation, the slope of the transformation shall meet SMACNA "Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure.

In general, keep changes in direction and changes in shape to minimum permitted by distribution requirements and building conditions. Make turns with ells, as conditions necessitate, in accordance with

SMACNA "'Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure.

SPLITTERS AND/OR HAND DAMPERS:

Provide splitters or butterfly dampers for adjustment of distribution to respective branches where indicated on drawings and elsewhere as required to properly balance system. Dampers shall meet SMACNA "Low Pressure Duct Construction Standards", or SMACNA "High Pressure Duct Construction Standards", depending on system pressure.

DEFLECTORS:

Provide deflectors at all branch take-offs, and elsewhere as required. Fabricate of galvanized steel sheet of same thickness as used in ductwork of corresponding size. Securely anchor vanes to duct or casing, and brace free-standing edges as specified for turning vanes in elbows.

ACCESS DOORS:

Provide access doors of suitable size where required to service equipment. Fabricate doors of 24 U. S. Gauge galvanized steel hinged to a 24 gauge galvanized mounting frame, and provide with fastening devices to give tight closure on felt gasket. Doors for insulated duct shall be double panel construction with 1" rigid insulation material between metal panels.

ACCESS PANELS:

Construct access panels as specified for access doors, and provide at all locations where any operable device occurs inside ducts, i.e., dampers, controls, filters, louvers, fire dampers, etc.

SPECIALTIES:

Where drawings or specifications require that ducts be insulated, make provision for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors and similar operating devices. A metal collar equivalent in depth to insulation thickness (and of suitable size to which insulation may be finished) shall be mounted on duct. Insulation on duct shall extend continuously through walls, etc.

Provide extension collars for outlets, air guide vanes, and other specialties where they occur in the ducts.

AIR DISTRIBUTION DEVICES:

Diffusers, registers, and grilles shall be installed indicated or implied on drawings. All ceiling diffusers and grilles shall be designed to minimize ceiling and/or wall discoloration, and shall be model and finish as indicated on drawings. Air distribution manufacturer and Contractor shall be jointly responsible for and certify delivery or exhaust. (See Testing Section for duct system.)

Items scheduled on the drawings are used for design purposes. Similar units as manufactured by Nailor Industries, Titus, Krueger, Price and Metal*Aire shall be considered equal. Maximum dba shall be 30. If indicated on the drawings, supply and return grilles shall be equipped with volume dampers of the opposed blade type. The dampers are to be adjustable from the face. All grilles, registers and diffusers shall have white baked enamel finish, unless indicated otherwise.

DAMPERS:

Balancing dampers shall be installed at each branch run to allow for proper balance of the system. Each damper shall be supplied with a quadrant locking device which extends beyond the ductwork for external adjustment.

FLEXIBLE CONNECTIONS:

For low velocity duct work (less than 2400 FPM), provide flexible connections at inlet and outlet of each fan connected to ductwork and elsewhere as indicated. Flexible connections shall be 6 inches wide, waterproof and fireproof, and shall be 24 gauge Metaledge Ventfab, as manufactured by Ventfabrics, Inc.

DUCT SEALANT:

Prior to insulating, all duct joints (except gasketed joints), seams and connections shall be sealed with brush-on type water-based sealant equal to United-McGill Duct Sealant. Apply in accordance to manufacturer's instructions and / or recommendations.

CLEANING DUCT SYSTEM:

Upon complete installation of ducts, clean entire system of rubbish, plaster, dirt, etc., before installing any outlets. After installation of outlets and connections to fans are made, blow out entire systems with all control devices wide open.

DUCTWORK INSULATION: See Section 15500, Mechanical Insulation

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART I: GENERAL

Provide all labor, materials, accessories, and equipment required to furnish and install louvers as shown on the accompanying plans and specified in this document.

PART II: PRODUCTS

STATIONARY LOUVERS:

Louvers shall have the following features:

a. The unit shall have a rain proof exterior with a built-in backdraft damper (for exhaust applications)
b. The blades shall be constructed of not lighter than 14 gauge 6063T5 extruded aluminum @ 3" o.c.
c. Frame shall be constructed of not lighter than 12 gauge extruded aluminum.
d. Provide blade edge of vinyl or rubber to give minimum leakage shall be 1 cfm/ft^2 at 1/2" SP.
e. Furnish extended sill and insect screen
f. Finish shall be Kynar 500 with 20 year warranty or approved equal – custom color(s) selected by Architect

Louvers shall be manufactured by Ruskin, Air Balance, Vent Products, Cesco or Reliable.

Submit (3) color samples for approval by the Architect.

PART III: EXECUTION

Install in accordance with SMACNA requirements.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

GENERAL:

Furnish and install 1 year supply of 1" air filters disposable air filters in all fan coils and 2" for air handlers. One year supply consists of four (4) sets for 60 day replacement cycle and does not include first sets installed during start-up and replacement prior to Owner acceptance of building.

Provide an air filter replacement schedule indicating size and quantity for each HVAC unit with submittal for approval.

Air filters shall be medium efficiency, pleated, disposable type. Each filter shall consist of cotton and synthetic media, media support grid, and enclosing frame. The filter shall be listed and identified on the frame as Underwriters' Laboratories Class 2.

Filter shall have not less than 2.3 square feet of media per square foot of filter face area and not less than 16 pleats per linear foot of filter face area. A 96% open area media support grid of welded wire construction, coated with rust inhibitor shall be bonded to the air exiting side of the filter. The enclosing frame shall be of high wet-strength beverage board with diagonal support members bonded to the air entering and air exiting side of each pleat. The inside periphery of the enclosing frame shall be bonded to the filter pack.

Filter shall have an average efficiency of 25-30%, and an average arrestance of not less than 90% in accordance with ASHRAE Standard 52.1-1992. The minimum MERV when tested under ASHRAE 52.2 shall be no less than MERV 7. Initial resistance at 375 feet per minute approach velocity shall not exceed 0.28" iwc

A test report corresponding to each of the aforementioned ASHRAE Standards are required submittals.

MANUFACTURER:

Filters shall be Farr 30/30.

Units manufactured by Flanders and American Air Filter are acceptable provided all specifications are met or exceeded.

END OF SECTION

GENERAL:

The Electrical Contractor shall provide all power wiring to the line side HVAC equipment disconnects, wiring troughs, junction box, etc. Unless noted otherwise, or as indicated on the drawings the HVAC Contractor shall be responsible for final connections using a licensed electrical contractor and shall furnish manufacturer's recommended HVAC fuses.

In some cases where there is a unit mounted disconnect or safety switch, the electrical contractor shall furnish and install junction boxes with slack cable for this Contractor's equipment requiring electrical service. This Contractor shall make a connection to the slack cable in the junction box, extend it from that point through the local disconnecting means and make the final connections in this equipment.

All control switches for remote equipment shall be provided with on/off indicator lights at the switch.

Ensure that all rotating equipment has a power disconnect available within sight of the equipment, regardless of whether required by the NEC.

The HVAC Contractor shall also provide all control wiring, conduit, equipment interlocks, low voltage device or motor power connections, and similar in accordance with this section or Division 16 of these specifications. Provide all necessary cabinets, panels, junction boxes, interconnecting signal cabling & associated hardware, transformers, relays, engineering support, etc. for a complete and operational system that executes the specified control sequence of operation.

MOTOR STARTERS, CONTROLLERS AND CONTACTORS:

Motor controllers and contactors shall be as indicated or specified and shall be furnished under each Section of this Division requiring such controllers unless otherwise indicated to be provided in a Motor Control Center under Division 16.

Motor controllers shall, unless otherwise specifically noted, be combination magnetic type, with thermal overload relays and heaters in each phase conductor, with operating coils for 120 volts as noted on the drawings or as required. Maximum trip rating of starters for hermetic motors shall be at least 105% of the nameplate full load current of the motor.

Starters shall be provided with build-in selector switches (H-O-A) or pushbutton stations where required. Combination starters shall be provided with sufficient auxiliary contacts or control relays for control sequence as specified, indicated or as required, and with sufficient auxiliary contacts on its circuit breaker or with control relays so that opening the circuit breaker ahead of the starter unit opens all hot control lines within the starters. All starters furnished under this Section shall be mounted in individual NEMA I enclosures, unless otherwise specified or indicated on drawings. Special requirements are specified in the separate Sections of this Division or indicated on the drawings.

Equipment shall be manufactured by Square D to match equipment furnished under Division 16

ROOM-INSTRUMENT MOUNTING:

Room instruments shall be mounted so that their switching devices are 54" maximum above the finished floor unless a clear space of 30" wide by 48" long for wheelchair access is not available, mount at 48" AFF to comply with the American Disability Act (ADA).

CONTROL WIRING:

Run control wiring in metallic raceway in masonry walls, boiler room and exposed conditions. All other signal cables shall be run on utility platform on wire management bridle hooks provided by this contract. Do not run inside raceway with power conductors. Use copper wire or control cable, #18 minimum

(except that digital signaling can be NEC class 2). The contractor shall connect to junction box(s) or other termination points provided by the Electrical Contractor for control power. See Electrical Section of these specifications for materials and installation requirements. All wiring shall be color and number coded.

RELAYS:

Indexing relays shall be 24 VAC coils “relay in a box” with pilot light & off/on switch, IDEC or equal. All line side relay wiring shall be 12 AWG and run in metallic raceway. Relays shall be installed in NEMA 1 enclosures.

CONTROL CABINETS:

Control cabinets shall be provided for mounting of control devices in utility platform and/or boiler room. Cabinet shall be UL listed lockable, code gauge gray painted steel, with knockouts, and hinged door. Enclosure shall be equal to Austin Co. CT series

Provide boiler room cabinet enclosure with swing-down table shelf for use with laptop computer.

COORDINATION OF ELECTRICAL POWER REQUIREMENTS:

Mechanical contractor shall coordinate voltage and amperage requirements for all HVAC equipment and controls devices with the Electrical Contractor prior to ordering equipment submittals. Make adjustments to equipment voltage or phase requirements as necessary to match electrical power being provided. Make engineer/architect aware of any omissions, conflicts or issues.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

ADJUSTMENT AND TRIAL RUNS:

Upon completion of all work, the Contractor shall operate the plant in the presence of the engineer for the purpose of demonstrating quiet and satisfactory operation, the proper setting of controls, safety and relief valves, and cleanliness of system. Heating and cooling shall be tested separately during periods approaching the design conditions and shall fully demonstrate fulfillment of capacity requirements. Test procedures shall be in accordance with applicable portions of ASME, ASHRAE and other generally recognized test codes as far as field conditions will permit.

AIR BALANCING & TESTING:

Air Balancing and System Testing includes (1) balancing air distribution, (2) adjustment of total system to provide design quantities, (3) electrical measurement, (4) verification of performance of all equipment and controls, and (5) sound and vibration measurement. Contractor shall provide all required instrumentation and equipment required to obtain proper measurements. Contractor shall perform final test and balance of selected areas in presence of Engineer. The following procedure is adapted from the 1995 ASHRAE Applications Handbook, Ch. 34: Testing, Adjusting and Balancing, and Associated Air Balance Council:

(1) All supply and return air-duct dampers are set at full open position. All diffuser and side-wall grilles are set at full open position. Outside-air damper is set at minimum position. All Controls are checked and set for full cooling cycle. Branch liner splitter dampers are set to open position. All extractors and distribution grids are set in wide-open positions.

(2) Drill all probe holes for static-pressure readings, pitot tube traverse readings, and temperature readings. Check motor electric current supply and rated running amperage of fan motors. Check fan and motor speeds. Check available adjustment tolerance.

(3) Make first complete air-distribution run throughout entire system, recording first-run statistics. Using pitot tube traverse in all main ducts, branch ducts, and supply and return, proportion all air in required amounts to the various main-duct runs and branch runs. Make second complete air-distribution run throughout entire system for check on proper proportion of air.

(4) Using pitot tube traverse, set all main-line dampers to deliver proper amount of cfm to all areas. Using pitot tube traverse, set all branch-line dampers to deliver proper amount of cfm to diffusers amount of cfm to diffusers and side-wall supply grilles in each zone. Read cfm at each outlet and adjust to meet requirements. Test and record all items as listed on attached form.

Final air balancing form (3 copies) submitted to Engineer shall be on attached form adapted from the Associated Air Balance Council (AABC) and the National Environmental Balancing Bureau (NEBB).

END OF SECTION

AIR BALANCE REPORT

Project: _____ *System No.* _____
Contractor: _____ *CFM:* _____
Date: _____ *S.P.:* _____
Air Balanced by: _____ *Fan RPM:* _____
Instrument Mfr #: _____ *Motor Voltage:* _____
Date Calibrated: *Motor Amperage:*

			Effective	*Design Values*		*Field Test*		*Final Test*		*%*
Location	*No.*	*Model/Size*	*Area*	*FPM*	*CFM*	*FPM*	*CFM*	*FPM*	*CFM*	*DEV.*
	1									
	2									
	3									
	4									
	5									
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PROCEDURE/NOTES:

(1) Review Specification Section 15980 prior to air test & balance.
(2) Ensure fan is providing specified air volume within 5%.
(3) Set all dampers to full open position prior to first field test.
(4) Identify air distribution device nos. on HVAC as-built drawing.
(5) Adjust dampers accordingly and recheck entire system as required.
(6) Acceptable % deviation is +/-10%.

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SCOPE OF WORK:

The scope of work consists of the furnishing and installing of complete electrical systems including miscellaneous systems. The Electrical Contractor (hereafter referred to as "the Contractor", or Electrical Contractor) shall provide all supervision, labor, materials, equipment, machinery, and any and all other items necessary to complete the systems. The Contractor shall note that all items of equipment are specified in the singular; however, the Contractor shall provide and install the number of items of equipment as indicated on the drawings and as required for complete systems.

It is the intention of the Specifications and Drawings to call for finished work, tested and ready for operation.

Any apparatus, appliance, material, or work not shown on the drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered, and installed by the Contractor without additional expenses to the Owner.

Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the Contractor's estimate, the same as if herein specified or shown.

With submission of bid, the Contractor shall give written notice to the Architect of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules, and any necessary items or work omitted. In the absence of such written notice, it is mutually agreed that the Contractor has included the cost of all required items in his proposal, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensation.

NOTICE TO BIDDERS, INSTRUCTIONS TO BIDDERS, SUPPLEMENTARY INSTRUCTIONS, GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, SPECIAL CONDITIONS, GENERAL REQUIREMENTS bound in the front of this document are included as a part of the specifications for this work.

ELECTRICAL DRAWINGS AND SPECIFICATIONS:

The electrical drawings are diagrammatic and indicate the general arrangement of fixtures, equipment, and work included in the contract. Consult the architectural, structural, plumbing, fire alarm, integrated communications, and mechanical drawings and details for exact locations and dimensions of fixtures and equipment; where same are not definitely located, obtain this information from the Architect.

The Contractor shall follow drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Architect shall be notified before proceeding with installation. If directed by the Architect, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

The plans and these specifications are intended to describe, imply and convey the materials and equipment as well as necessary labor, required for the installation as outlined in the paragraph entitled "Scope of Work". Any omissions from either the drawings or these specifications are unintentional, and it shall be the responsibility of this Contractor to call to the attention of the Architect or Engineer any pertinent omissions before submission of a bid. The drawings which accompany these specifications are not intended to show in complete detail every fitting which may be required; however wherever reasonable implied by the nature

of the work, any such material or equipment shall be installed by this Contractor as a part of his contract price. In no case will any extra charge be allowed unless authorized in writing by the Architect or Engineer.

The Contractor shall arrange with the General Contractor for required concrete and masonry chases, openings, and sub-bases so as not to delay progress of work. Work shall be installed sufficiently in advance of other construction to conceal piping and to permit work to be built in where required.

It shall be understood and agreed by all parties that where the words “Furnish”, “Install”, and / or “Provide” appear, the following definitions apply:

Furnish - to supply or give.
Install - to place, establish or fix in position.
Provide - to furnish and install as defined above.

CODES, PERMITS, AND FEES:

The Contractor shall give all necessary notices, including electric and telephone utilities, obtain all permits, and pay all government taxes, fees, and other costs, including utility connections or extensions in connection with his work file all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction at each phase of construction as required; obtain all required certificates of inspection for his work and deliver same to the Architect before request for acceptance and final payment for the work.

The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings (in addition to contract drawing and documents) in order to comply with all applicable laws, ordinances, rules, and regulations, whether or not shown on drawings and / or specified.

All work and materials under this section shall be in strict compliance with more stringent requirements of the North Carolina State Building Code, including the National Electrical Code, NFPA 101-Life Safety Code, Regulations of the State Fire Marshall, UL Directory of Electrical Construction Materials, and requirements of the local utility company.

VERIFICATION OF DIMENSIONS, DETAILS, EXISTING FIELD CONDITIONS:

The Contractor shall visit the premises prior to bidding, and thoroughly familiarize himself with all details of the work, working conditions, verify dimensions in the field, provide advice of any discrepancy, and submit shop drawings of any changes he proposes to make in quadruplicate for approval before starting any work. The Contractor shall install all equipment in a manner to avoid building interference.

COORDINATION WITH EQUIPMENT PROVIDED BY OTHERS:

Electrical contractor shall coordinate voltage, phase and amperage requirements for all Plumbing, HVAC, and Kitchen equipment with the sub-contractor providing the equipment prior to ordering electrical gear submittals. Make adjustments to panels, feeders, and breakers as necessary to feed actual equipment being provided. Make engineer/architect aware of any conflicts or issues.

ACCEPTABLE MANUFACTURERS:

Acceptable manufacturers, as specified in the Contract Documents, implies that the specified manufacturer may produce acceptable products equal in quality of materials and performance to such item specified. The Contractor will be required to provide products meeting or exceeding the "Standard of Quality and Performance" as dictated by the product selection noted. However, any changes which result (from substitution of other manufacturers) in the electrical work or work of other Contractors, shall be paid for by the Contractor.

SHOP DRAWINGS:

The Contractor shall submit five (5) copies of the shop drawings to the Architect for approval within thirty (30) days after the award of the general contract. If such a schedule cannot be met, the Contractor may request in writing for an extension of time to the Architect. If the Contractor does not submit shop drawings in the prescribed time, the Architect has the right to select the equipment.

Provide manufacturer's cuts of items to be provided under this Contract. Included, but not limited to these items, are any of the following which may be required in this Contract: Fixtures, switches, outlet boxes, device plates, panelboards, transformers, conductors, pull boxes, wiring troughs, circuit breakers, disconnect switches, emergency fixtures, receptacles, etc.
The shop drawings shall be neatly bound in five (5) sets and submitted to the Architect with a letter of transmittal. The letter of transmittal shall list each item submitted along with the manufacturer's name.

Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications.

COORDINATION WITH OTHER TRADES:

Coordinate all work required under this section with work of other sections of the specifications to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings and shall make sure that proposed equipment can be accommodated. If interferences occur, Contractor shall bring them to attention in writing, prior to signing of contract; or, Contractor shall at his own expense provide proper materials, equipment, and labor to correct any damage due to defects in his work caused by such interference.

INSPECTION AND CERTIFICATES:

On the completion of the entire installation, the approval of the Architect and Owner shall be secured, covering the installation throughout. The Contractor shall obtain and pay for Certificate of Approval from the public authorities having jurisdiction. A final inspection certificate shall be submitted to the Architect prior to final payment. Any and all costs incurred for fees shall be paid by the Contractor.

EQUIVALENTS:

When material or equipment is mentioned by name, it shall form the basis of the Contract. When approved by the Architect in writing, other material and equipment may be used in place of those specified, but written application for such substitutions shall be made to the Architect as described in the Bidding Documents. The difference in cost of substitute material or equipment shall be given when making such request. Approval of substitute is, of course, contingent on same meeting specified requirements and being of such design and dimensions as to comply with space requirements.

EXCAVATING AND BACKFILLING FOR ELECTRICAL WORK:

Refer to Sections 02202, 02220 and 15150.

CUTTING AND PATCHING:

On new work, the Electrical Contractor shall furnish sketches to the General Contractor showing the locations and sizes of all openings and chases, and furnish and locate all sleeves and inserts required for the installation of the electrical work before the walls, floors, and roof are built. The Electrical Contractor shall be responsible for the cost of cutting and patching where any electrical items were not installed or

where incorrectly sized or located. The Contractor shall do all drilling required for the installation of his hangers. See also Section 01050.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

CONDUIT SYSTEM:

Furnish and install all conduits, or other raceways, fittings, boxes, and other component parts specified or required for completion and proper operation of the power distribution, fire alarm, data, security and other low voltage systems shown on the drawings. See also Fire Alarm, IC and Security drawings and coordinate closely with all of the Low Voltage System Sub-Contractors for their requirements during construction.

Other than as noted above, conduit shall be sized in accordance with the current NEC. All conduit shall be neatly installed parallel to, or at right angles to beams, walls and floors of the building in a neat and workmanlike manner. All bends shall be made with standard conduit elbows or conduit bent to not less than the same radius as that of a standard conduit elbow. Conduits shall be supported at intervals not greater than 8' and within 3' of any bend, cabinet, outlet or junction box. Conduits shall be supported by approved pipe straps or clamps, secured by means of toggle bolts on hollow masonry, expansion shields and machine screws or standard pre-set inserts on concrete or solid masonry, machine screws or bolts on metal surfaces, and wood screws on wood construction.

Conduit 3/4” (minimum) and larger shall be electrical metallic tubing (EMT). EMT shall be cold-rolled steel tubing with a coating on the outside and protected on the inside by a zinc, enamel, or equivalent corrosion-resistant coating and conforming to the requirements of ANSI C 80.3-1966 or later edition. EMT may be installed in dry construction in furred spaces, in partitions other than concrete and solid plaster, or for exposed work except on mechanical structures or supports, or in refrigerated areas. EMT shall not be installed where: it will be subject to physical damage; where it will be installed nearer than 4’ from finished floor in exposed areas; where it will be subject to severe corrosive influence; where the trade size is larger than 2”; where it will be installed in masonry walls; or where tubing, elbows, couplings, and fittings would be in concrete or in direct contact with the earth. Electric metallic tubing fittings shall be all plated steel hexagonal threaded compression type, with insulated throats. No pot metal, set screw, or indenter fittings shall be used. PVC conduit shall be used in masonry wall construction. Contractor shall transition to EMT or rigid conduit at the top of masonry walls. PVC conduit shall not be used in stud walls.

Connections to lighting fixtures will be permitted with flexible steel conduit strapped every 6’-0”, with UL listed AC type cables, used in strict accordance with current NEC Article 333. Armored Cable assembly shall encase conductors in a continuous length of galvanized cold rolled steel strip, spirally wound with adjacent strips locked to turn all edges inward. The ends shall be terminated with fiber bushings to protect conductors from sharp edges. Fittings shall be the insulated throat type, T & B 3100 series or equivalent.

All underground conduit shall be UL Listed Schedule 40 PVC conforming to Article 347 of the current NEC, or rigid galvanized steel. At the Contractor's option, this installation may consist of rigid steel conduit with PVC coating, minimum of 15 mils of PVC. Where schedule 40 PVC is installed under floor slabs, the elbows required to turn the raceway up into cabinets, equipment, etc., shall be of rigid steel. A copper ground wire shall be installed in all PVC conduits . PVC conduit shall not be used above the floor slab, unless roughed-in masonry wall.

All exposed conduit to 5’- 0” above finish floor shall be rigid galvanized steel or IMC conduit. Liquid-tight flexible steel conduit with an extruded PVC jacket shall be used for connections to exterior motors and compressors. Liquid-tight flexible conduit fittings shall be insulated throat type, Appleton STB type or equal.

All permanent conduit stub-outs shall be sealed with galvanized standard water pipe caps immediately after installation. All conduits crossing expansion joints shall have approved type expansion fittings as manufactured by Crouse Hinds, Killark or Appleton. Fittings shall be of type to ensure ground continuity. Provide a 240 lb. tensile strength poly pull-wire in all empty conduits.

SURFACE MOUNTED RACEWAY

Two piece metal surface mounted raceway shall be used in all cases where it is not possible or desirable to run conduit concealed in the wall unless specifically noted otherwise on the plans. Provide Wiremold 3000 Series or equal. Provide large divided two channel raceway (4000 Series) in locations where power and low voltage wiring are to be routed in the same raceway.

OUTLETS AND PULL BOXES:

All boxes shall be UL labeled or listed by an approved agency. At each location where required, an outlet box of a type to suit the intended use shall be installed. Boxes shall be fastened to building structure in an approved manner. Flush outlet, junction and pull boxes shall be pressed galvanized or sheradized steel, either square or octagonal with knockouts on tops and sides, and fitted with plaster covers where necessary to set flush with the finished surface. For use in hollow-core masonry walls, switch boxes shall be of sufficient depth to permit conduit to rise in the core with minimum cutting of block. Provide plaster rings or box extensions for flush devices with finish surface. Boxes for unplastered masonry walls shall be masonry type with device mounting ears on the interior of the box.

Convenience outlet boxes shall be generally mounted approximately 18" above floor, 48" above floor in mechanical equipment rooms and shop type areas, and 4" above counter backsplash, unless otherwise noted. Convenience outlets for drinking fountains shall be installed behind fountain enclosure so as not to be visible; coordinate with Plumbing Contractor.

Lighting switch outlet boxes shall be 4' above floor, unless noted or required otherwise. Where switches occur in 4' high tile walls, they shall be lowered by 6 inches.

Pull boxes shall be used as required in long runs of conduit to facilitate pulling of wires. All interior pull boxes shall be constructed of code gauge galvanized sheet metal, and not less than the minimum size recommended by the NEC. Boxes shall be furnished with screw-fastened covers. When several feeders pass through a common pull box they shall be tagged to indicate clearly their electrical characteristics, circuit number, and panel designation. Wire markers shall be as manufactured by W. H. Brady Co., or equal. In no case shall a pull box be installed in an inaccessible location. Boxes shall be provided with fixed or removable steel barriers for each circuit where two or more feeders pass through the box. In case of banked conduit runs consisting of more than two horizontal rows of conduits, where barriers would be impracticable, the cables for each conduit shall be tied together with heavy waxed twine and wrapped with one wrap of heavy grade tape.

Where two or more outlets are to be installed in one location, they shall be installed in gang boxes suitable for the intended purpose.

Outlet boxes for outdoor use, and for exposed use where not covered by fixture canopies, shall be cast metal suitable for the intended purpose, having integral threaded hubs, and of the weatherproof type with gasket. Provide special outlet boxes where indicated.

All junction boxes shall be marked with panel and circuit number which it contains.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

CONDUCTORS FOR 600 VOLTS OR LESS:

All conductors shall be copper with a minimum conductivity of 98% and shall be delivered to the job site in their original packages, marked or tagged as follows : UL label , size, type, and insulation of the wire; name of manufacturer and trade name of the conductor: and date of manufacture. All conductors shall be insulated for 600 volts unless otherwise indicated. Furnish and install all conductors specified or required for completion and proper operation of the various systems shown on the drawings.

Conductors shall be 600 volt type THW or THWN. Branch circuit conductor shall not be smaller than No. 12 AWG, except where specifically noted otherwise. Home runs originating more than 80' at 120 volts from panel location shall be No. 10 AWG minimum size. Wires No. 10 AWG and smaller shall be solid; wires No. 8 AWG and larger shall be stranded. Where branch circuits are fed through fluorescent fixture channels, use code grade type THHN or XHHW. All MC cables where permitted shall include a separate copper ground conductor sized per phase conductors.

Provisions of Section 210-5, Color Code, NEC, shall be strictly complied with. Color coding shall include feeders and mains and be consistent throughout entire system. For 120/208 volt systems, use black, red, and blue for phases A, B, & C respectively. For 277/480 volt systems, use brown, orange, and yellow for phases A, B, & C respectively.

All conductors in vertical raceways shall be properly supported at intervals not greater than those specified in Section 300-19 of NEC.

All wire and cable except as specifically stated otherwise, shall be of one of the following makes: Anaconda Wire and Cable Co., General Cable Corp., General Electric Co., or Okonite Co.

JOINTS AND CONNECTIONS:

The Engineer reserves the right to inspect any and all joints made in wiring. If they are taped prior to being inspected, the tape shall be removed as ordered from any joint or joints for inspection. After inspection and correction of any fault found, the Contractor shall properly retape the joints.

Conductors shall be continuous without joints or splices in runs between outlet boxes. All splices shall be made at boxes only. Where stranded conductors are to be connected to any apparatus, bus work, switches or fuse blocks, they shall be connected by suitable mechanical solderless type lugs or spades. All lugs shall be permanently bolted in such position as to give maximum contact surface available. Where multiple circuits are run from same switch or panel, individual lugs for each conductor shall be used. Feeder taps in junction boxes or panel gutter shall be made with insulated cover panel guttertaps. Feeder conductors shall not be spliced, feeder conductors shall be continuous for the length of run.

Solid conductors, namely those sized #10 and #12 AWG copper, shall be spliced by using Ideal "wire-nuts", 3M Co. "Scotchlok", or T & B "Piggy" connectors for branch circuit splices in junction boxes and light fixtures, except recessed fixtures as noted above. "Sta-Kon" or other other permanent type crimp connectors shall not be used.

Stranded conductors, namely #8 AWG copper and larger, shall be spliced by approved mechanical connectors plus gum tape, plus friction or plastic tape. Solderless mechanical connectors, for splices and taps, provided with UL approved insulating covers, may be used instead of mechanical connectors plus tape.

DEVICE PLATES:

A device plate shall be provided for each outlet to suit the device installed. All plates shall be no. 302 stainless steel construction. All plates shall be “jumbo” size.

Device plates shall be of the one piece type, of suitable shape for the devices to be covered. The use of sectional device plates will not be permitted. Plates having a .375" bushed hole in the center shall be installed on all wall mounted outlets for telephones.
Devices and/or plates installed prior to painting shall be properly taped and shall be cleaned after painting, if necessary. Blank plates shall be installed on all unused outlets.

Plates shall be manufactured by Pass & Seymour, Bryant, or Hubbell. Provide sample of plates to Architect for approval.

RECEPTACLES:

Duplex convenience outlets for general use shall be rated 20 amperes, 125 volts, duplex, for standard parallel blade three-wire grounded type caps, Hubbell No. 5362-I (ivory), Leviton, Pass & Seymour or Arrow-Hart or approved equal. Color to be selected by Architect. Where outlets are installed vertically, ground plug position shall be on top and on right side where outlets are installed horizontally.

SPECIAL USE RECEPTACLES:

Provide special receptacles including receptacles with ground fault circuit interrupter protection, where needed, as required by equipment. Provide MOV-based transient voltage surge suppression devices (SS), where shown on plan. Tamper-resistant receptacles (TP) shall prevent insertion of objects other than a properly rated 2 or 3 wire plug using “floating” shutters. Equal devices by Hubbell, Leviton, Pass & Seymour or Arrow-Hart are considered acceptable.

WALL SWITCHES:

Wall switches shall be installed as shown on the drawings and shall be connected to provide control of the outlets indicated. Switches shall be rated at 20 amperes for 120 volts or 277 volts lighting circuits. Hubbell No. 1221 (or 1221-1), for single pole: Hubbell Catalog No. 1223 (or 1223-1) for 3-way; Hubbell Catalog No. 1224 (or 1224-1) for 4-way. Weather-proof switches shall be Hubbell No. 1781 single pole or Hubbell No. 1783 3-way. Provide sample of switches to Engineer for approval. Color of switches to be selected by Architect.

Automatic light switches shall have passive infra-red occupancy switch with light sensor to prevent light from switching on when daylight is above pre-set level. Switch shall be UL listed, have adjustable time delay of 30 seconds to 30 minutes, auto/off control, and minimum coverage of 900 square feet, Automatic light switch shall be UNENCO model no. D-IS.

Provide special purpose switches where noted on the drawings, or elsewhere. Equal devices by Pass & Seymour or Arrow-Hart are considered acceptable.

For wall switches indicated as dimmers on LED lighting, coordinate the exact 0-10 volt dimmer that is compatible with LED driver at 277V for the specific fixtures provided. Install the correct size wall box to accommodate the specific dimmer to be installed.

END OF SECTION

SERVICE EQUIPMENT AND POWER DISTRIBUTION:

Furnish, install and completely connect the circuit breaker type service, panelboard and distribution equipment as indicated. All construction shall meet applicable standards of ANSI, IEEE, and NEMA, and all equipment shall bear UL label insofar as it is available. Equipment shall be Square D QED, I-Line or QMB; equipment manufactured by Cutler-Hammer (Eaton) , General Electric, or ITE Siemens will be considered equal.

Provide a copper bus interior with an insulated neutral in the Main Distribution Panel. This neutral bus shall be the source for all insulated neutral conductors of the system. Jumpers shall be installed to connect the insulated neutral bus to the uninsulated grounding bus. The uninsulated grounding bus shall be the source of grounds for all grounding and bonding (not neutrals) of equipment. Equipment UL listed for use as a Service Entrance shall have the Neutral and Ground bars bonded together per Current NEC requirements.

Electrical contractor is responsible for providing all transformer and equipment data to gear supplier as necessary for the supplier to evaluate and coordinate any circuit breaker settings to ensure that downstream breakers trip prior to any upstream breakers.

LIGHTING AND POWER PANELBOARDS:

Panelboards shall be of the thermal-magnetic circuit-breaker type and shall consist of an assembly of single, double, and triple-pole breakers. Each circuit-breaker shall be bolted-in, removable without disturbing the adjacent units and shall have trip ratings as indicated. All multipole breakers shall be common trip. Ground fault circuit breakers shall be used as indicated on the drawings.

Each panelboard shall be installed in an appropriate cabinet of sufficient size with top 6’- 0” above finish floor and shall conform to the requirements of UL standard for cabinets and boxes. Standard cabinets with surface or flush type trim and door shall be used, as required. Cabinets shall have a minimum width of 20" unless noted otherwise. A neutral bar shall be provided in each panel with a terminal for each breaker. Grounding lugs shall be provided.

Cabinet shall be made of spot welded galvanized sheet steel not less than N.E.C. gauge with hinged door and trim of the same material. When closed, the door shall fit accurately in the opening provided and present a flush finish with the trim. The door shall be equipped with a key operated lock. Furnish one key with each lock. All door locks shall be keyed alike. Knockouts in cabinets are not acceptable. Cabinets shall be finished with manufacturer's standard painted finish.

On the inside of each door, a typewritten directory identifying each circuit shall be mounted in a suitable protective enclosure. Panelboards shall have laminated plastic designations on inside corresponding to feeder and drawing identifications.

Panelboards shall be Square D I-Line or NQOD Series or equal by Cutler-Hammer, General Electric, or Siemens.

SHUNT TRIP PROTECTION:

All electrical equipment located under a kitchen hood with a fire suppression system shall be protected by a shunt trip device that is interlocked with the suppression system. Upon activation of the suppression system the shunt device shall trip and disconnect power for the equipment under the hood. This may be done via individual shunt trip breakers or a single main breaker that is shunted upon activation of the suppression system. If a main shunt breaker is utilized no circuits should be fed from the respective distribution panel other than the circuits for the equipment under the hood. Elevator feeder circuits shall also be protected by a shut trip device if the elevator shaft and/or the elevator equipment room are protected by a fire suppression system. Coordinate with the General Contractor for final plans from the Sprinkler Design-Build Contractor.

SURGE PROTECTION:

Furnish and install transient voltage surge suppressor (TVSS) units where indicated on the drawing risers as 'SP' to protect AC electrical circuits from the detrimental effects of lightning, utility switching transients, AC motor transients, and other internal generated transients. TVSS shall comply with UL 1449, have a Category C pulse life for all protection modes (L-N, L-G or L-L where applicable), shall operate bio-directionally, and shall have a maximum single pulse current capacity of 50 KA per mode in accordance with NEMA LS1-1992. Acceptable manufacturers include Leibert, Current Technology, LEA, and United Power. Provide complete shop drawing submittal including installation instructions, dimensional drawings, clamp voltage data, and 3rd party data confirming single pulse current capacity rating. Provide on-site manufacturer's testing and start-up.

SAFETY DISCONNECT SWITCHES:

Disconnect switches shall be horsepower rated, installed where indicated and / or required by the NEC. Switches, except where shown as beined by other sections shall be furnished under this Section. Switches shall be heavy duty, fused unless otherwise noted, sized as shown, quick-make, quick-break, NEMA type "ND" with NEMA 1 enclosure, type HD, Square D. Switches to be installed outdoors shall be NEMA type 3R, with raintight conduit hubs. All switches shall be capable of being locked in the "off" position. Fuses shall be one-time, non-renewable types, dual-element, time-delay, Bussman or equal as required for application.

MOTOR STARTERS:

Motor controllers shall, unless otherwise specifically noted, be combination magnetic type, with thermal overload relays and heaters in each phase conductor, with operating coils for 120 volts as noted on the drawings or as required. Maximum trip rating of starters for hermetic motors shall be at least 105% of the nameplate full load current of the motor.

Starters shall be provided with build-in selector switches (H-O-A) or pushbutton stations where required. Combination starters shall be provided with sufficient auxiliary contacts or control relays for control sequence as specified, indicated or as required, and with sufficient auxiliary contacts on its circuit breaker or with control relays so that opening the circuit breaker ahead of the starter unit opens all hot control lines within the starters. All starters furnished under this Section shall be mounted in individual NEMA I enclosures, unless otherwise specified or indicated on drawings. Special requirements are specified in the separate Sections of this Division or indicated on the drawings.

LIGHTING CONTACTORS:

Each lighting contactor shall have heavy-duty ballast load rated contacts. Each contactor shall have mechanically held contacts, and silver cadmium oxide double break contacts. Contacts shall be field convertible with normally open and normally closed indicators. Each contactor shall be UL listed and CSA certified. All new lighting contactors for each new building shall be housed in a properly sized NEMA-1 enclosure with fully hinged and lockable door.

FIRE ALARM & HVAC CONTROLS:

Electrical contractor is responsible for all conduit and wiring required to power any fire alarm control or booster panels, magnetic door holders, and the HVAC Building Automation Controls system cabinets. There shall be at least (2) Fire Alarm and (2) HVAC control system circuits per wing of the school. Coordinate exact location and quantity of cabinets with Fire Alarm and Mechanical's Controls Sub-Contractor. Termination to Fire Alarm and HVAC controllers and to HVAC equipment shall be by controls contractor. Electrician shall use 1P-20A circuits designated as Fire Alarm or HVAC Controls on panel schedules or the closest available spare 1P-20A (120V) breakers for powering the controls system. Notify Engineer if circuits were not indicated and update panel directories on Record Drawings.

GROUNDING:

Provide a bare stranded continuous copper grounded conductor, size as indicated, from the service equipment grounding bus to the cold-water service main where it enters the building ahead of main valve on water pipe main. Also, provide a driven ground per NEC 250-81 (a). Provide all necessary grounding clamps and full-size jumpers around all valves, meters, and similar fittings between point of connection and street main. The main grounding conductor shall be connected to the neutral conductor at one location only, within and on the low voltage side of the main transformer and more specifically the equipment grounding bus associated with the main insulated neutral bus in the MDP. The insulated neutral bus must be insulated and serve to provide the neutral source for all the insulated neutral conductors of the system. Jumpers shall be installed to connect the insulated neutral bus to the uninsulated grounding bus and all grounding and bonding of equipment (not neutrals) shall be attached to the uninsulated grounding bus.

System and equipment grounds shall be checked for proper value of resistance using the Megger ground tester in accordance with the method prescribed by the manufacturer of the instruments. Resistance of ground shall not be in excess of 25 ohms, measured to include the grounding cable. The Contractor shall report the results of these tests to the Engineer in writing. If the resistance cannot be reduced to the value prescribed above, further instructions will be given the Contractor.

All equipment connected under this section shall be grounded and shall conform with the more stringent requirements of the NEC, National Electrical Safety Code, the N. C. State Building Code, or this specification.

Panels, junction boxes, safety switches, disconnect switches, contactors, starters, motors, dry transformers, bus duct and other equipment shall be bonded to the conduit system with a grounding conductor by means of grounding locknuts and bushings as required hereinafter, except where conduit terminates in threaded hub or fittings. All joints or terminations shall be made with standard tapered pipe threads drawn tight to preserve electrical continuity.

Provide grounding bushings and copper jumpers across all concentric or eccentric knockouts and on all conduits larger than 1". Elsewhere, double-lock-nuts with plastic or fiber bushings, or a single lock-nut and malleable bushing may be used. If Contractor selects to use a single locknut and malleable bushing, care shall be taken that the full number of threads project through to permit the bushing to pull tight against the ends of the conduit, after which the lock-nut shall be made up sufficiently tight to draw the bushing into firm electrical contact with the box.

Where flexible conduits are used, provide grounding conductor within flexible conduit to ensure continuity of ground. Minimum size of jumper around flex shall be No. 10.

EQUIPMENT IDENTIFICATION:

Provide black-on-white laminated plastic name plates for each switch or circuit breaker on service equipment, disconnect switches, terminal cabinets, panelboards and wiring troughs. The name plate shall be engraved to indicate the equipment controlled or identified. Name plates shall be securely fastened to equipment using two screws.

CONNECTIONS TO EQUIPMENT:

Electrical Contractor shall provide rough-in, junction box, or wiring trough as indicated. Electrical Contractor shall provide and install disconnect switches and motor starters for equipment provided under Division 16. All external disconnect switches, motor starters, and any fuses required for equipment furnished under Division 15 shall be provided by the Div 15 contractor and installed by the Electrical Contractor. Coordinate all equipment locations with all other contractors prior to installation of electrical equipment. Consult all Contract drawings which may affect location of equipment or apparatus furnished by others and make any minor adjustments as required. Electrical Contractor is responsible for all line side and load side wiring for all equipment requiring electrical power. Line side wiring is defined as the wiring from the distribution panel circuit

to the point of disconnect (internal or external) for the equipment, whether provided by the contractor or factory installed by the equipment manufacturer. Load side wiring is defined as the wiring from the point of disconnect to all equipment requiring electrical power. All final electrical terminations to the piece of equipment shall be done by the contractor providing the equipment.

Electrical Contractor must closely coordinate with the equipment supplier regarding Voltage, H. P., F. L. A., outlet mounting heights, connection cord plug-receptacle electrode configurations and other special wiring requirements.

Electrical Contractor is responsible for coordinating quantity and location of all sprinkler system devices with sprinkler contractor.

Electrical Contractor shall review the Architectural, Civil, Plumbing, Mechanical, Fire Alarm and IT plans to provide branch circuits and final connections to powered equipment furnished by others for complete and operational equipment. This is a sample list and may not represent all connections required:

1) MDF & IDF equipment racks
2) Electronic Door Closers or Access Control Electric Doors.
3) HVAC Controls Equipment
4) Controlled Access electrified security doors (See Door Hardware Schedule)
5) Sprinkler controls/panels
6) Projectors and associated screens
7) Hand Dryers (See Architectural plans and elevations)
8) Electric Water Heaters & Associated Recirculation Pumps (Refer to Plumbing Plans)
9) Clothes Washers and Dryers
10) Fire Alarm Control Panels and Booster Panels (See FA Contractor Shop Drawings)
11) Fire Shutters (See Architectural Plans & Specifications)
12) Motorized Basketball Goals and/or Gym Divider Curtains
13) Scoreboards and Shot Clocks
14) Motorized Bleachers
15) PA Systems and associated ampliphiers (Gym, Café, Auditoriums and MP Rooms)
16) Powered Hotboxes (See Civil Site Plan for exact locations)

END OF SECTION

PART I: GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 16 Section'Wires and Cables" for requirements for grounding conductors.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for grounding rods, connectors and connection materials, and grounding fittings.

C. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Field tests and observation reports certified by the testing organization and indicating and interpreting the test reports for compliance with performance requirements.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, or a full member company of the International Electrical Testing Association (NETA).

1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Comply with NFPA 70.

C. Comply with UL 467.

D. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1 . The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

PART II: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Erico Inc.; Electrical Products Group.
2. Galvan Industries, Inc.
3. Heary Brothers Lightning Protection Co.
4. Ideal Industries, Inc.
5. Kearney.

6. O-Z/Gedney Co.
7. Raco, Inc.
8. Thomas & Betts, Electrical.

2.02 GROUNDING AND BONDING PRODUCTS

A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.03 WIRE AND CABLE GROUNDING CONDUCTORS

A. Comply with Division 16 Section 'Wires and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

1. Material: Copper.

B. Equipment Grounding Conductors: Insulated with green color insulation.

C. Grounding-Electrode Conductors: Stranded cable.

D. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.

E. Bare Copper Conductors: Conform to the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

2.04 MISCELLANEOUS CONDUCTORS

A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.

B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Bonding Straps: Soft copper, 0.05 inch (1 mm) thick and 2 inches (50 mm) wide, except as indicated.

2.05 CONNECTOR PRODUCTS

A. Exothermic-Welded Connections: Provided in kit form and selected per manufacturers written instructions for specific types, sizes, and combinations of conductors and connected items.

2.06 GROUNDING ELECTRODES AND TEST WELLS

A. Grounding Rods: Copper-clad steel.

1. Size: 5/8 inch by 120 inches (16 by 3000 mm).

B. Plate Electrodes: Copper, square or rectangular shape. Minimum 0.10 inch (3 mm) thick, size as indicated.

PART III: EXECUTION

3.01 APPLICATION

A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

1 . Install equipment grounding conductor with circuit conductors for all circuits and feeders.

B. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide a No. 4 AWG minimum insulated grounding conductor in raceway from grounding-electrode system to each Telephone Terminal Board (TTB).

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50by-300-mm) grounding bus.

C. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-26.

D. Metal Poles Supporting Outdoor Lighting Fixtures: Ground pole to a grounding electrode in addition to separate equipment grounding conductor run with supply branch circuit.

3.02 INSTALLATION

A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.

B. Electrical Room Grounding Bus: Space 1 inch (25 mm) from wall and support from wall 6 inches (1 50 mm) above finished floor, except as otherwise indicated.

C. Grounding Rods: Locate a minimum of 1 -rod length from each other and at least the same distance from any other grounding electrode.

1. Drive until tops are 2 inches (50 mm) below finished floor or final grade, except as otherwise indicated.
2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.

D. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

E. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 inches (600 mm) below grade.

F. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install a grounding jumper across dielectric fittings. Bond grounding conductor conduit to conductor at each end.

G. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.

H. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

3.03 CONNECTIONS

A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1 . Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat an-u' seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections. Comply with manufacturers written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and grounding rods.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturers published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

H. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Agency: Engage an independent electrical testing organization to perform tests described below.

B. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.

C. Maximum grounding to resistance values are as follows:
1. Equipment Rated 500 kVA and Less: 10 ohms.
2. Equipment Rated 500 to 1000 kVA: 5 ohms.

D. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

E. Report Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.05 ADJUSTING AND CLEANING

A. Restore surface features, including vegetation, at areas disturbed by work of this Section. Reestablish original grades, except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

LIGHTING FIXTURES:

Furnish and install all lighting fixtures as indicated on the drawings. Fixtures shall be complete with globe or reflector, and lamps, and wired ready for operation at the completion of installation. All fixtures shall have UL approval under their latest rulings indicating that fixture is approved for the intended usage. This Contractor shall provide proper fixture frames to suit type and dimensions of ceilings, confirming ceiling data with Contractor prior to ordering fixtures.

All fixtures shall be self-supporting, independent of the suspended ceiling. Fixtures shall be secured to the structure at a minimum of two points at opposing ends by wire equal to gauge of wire suspending the ceiling. Where fixture channels are joined to form a continuous length, provide one hanger at each end of the run and at each joint. Damaged fixtures shall be replaced at Contractor's expense.

ELECTRONIC DRIVERS/BALLASTS:

Fluorescent ballasts shall be high power factor electronic ballasts where indicated on schedule, designed for the rapid start operation of T8 lamps. Electronic ballast shall have a frequency of operation of 20 KHZ or greater, and operate without visible flicker. Ballast shall be UL listed Class P, CSA certified, sound rated "A", withstand line transients as defined in ANSE/1EEE C62-41 Category A, and meet FCC requirements of Rules and Regulations, Part 18 for non-consumer equipment. Electronic ballast casing temperature shall not exceed a 25°C rise over 40°C ambient temperature or not exceed 85°C total. Electronic ballasts shall be by Advance Transformer Co., model Mark V or approved equal by Motorola or Magnetek.

LAMPS:

All lamps shall be as manufactured by Sylvania, Phillips, or General Electric Co.. Incandescent lamps shall be inside frosted 130V extended service unless otherwise noted. The Contractor shall be responsible for replacing **all** lamps which burn out during warranty period starting after Owner accepts project.

Unless indicated otherwise on drawings, LED and/or fluorescent lamps shall have energy saving drivers/ballasts, and a 3500 K color temperature with a color rending index of 80 or better.

High pressure sodium lamps shall be GE "Lucalox" series or equal with median value of rated life no less than 24,000 hours.

EMERGENCY LIGHTING:

Furnish and install specified battery-powered emergency lighting units where indicated on the plans. Emergency lighting unit shall comply with the State of North Carolina Department of Insurance Document entitled "Requirements for Battery Powered Emergency Lighting Units" all subsequent addenda. Fixture shall have test light and switch accessible and visible from floor.

EXIT LIGHTING:

Furnish and install LED emergency exit sign with battery backup, brown-out protection, pilot light, test switch, and regulated power supply, where indicated on the plans unless specified otherwise. Exit signs shall comply with the State of North Carolina Department of Insurance Document entitled "Requirements for Electrically Powered Exit Signs" dated 20 March 1995 and all subsequent addenda.

EXIT & EMERGENCY LIGHTING CONTROLS:

Contractor shall make provisions for Building Automation System (BAS) under Division 15 to exercise batteries on 21 to 28 day cycles. Coordinate with MC during rough-in as required with junction box for low voltage input to contactor.

LIGHTING CONTACTORS:

Each lighting contactor shall have heavy-duty ballast load rated contacts. Each contactor shall be normally closed contacts with mechanically held operators for open position, and silver cadmium oxide double break contacts. Contacts shall be field convertible with normally open and normally closed indicators. Each contactor shall be UL listed and CSA certified. All new lighting contactors for each new building shall be housed in a properly sized NEMA-1 enclosure with fully hinged and lockable door.

OUTDOOR LIGHTING CONTROLS:

For outdoor lighting applications, furnish and install contactors rated for load and photocells. Contractor shall make provisions for Building Automation System (BAS) or energy management control. Coordinate with MC during rough-in as required with junction box for low voltage input to contactor.

Photocells where indicated on drawing, shall be mounted in weather-proof enclosure under eastern facing eaves/overhangs with turn-on / off operations at 3-5 fc. Photocell shall be intermatic type K4221, for 120V and K4233 for 277V applications. Acceptable manufacturers are Tork, Intermatic, or Paragon. Photo cells shall not control luminaires directly all luminaries shall be controlled through a lighting contactor. Coordinate photocell specified with contactor coil rating.

END OF SECTION

PART 1.0 - GENERAL

1.1 DESCRIPTION:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
B. Division 16 Basic Electrical Materials and Methods sections apply to work specified in this section. Fire Alarm System shall comply with N. C. Department of Insurance document entitled "Requirements for Fire Detection and Alarm Systems" dated 25 July 2005 as included within this specification section.
C. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.
D. The fire alarm system shall comply with requirements of 2005 NFPA Standard 72 except as modified by the North Carolina State Building Code and local codes and ordinances. The system shall be electrically supervised and monitor the integrity of all conductors.
E. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).
F. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.
G. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

1.2 AUTHORITY HAVING JURISDICTION (AHJ) DEFINED, BUILDING PERMITS:

A. **For State-owned facilities in North Carolina** the AHJ for Code compliance is the NC Department of Insurance - Office of State Fire Marshal. The AHJ for construction administration and inspection purposes is the entity that contracted for the design services, either the State Construction Office or the owning Agency, as applicable. NOTE: Fire alarm system inspection or acceptance testing may be delegated to the design engineer by contract.

   No building permit is required for construction or renovation of facilities that are funded by the State of North Carolina and located on State-owned land. However, privately-funded projects on land leased from the State (e.g., student housing) must still be submitted to local building officials for approval, permits, and inspections.. (See below.) Written NCDoI approval of the plans and specifications submitted for review is considered the equivalent of a building permit for State projects but that alone does not give authorization to proceed with construction. Such authorization requires written clearance from the entity that administers the contract.

B. **For private sector or local government projects** the AHJ is the local government entity that
approves project plans, issues building permits, and inspects construction.

1.3 SCOPE:

A. A new intelligent reporting, microprocessor-controlled fire detection system shall be installed in accordance to the project specifications and drawings.
B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 7 (Class A) Signaling Line Circuits (SLC).
2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
4. Digitized electronic signals shall employ check digits or multiple polling.
5. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
6. Alarm signals arriving at the main FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
7. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone which ever is greater.
8. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
9. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
10. Two-way telephone communication circuits shall be supervised for open and short circuit conditions.

C. BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED on the FACP shall flash.
2. A local piezo electric signal in the control panel shall sound.
3. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. FACP history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
5. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

D. MONITORING OF SIGNALS BY SUPERVISING STATION:

1. Each system with automatic fire detection, or which monitors a sprinkler system, shall be equipped with a 4-channel (minimum) Digital Alarm Communicator Transmitter (DACT) for transmission of fire alarm, supervisory, and trouble signals to a Central Station, Remote Supervising Station, or Proprietary Supervising Station. The following signals shall be reported as applicable, in accordance with 3.4.
   • Fire Alarm
   • Burglary / Intrusion / Duress / Other Security or Emergency Alarm (See 3.3)
   • Fire Alarm System AC Power Trouble (only if 120vac interrupted for 8 hours)

   EXCEPTION #1: In lieu of a DACT, the use of an addressable network is acceptable. Other appropriate means of transmitting fire alarm system signals off-premises may be permitted to be used, at the discretion of the AHJ who approves the plans.

2 The precedence of signals transmitted to the Supervising Station shall be as follows:
   1. Fire Alarm
   2. Security Alarm
   3. Supervisory Signal
   4. Trouble Signal

Fire Alarm System AC Power Trouble signal must not be sent unless maintained for 8 hours, to avoid nuisance transmissions to the supervising station from short term 120vac power outages (from switching transients, thunderstorms, etc.).

3. The Contractor must provide a type of DACT that is compatible with the owner's alarm receiving equipment, or the Supervising Station selected by the owner, as applicable. He must also program the PROM, connect each DACT to the telephone line(s) provided to him, and verify proper signal receipt by the Supervising Station.

1.4 SUBMITTALS

A. General:
   1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
   2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
   3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
   2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
   3. Show annunciator layout, configurations, and terminations.

C. Manuals:
   1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
   2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
   3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications
   1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
   2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

E. Certifications: Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.5 GUARANTEE:

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.6 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.
B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.
C. Maintenance and testing shall be on a semiannual basis or as required by the AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:
    1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
    2. Each circuit in the fire alarm system shall be tested semiannually.
    3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 7.

1.7 POST CONTRACT EXPANSIONS:

A. The contractor shall have the ability to provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.
B. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable control modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).
C. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.
D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.
E. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.8 APPLICABLE STANDARDS AND SPECIFICATIONS:

The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

A. National Fire Protection Association (NFPA) - USA:

No. 12	CO2 Extinguishing Systems (low and high)
No. 12B	Halon 1211 Extinguishing Systems
No. 16	Foam/Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
	Clean Agent Extinguishing Systems
No. 72-1996	National Fire Alarm Code

B. Underwriters Laboratories Inc. (UL) - USA:
   No. 268 Smoke Detectors for Fire Protective Signaling Systems
   No. 864 Control Units for Fire Protective Signaling Systems
   No. 268A Smoke Detectors for Duct Applications
   No. 521 Heat Detectors for Fire Protective Signaling Systems
   No. 464 Audible Signaling Appliances
   No. 38 Manually Actuated Signaling Boxes
   No. 1076 Control Units for Burglar Alarm Proprietary Protective Signaling Systems
   No. 1971 Visual Notification Appliances
C. Local and State Building Codes.
D. All requirements of the Authority Having Jurisdiction (AHJ).

1.9 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
   UL Underwriters Laboratories Inc
   FM Factory Mutual
B. The fire alarm control panel shall meet UL Standard 864 (Control Units) and UL Standard 1076 (Proprietary Burglar Alarm Systems).

PART 2.0 PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL:

A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.
B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRE:

A. Conduit:
   1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements. Raceways shall be provided for all concealed installations, rated wall penetrations and exposed installations within the boiler room. Installations within other areas shall be run raceway.
   2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross-sectional area where three or more cables are contained within a single conduit.
   3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
   4. Wiring for 24-volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch (19.1 mm) minimum.

B. Wire:
1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wiring used for the multiplex communication circuit (SLC) shall be twisted and shielded and support a minimum wiring distance of 10,000 feet. In certain applications, the system shall support up to SLCs with up to 1,000 feet of untwisted, unshielded wire. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
5. All field wiring shall be electrically supervised for open circuit and ground fault.

C. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold-water pipe or grounding rod.

2.3 MAIN FIRE ALARM CONTROL PANEL:

A. The FACP shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system-controlled devices. Basis of Design shall be Notifier. Equivalent products by Gamewell, Potter and Edwards EST, shall be considered equals. Other manufacturers require approval prior to bid submission.

B. Operator Control
1. Acknowledge Switch:
   a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
   b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
2. Alarm Silence Switch:
   Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
3. Alarm Activate (Drill) Switch:

The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

4. System Reset Switch:
   Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
5. Lamp Test:
   The Lamp Test switch shall activate all system LEDs and light each segment of the liquid crystal display.

C. System Capacity and General Operation
   1. The control panel shall provide or be capable of expansion to 396 intelligent/addressable devices.
   2. The control panel shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 3.0 amps @ 30 VDC. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance Circuits.
   3. The system shall support up to 8 additional output modules (signal, speaker, telephone, or relay), each with 8 circuits for an additional 64 circuits. These circuits shall be either Class A (NFPA Style D) or Class B (NFPA Style Y) per the project drawings.
   4. The fire alarm control panel shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
   5. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
   6. The system shall allow the programming of any input to activate any output or group of outputs. Systems which have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes.
   7. The FACP shall provide the following features:
      a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
      b. Detector sensitivity test, meeting requirements of NFPA 72, Chapter 7.
      c. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
      d. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be 1 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also include up to nine levels of prealarm, selected by detector, to indicate to maintenance personnel of impending alarms.
      e. The ability to display or print system reports.
      f. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
      g. PAS presignal, meeting NFPA 72 requirements.
      h. Rapid manual station reporting (under 3 seconds).
      i. Non-alarm points for general (non-fire) control.
      j. Periodic detector test, conducted automatically by the software.

k. Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.
l. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
m. Walk test, with a check for two detectors set to same address.
n. Control-by-time for non-fire operations, with holiday schedules.
o. Day/night automatic adjustment of detector sensitivity.
p. UL-1076 security monitor points.

8. The FACP shall be capable of coding notification circuits in march time (120 PPM), temporal (NFPA 72). Main panel notification circuits (NAC 1,2,3 and 4) shall also support special two and three stage operations. The two-stage feature allows 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. The three-stage option provides 20 PPM with one detector in alarm, 120 PPM with two detectors in alarm, and steady on with release.

D. Central Microprocessor
1. The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, non-volatile memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.

2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.
4. A special program check function shall be provided to detect common operator errors.
5. An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
6. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download. This program shall also have a verification utility which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

E. Display
1. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
3. The display shall include an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide 8 Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY SIGNAL, SYSTEM TROUBLE, DISABLED POINTS, and ALARM SILENCED.
4. The display keypad shall be an easy-to-use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and

field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.

5. The display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.
6. The system shall support an optional battery ammeter/voltmeter display.

F. Signaling Line Circuits (SLC)

1. The system shall include two SLCs. Each SLC interface shall provide power to and communicate with up to 99 intelligent detectors (ionization, photoelectric or thermal) and 99 intelligent modules (monitor or control) for a system capacity of 396 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. The Loop Interface Board (LIB) shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
3. The detector software shall meet NFPA 72, Chapter 7 requirements and be certified by UL as a calibrated sensitivity test instrument.
4. The detector software shall allow manual or automatic sensitivity adjustment.

G. Serial Interfaces

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Electronic Data Processing (EDP) peripherals.
2. One EIA-232 interface shall be used to connect an UL-Listed 40 or 80 column printer. Printers which are not UL-Listed are not considered acceptable substitutes.
3. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.
4. The EIA-485 interface may be used for network connection to a proprietary receiving unit.

H. Notification Appliance Circuit (NAC) Module

1. The Notification Appliance Circuit module shall provide four fully supervised Class A or B (NFPA Style Z or Y) notification circuits. An expansion circuit board shall allow expansion to eight circuits per module.
2. The notification circuit capacity shall be 3.0 amperes maximum per circuit and 6.0 amperes maximum per module.
3. The module shall not affect other module circuits in any way during a short circuit condition.
4. The module shall provide eight green ON/OFF LEDs and eight yellow TROUBLE LEDs.
5. The module shall also provide a momentary switch per circuit that may be used to manually turn the particular circuit on or off or to disable the circuit.
6. Each notification circuit shall include a custom label inserted to identify each circuits location. Labels shall be created using a standard typewriter or wordprocessor.
7. The notification circuit module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal strips shall be UL listed for use with up to 12 AWG wire.
8. Each circuit shall be capable of, through system programming, deactivating upon depression of the signal silence switch.
9. Alarm notification appliance (NAC) circuits shall be NFPA 72 Style Y (Class B). The load connected to each circuit must not exceed 80% of rated module output and the coverage of each circuit shall not exceed 3 floors (to limit the effect of faults, and to facilitate troubleshooting). The NAC voltage drop during alarm must not exceed **14**% of the voltage measured across the batteries at that time. To achieve this, the design must consider wire size, length of circuit, device load, inherent voltage loss within the

FACU's power supply, etc. The contractor shall use power outage testing to verify that the NAC circuit was designed and installed properly.

I. Control Relay Module
   1. The control relay module shall provide four Form-C auxiliary relay circuits rated at 5 amperes, 28 VDC. An expansion circuit board shall allow expansion to eight Form-C relays per module.
   2. Each relay circuit shall be capable of being activated (change in state) by any initiating device or from any combination of initiating devices.
   3. The expansion module shall provide 8 green ON/OFF LEDs and 8 yellow LEDs (indicates disabled status of the relay).
   4. The module shall provide a momentary switch per relay circuit that may be used to manually turn the relay ON/OFF or to disable the relay.
   5. Each relay circuit shall include a custom label inserted to identify its location. Labels shall be created using a standard typewriter or word processor.
   6. The control relay module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal blocks shall be UL listed for use with up to 12 AWG wire.

L. Enclosures:
   1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
   2. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
   3. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be selected for either right or left hand hinging.

N. Power Supply:

   1. The main power supply for the fire alarm control panel shall provide 6.0 amps of available power for the control panel and peripheral devices.
   2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
   3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 55 AH or may be used with an external battery and charger systems. Battery arrangement may be configured in the field.
   4. The main power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:
      Ground Fault LED
      Battery Fail LED
      AC Power Fail LED
   5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
   6. The main power supply shall provide a battery charger for 24 hours of standby using dual rate charging techniques for fast battery recharge.
   7. The main power supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
   8. The main power supply shall provide meters to indicate battery voltage and charging current.
   9. All circuits shall be power-limited, per 1995 UL864 requirements.
   10. The following protection against voltage transients and surges must be provided by the fire alarm equipment supplier, and installed by the electrical contractor:
       On AC Input: A feed-through (not a shunt-type) branch circuit transient arrestor such as the EFI HWM-120, Leviton OEM-120EFI, Northern Technologies TCS-HW,

Transtector ACP100BWN3, or any equivalent UL Listed device submitted to and approved by the electrical design engineer. Install suppressor in a listed enclosure near the electrical panelboard, and trim excess lead lengths. Wind small coil in the branch circuit conductor just downstream of the suppressor connection. Coil to be 5 to 10 turns, about 1" diameter, and securely tie-wrapped. This series impedance will improve the effectiveness of the arrestor in suppressing voltage transients.
On DC Circuits Extending Outside Building: Adjacent to the FACU, and also near point of entry to outlying building, provide "pi"-type filter on each leg, consisting of a primary arrestor, series impedance, and a fast-acting secondary arrestor that clamps at 30v-40v. Some acceptable models: Innovative Technology D2S33-2ML, Simplex 2081-9027 and 2081-9028, Transtector TSP8601, Ditek DTKxLVL series, Citel America B280-24V, and Northern Technologies DLP-42. Submit specifications on others to the engineer for approval. UL 497B listing is normally a prerequisite for their consideration. Devices using only MOV active elements are not acceptable.

O. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24-volt power supply or used to power Notification Appliances.
   1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24-volt power. It shall include an integral charger designed to charge 7.0-amp hour batteries and to support 60-hour standby.
   2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
   3. The FCPS shall include an attractive surface mount backbox.
   4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
   5. The FCPS include power limited circuitry, per UL standards.
   6. Refer to Item P.10.

R. Specific System Operations
   1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
   2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
   3. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
   4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
      a. Device status
      b. Device type
      c. Custom device label
      d. View analog detector values
      e. Device zone assignments
      f. All program parameters
   5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
   6. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 1000 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Each of these

activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety.

7. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
8. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
9. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
10. Software Zones: The FACP shall provide 99 software zones and 10 additional special function zones.
11. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
    a. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
    b. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
    c. Walk test shall be selectable on a per device/circuit basis. All devices and circuits which are not selected for walk test shall continue to provide fire protection and if an alarm is detected, will exit walk test and activate all programmed alarm functions.
    d. All devices tested in walk test shall be recorded in the history buffer.
12. Waterflow Operation: An alarm from a waterflow detection device shall activate the appropriate alarm message on the 80-character display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.
13. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the 80-character display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
14. Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch. Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.
15. Combo Zone: A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

2.4 SYSTEM COMPONENTS:

A. Speakers:
    1. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.5 to 2.0 Watts. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).
    2. Frequency response shall be a minimum of 400 HZ to 4000 HZ.

3. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

B. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:
   1. The maximum pulse duration shall be 2/10 of one second.
   2. Strobe intensity shall meet the requirements of UL 1971.
   3. The flash rate shall meet the requirements of UL 1971.
   4. Strobes within common spaces shall be sequenced to flash simultaneously.

C. Serially Connected Annunciator
   1. The annunciator shall communicate with the fire alarm control panel via a two wire EIA 485 (multi-drop) communications circuit.
   2. The annunciator shall require no more than four wires for operation. Annunciation shall include: intelligent addressable points, system software zones, control relays, and notification appliance circuits. The following operations shall also be provided:
      a. Up to 32 annunciators, each with up to 64 points, may be installed on the system.
      b. The annunciator shall include a single electrical key switch to disable all switch functions.
      c. The annunciator shall provide alarm and trouble resound, with flash for new conditions.
      d. An optional repeater shall be available which allows the serial data to be repeated, supporting extended wire distances. A version shall also be available for connecting annunciators over a dual fiber optic pair.
      e. This unit shall provide for each zone: alarm indications, using a red alarm and yellow trouble long-life LEDs and control switches for the control of fire alarm control panel functions. The annunciator will also have an ON-LINE LED, local piezo electric signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels.
      f. Switches shall be available for remote annunciation and control of output points in the system, system acknowledge, telephone zone select, speaker select, global signal silence, and global system reset within the confines of all applicable standards.

D. Alphanumeric LCD Type Annunciator: Remote Monitoring Panel
   1. The alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
   2. The LCD annunciator shall display all alarm and trouble conditions in the system.
   3. An audible indication of alarm shall be integral to the alphanumeric display.
   4. The display shall be UL listed for fire alarm application.
   5. It shall be possible to connect up to 32 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
   6. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-485 interface. This is a two-wire loop connection and shall be capable of distances to 6,000 feet. Each terminal mode LCD display shall mimic the main control panel.
   7. The system shall allow a minimum of 32 terminal mode LCD annunciators. Up to 10 LCD annunciators shall be capable of the following system functions: Acknowledge, Signal Silence and Reset which shall be protected from unauthorized use by a key switch or password.

G. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

H. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station.
   1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections

between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.

2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
3. The UDACT shall be completely field programmable from a built-in keypad and 4-character red, seven segment display.
4. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
5. Communication shall include vital system status such as:
   - Independent Zone (Alarm, trouble, non-alarm, supervisory)
   - Independent Addressable Device Status
   - AC (Mains) Power Loss
   - Low Battery and Earth Fault
   - System Off Normal
   - 12 and 24 Hour Test Signal
   - Abnormal Test Signal (per UL requirements)
   - EIA-485 Communications Failure
   - Phone Line Failure
6. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

I. Field Wiring Terminal Blocks ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks which are permanently fixed are not acceptable.

J. Printer
1. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed. Printing shall be in ink. Thermal paper will not be accepted.

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General
1. Addressable devices shall use simple to install and maintain decade (numbered 1 to 10) type address switches.
2. Addressable devices which use a binary-coded address setting method, such as a DIP switch, are not an allowable substitute.
3. Detectors shall be intelligent and addressable and shall connect with two wires to the fire alarm control panel signaling line circuits.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.

6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications.
8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
11. Detectors shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LEDs shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
12. Addressable devices shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

B. Addressable Pull Box (manual station)
1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. In educational facilities, manual stations shall be provided with surface mounted clear polycarbonate covers with an integral sounder base (95 dB minimum). Power for sounder base shall be hard wired from the fire alarm system, battery powered sounder bases shall not be acceptable. STI Stopper II model STI-1130-PULL shall be the basis of design. Approved equals by other manufacturers are acceptable.

C. Intelligent Photoelectric Smoke Detector
1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Ionization Smoke Detector
1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

E. Intelligent Multi-Detector
1. The intelligent multi-detector shall be an addressable device which is designed to monitor photoelectric, ionization, and thermal technologies in a single sensing device.

This detector shall utilize advanced electronics which react to smaller products of combustion found in fast flaming fires (ionization), slow smoldering fires (photoelectric), and heat (thermal) all within a single sensing device.

2. The multi-detector shall include two bicolor LEDs which flash green in normal operation and turn on steady red in alarm.

F. Intelligent Thermal Detectors
   1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

G. Intelligent Duct Smoke Detector
   1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
   2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

H. Addressable Dry Contact Monitor Module
   1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
   2. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
   3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
   4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch x 1-1/4 inch x 1/2 inch. This version need not include Style D or an LED.

I. Two Wire Detector Monitor Module
   1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
   2. The two-wire monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box or with an optional surface backbox.
   3. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

J. Addressable Control Module
   1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.
   2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
   3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
   4. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised, UL listed remote power supply.
   5. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

K. Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.6 SMOKE DETECTOR APPLICATION AND INSTALLATION:

A. All addressable spot type and duct smoke detectors shall be the analog type and the alarm system shall automatically compensate for detector sensitivity changes due to ambient conditions and dust build-up within detectors. This feature must be armed and sensitivities set prior to acceptance of the system.
B. Spot-type detectors must be the plug-in type, with a separate base (not a mounting ring), to facilitate their replacement and maintenance. The base shall have integral terminal strips for circuit connections, rather than wire pigtails. Each detector or detector base shall incorporate an LED to indicate alarm.
C. Spot-type smoke detectors shall have a built-in locking device to secure the head to the base, for tamper resistance. For detectors mounted within 12 feet of the floor, activate this lock after the system has been inspected and given final acceptance.
D. Spot-type smoke detectors shall not be used where ceiling height exceeds 25 feet because it makes access for maintenance very difficult and could impede response.
E. Unless suitably protected against dust, paint, etc., spot type smoke detectors shall not be installed until the final construction clean-up has been completed. In the event of contamination during construction, the detectors must be replaced.
   CAUTION: Covers supplied with smoke detector heads do not provide protection against heavy construction dust, spray painting, etc., and must not be used for that purpose. They are suitable only during final, minor cleanup or touchup operations.
F. A detector installed where accidental damage or deliberate abuse is expected shall be provided with a guard that is listed for use with it and is acceptable to the AHJ.
G. Identification of individual detectors is required. Assign each a unique number as follows, in sequence starting at the FACU: (Addressable Loop # -- Device #). Put on the as-built plans, and also permanently mount on each detector's base so that it's readable standing on the floor below without having to remove the smoke detector. Exception: For detectors with housings (i.e., air duct, projected beam, air sampling, flame), apply the identification to a suitable location on exterior of their housing.
H. All air duct/plenum detectors must have a Remote Alarm Indicator Lamp (RAIL) installed in the nearest corridor or public area and identified by an engraved label affixed to the wall or ceiling. Duct smoke detectors are permitted to be installed only inside an air duct. It is not appropriate to mount them in front of a return air opening. Duct detectors shall also be installed in a manner that provides suitable, convenient access for required periodic cleaning and calibration (see K.).
I. Duct detector sampling tubes shall extend the full width of the duct. Those over 36 inches long must be provided with far end support for stability.
J. Each duct detector installation shall have a hinged or latched duct access panel, 12x12 inches minimum, for sampling tube inspection and cleaning. Indicate airflow direction on the duct, adjacent to the detector, using stencil or permanent decal.

K. AUTOMATIC FIRE/SMOKE DETECTORS USED SHALL BE SELECTED IN ACCORDANCE WITH TABLE I:

Applications Matrix for Selecting Detection Devices, which follows this Section.

TABLE I -- APPLICATIONS MATRIX FOR SELECTING DETECTION DEVICES

SMOKE/FIRE DETECTOR APPLICATION	ACCEPTABLE DETECTOR TYPES*			
	ION	PHOTO	IR/UV FLAME	HEAT
Atriums/Auditoriums		B**		
Corridors – Any Occupancy		X		
Office Areas	X	X		
Cable Rooms (PVC)		X		
Elevator Equipment Rooms	X			
Furnace/Boiler Rooms				X
Gymnasiums		B**		
Laboratories (Chemical)			X	X
Linen Rooms		X		
Mech/Elect. Equipment Rooms	X	X		X
Motor-Generator Rooms			X	X
Attics (Non-Conditioned Environment)				X
Loading Docks			X	X
Non-Conditioned or Hostile Environment			X	X
Storage (Conditioned Environment Only)	X	X		
Duct Smoke Detectors		X		

***** Multi-sensor detectors employing the indicated technology are an acceptable alternative to the type of detector(s) indicated for any application.
****** "B" symbol indicates projected beam (linear beam) type smoke detector with separate transmitter and receiver, or with transceiver and prism reflector. Typical operating range limits are 30-300 feet but best service is obtained when the IR light beam spans 50-200 feet. Consider potential obstructions (banners, etc.) and accessibility for required maintenance.
CAUTION: Spaces which may be exposed to vehicle exhaust, fumes from nearby cooking, fireplaces, etc., high/low temperatures or high humidity (including dishwashing, laundry) are generally unsuitable for the use of smoke detectors. Heat detectors should include the rate-of-rise feature unless installed where temperatures may rise more than 15°F/minute from space heaters, vehicle exhaust stacks, furnaces, or following outside door closure. ***Always consider detection device ratings vs. the environment of planned installations!***

L. Emergency Voice/Alarm Communications:

Where specified by the design engineer, or required by Code, the system shall have Emergency Voice/Alarm Communications capability.

(1) One-way Emergency Voice-Alarm (PA Type) System

One-way Voice-Alarm (PA) systems are required for Assembly occupancies exceeding **1000** persons and may optionally be installed in large, low-rise buildings. The PA feature is useful for non-fire emergencies (e.g., bomb threat or severe weather) but is not for general building paging.

For all buildings, the One-way Voice/Alarm (PA) Communications System, where provided, must meet the requirements below.

Each floor, stairway, elevator **bank**, and Assembly space (>300) is to be a separate communication zone. Speakers are to be spaced to provide required sound levels. Check audio levels in all areas; adjust taps or install additional speakers, if needed.

Large Assembly occupancies generally require special system design and procedural considerations to assure safe and effective egress of large crowds in a fire (or other) emergency, without causing panic.

Normal audio amplifier power shall be a minimum of 120% of the system design load, per channel. For purposes of this calculation, use the amplifier's continuous two-tone output rating and the designed power setting of each individual speaker**. Provide a copy of this calculation with the shop drawing submittal to the engineer. Also include on the "calculations" sheet included as part of the as-built drawings.**

At least one backup amplifier shall be provided for each channel, equal in power to the largest primary amplifier. For systems with distributed amplifiers, provide one backup at each transponder location. Failure of any amplifier shall automatically result in the defective unit being switched off-line and replaced with the backup.

The audible emergency evacuation signal shall comply NCSBC and NFPA 72. This does not preclude the system from providing additional (non-evacuation) notification signals, including recorded voice messages, for specific emergency situations. Visible alarm notification appliances must also be provided per NC Code and ADA requirements.

One-way Voice**/**Alarm digital audio circuits are to be wired with twisted pair copper conductors (AWG 18 minimum) in jacketed cable, or with fiber optic cable. Analog audio circuits are to be wired with AWG 18 minimum twisted pair copper conductors in shielded cable, Belden 8790, West Penn 293, or equal. Cable jacket color is to be gray, with red (+) and black (-) conductor insulation. For shielded cables, the shield must be continuously connected from the amplifiers to the end of line. Tape the shield splice at each speaker and handset, to insulate from ground. Single point ground the shield at the amplifier or control unit unless prohibited by system manufacturer.

2.7 BATTERIES:

A. The batteries shall be sized per Amp-hour calculations provided by the manufacturer with 25% additional capacity minimum, 12-volt nominal (two required).
B. The battery shall have sufficient capacity to power the fire alarm system for not less than 60 hours plus 5 minutes of alarm upon a normal AC power failure.
C. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
D. If necessary to meet standby requirements, external battery and charger systems may be used.

PART 3.0 - EXECUTION

3.1 SYSTEM CONFIGURATION AND INSTALLATION: (Refer to Attached Figure A)

A. Signaling Line Circuits (SLC's, also called addressable loops) must be NFPA Style 6 (Class A) with no "T" taps. Each must have a minimum of 20% spare addresses, for future use. Individual loops are permitted to cover more than 1 floor of a building.
B. To minimize wiring fault impact, isolation modules shall be provided as follows. If ceiling height ≤10 feet, isolator base type initiating devices are permitted to be used:
   • In or immediately adjacent to the FACU, at each end of the addressable loop. These two isolators must be in the same room as the FACU and within 15 feet.
   • After each 25 initiating devices and control points on the addressable loop, or a lesser number where recommended by the manufacturer. (Check instructions.)
   • Near the point each addressable circuit extends outside the building walls
   • For loops covering more than one floor, install isolator at terminal cabinet on each floor (with additional isolator[s] on any floor with over 25 addresses).

   Each isolation module must be clearly labeled, readily accessible for convenient inspection (not above a lay-in ceiling), and shown on as-built drawings

C All fire alarm system wiring shall be in metal conduit, surface metal raceway, or (in finished areas only, for improved appearance) surface non-metallic raceway.
EXCEPTION #1: PVC conduit is permitted to be used underground, in concrete, and in locations subject to severe corrosion (such as coastal facilities or lab/process areas).

D. All conduits that penetrate outside walls from air-conditioned space must have internal sealing (duct-seal), to prevent condensation from infiltrating humid air.

E. There shall be **no** splices in the system other than at device terminal blocks, or on terminal blocks in cabinets. "Wire nuts" and crimp splices will **not** be permitted. Permanent wire markers shall be used to identify all connections at the FACU and other control equipment, at power supplies, and in terminal cabinets (see F.).

F. In multistory buildings, all circuits leaving the riser on each floor shall feed through a labeled terminal block in a hinged enclosure accessible from the floor. Terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.

G. Addressable loop (signaling line) circuits shall be wired with type FPL/FPLR/FPLP fire alarm cable, AWG 18 minimum, low capacitance, twisted shielded copper pair. Cable shield drain wires are to be connected at each device on the loop to maintain continuity, taped to insulate from ground, and terminated at the FACU. Acceptable cables include Atlas 228-18-1-1STP, BSCC S1802s19 (same as EEC 7806LC), West Penn D975, D991 (AWG 16), D995 (AWG 14), or equal wire having capacitance of 30pf/ft. maximum between conductors. Belden 5320FJ acceptable if only FPL rating needed. The cable jacket color shall be red, with red (**+**) and black (**-**) conductor insulation. (See 6.9 for other wiring.)
EXCEPTION #1: Unshielded cable, otherwise equal to the above, is permitted to be used if the manufacturer's installation manual requires, or states preference for, unshielded cable.
EXCEPTION #2: In underground conduit, use Type TC or PLTC cable (PE insulated) to avoid problems from moisture.

H. Addressable interface modules (used to monitor all contact type initiating devices) must be located in conditioned space, unless they are tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed location. With AHJ approval they may be permitted to serve as many as 6 heat detectors, or 3 sprinkler system valve supervisory switches, in a single space. A minimum of 1 sprinkler system valve supervisory switch installed at sprinkler system hotbox (location indicated on Civil Site Plan) and 2 sprinkler system valve supervisory switches in sprinkler room (Flow and Tamper Devices).

I. Except as required by elsewhere in these specifications 2.8 and G, all other circuits in the system shall be wired with AWG 14, stranded copper, THHN/THWN conductors, installed in conduit. Color code as shown below throughout the system, without color change in any wire run:
• Alarm notification Appliance Circuits (horns/strobes)……Blue (+)/Black (-)
• Separate 24vdc Operating Power (for equipment)……..…Yellow (+)/Brown (-)
• Door Control Circuits (magnet power, if from system)…...Orange
• Circuits from ZAM's to Monitored Devices (AWG 14/16)...Violet(+)/Grey (-)

J. Notification Appliance Circuit booster ("ADA") power supplies must be individually monitored by the FACU and protected by a smoke detector per NFPA 72. They shall not be located above a ceiling, or in non-conditioned space. NOTE: A 24vdc power circuit serving addressable control relays must also be monitored for integrity.

K. All junction boxes shall be painted red **prior** to pulling the wire. Those installed in finished areas are permitted to be painted outside to match the finish color.

3.2 TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

3. Verify activation of all waterflow switches.
4. Open initiating device circuits and verify that the trouble signal actuates.
5. Open and short signaling line circuits and verify that the trouble signal actuates.
6. Open and short notification appliance circuits and verify that trouble signal actuates.
7. Ground all circuits and verify response of trouble signals.
8. Check presence and audibility of tone at all alarm notification devices.
9. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
11. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 FINAL INSPECTION:

A. At the final inspection, a factory trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect. The fire alarm contractor shall provide prior notice to the owner, engineer and the AHJ, minimum 10 working days prior to 100% operational test. This operational test shall not be considered the contractor’s start up activity, these activities shall be performed prior to the witness testing.
B. Contractor shall submit a completed copy of the NFPA 72, RECORD OF COMPLETION upon successful 100% operational test.

3.4 PROGRAMMING, TESTING, AND CERTIFICATION:

A. All connections to the FACU and the system's programming shall be done only by the manufacturer, or by an authorized distributor that stocks a full compliment of spare parts for the system. The technicians who do this are required to be trained and individually certified by the manufacturer, for the FACU model/series being installed. This training and certification must have occurred within the most recent 24 months. Copies of the certifications must be part of the Shop Drawing submittal to the engineer, prior to installation. The submittal cannot be approved without this info.
B. When programming the system, activate the automatic drift compensation feature for all spot-type smoke detectors. Whether or not to activate the alarm verification feature for such detectors is to be determined by the design engineer/owner's rep. In the absence of clear guidance on the latter, do not activate alarm verification.
C. Set spot-type smoke detector sensitivities to normal/medium, unless directed otherwise by the design engineer/owner's rep.
D. Print a complete System Status and Programming Report, after the above steps have been done. This must include the program settings for each alarm initiating device and the current sensitivity of each analog addressable smoke detector. See E.
E. The manufacturer or authorized distributor must 100% test all site-specific software functions for the system and then provide a detailed report or check list showing the system's operational matrix. This documentation must be part of the "System Status and Programming Report" described in D.
F. Upon completion of the installation and its programming, the fire alarm technician shall test every alarm initiating device for proper response and indication, and all alarm notification appliances for effectiveness. Also, in coordination with the other building system contractors, all other system functions shall be verified, including (where applicable) elevator capture and the control of HVAC systems, door locks, pressurization fans, fire or smoke doors/dampers/shutters, etc. The engineer must be notified in advance of these 100% tests, to permit witnessing them if desired.
G, The contractor must fill out and submit the following documentation to the owner, through the engineer, prior to the AHJ's system acceptance inspection:
1. The NFPA 72-1999, Figure 1-6.2.1, "Record of Completion" Form. Use this form (no substitutes) to detail the system installation and also to certify that: (a.) It was done per Code, and (b.) The Code-required 100% test was performed. If a representative of the AHJ, owner, or engineer witnesses the tests, they sign the last line of the form to signify that fact only (annotating the form as needed).

2. For buildings with a smoke control or smoke purge system, an HVAC balance report, in the smoke control / smoke purge mode.
3. The System Status and Programming Report described in D. This must be generated on the day of the system acceptance inspection.

H. After completion of the 100% system test per F and submission of documentation per G, the contractor is to request the engineer to set up an inspection. The system must operate for at least two days prior to this inspection.

I. The fire alarm system will be inspected, with portions of it functionally tested. This will normally include the use of appropriate means to simulate smoke for testing detectors, as well as functionally testing the system interface with building controls, fire extinguishing systems and any off-premises supervising station. Operation of any smoke removal system will be checked as instructed by the AHJ. This statistical (sampling) inspection is intended to assure that the contractor has properly installed the system and performed the 100% operational test as required by NFPA 72. The contractor normally provides two-way radios, ladders, and other materials needed for testing the system, included a suitable smoke source.

3.5 DOCUMENTATION, OWNER TRAINING, AND SPARE PARTS:

A. In addition to the Shop Drawing submittal described in 1.1, the fire alarm system contractor shall provide the engineer two bound copies of the following technical information, for transmittal to the owner: (1) As-Built wiring diagram showing all loop numbers and device addresses, plus terminal numbers where they connect to control equipment, (2) Manufacturer's detailed maintenance requirements, (3) Technical literature on all control equipment, isolation modules, power supplies, alarm/supervisory signal initiating devices, alarm notification appliances, relays, etc, (4) The as-built "calculations" sheet referenced in paragraphs 1.14 and 2.5.

B. Complete configuration data (site-specific programming) for the system must be stored on electronic media and archived by the fire alarm system manufacturer or authorized distributor. A diskette or CD copy of this data shall be submitted to the engineer for transmission to the owner on the day the system is commissioned.

C. The manufacturer, or authorized distributor, must maintain software version (VER) records on the system installed. The system software shall be upgraded free of any charge if a new VER is released during the warranty period. For new VER to correct operating problems, free upgrade shall apply during the entire life of the system.

D. Basic operating instructions shall be framed and permanently mounted at the FACU. (If the owner concurs, they may instead be affixed to the inside of the FACU's door.) In addition, the NFPA 72 "Record of Completion" (see 7.7) must either be kept at/in the FACU, or its location shall be permanently indicated there by engraved label.

E. Provide an engraved label inside the FACU identifying its 120vac power source, as follows: **Panelboard location, panelboard identification, and branch circuit number.**

F. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

G. Instruction shall include a minimum of 8 hours instruction provided by the factory technical representative or the factory trained fire alarm technician of the local contractor. Contractor shall provide a minimum of five working days notice for the owner maintenance personnel.

H. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation" and typewritten bound summary, minimum 3 copies shall be provided.

3.6 SPARE AND RENEWAL COMPONENTS

Contractor shall provide the owner with a minimum of spares for all notification and detection devices, minimum quantities as follows:

SPARES

Fuses	2 of each size in system
Manual Fire Pull Station	2% of installed qty

Addressable Control Relays	4% of installed qty
Indoor Horn Strobes	4% of installed qty
Indoor Strobe only	4% of installed qty
Addressable Monitor Modules	4% of installed qty
Isolation Modules / Isolation Bases	4% of installed qty
Addressable Electronic Heat Detectors	4% of installed qty
Spot Type Smoke Detectors – Sounder Bases	6% of installed qty

No Spares are required for projected beam, air sampling or duct smoke detectors.

Increase decimal quantities to the next whole number (example 1.1 would equal 2 spare devices)

Contractor shall provide a renewal component price list, prices guaranteed for five years for all devices and equipment installed.

3.7 QUALITY ASSURANCE:

Manufacturer's Qualifications: Firms regularly engaged in manufacture of fire alarm systems of types, sizes, and electrical characteristics required, and whose products have been in satisfactory use in similar service for not less than 5 years.

Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects with fire alarm systems work similar to that required for this project. Qualified firm shall be a factory authorized service organization and possess a complete spare parts stock.

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

TESTS:

Test all lines to be concealed before burying or covering with new construction. Tests shall include proper operation of lights, receptacles, and equipment, continuity of conduit system, insulation leakage and impedance, elimination of motor single phasing or reverse rotation, and ground system resistance (see also Section 16400).

After the interior wiring system is completed and at such time as the Engineer or Owner's representative may direct, the Contractor shall conduct an operating test for approval. The tests shall be performed in the presence of the authorized representative of the Engineer and the installation shall be demonstrated to operate in accordance with the requirements of this specification. The Contractor shall furnish all instruments and personnel required for the test. The Contractor shall have sufficient tools and personnel available at the scheduled inspection to remove panel fronts, device plates, etc., as required for proper inspection of equipment, devices and wiring installation as may be required by the inspectors. Any material or workmanship which does not meet with approval of the engineer shall be promptly removed, repaired or replaced as directed, at no additional cost to the Owner.

ADJUSTMENTS:

Adjustments shall include load balancing of all electrical phases, at devices and panels. Balance all panelboards so that the maximum deviation of any one phase from the average of all the phases shall not exceed 10%. Re-type circuit directory as required after completion of adjustment.

CLEANING AND PAINTING:

Prior to final inspection, all equipment having factory finishes shall be thoroughly cleaned inside and outside. All damaged surfaces shall be replaced or refinished by Contractor, with paint same as original manufacturer. Engineer shall determine whether the damaged surface is to be replaced or painted.

RECORD DRAWINGS:

The Contractor shall maintain accurate records of all deviations in work as actually installed from work indicated on the drawings. On completion of the project, two (2) complete sets of marked-up prints shall be delivered to the Architect.

OPERATING AND MAINTENANCE INSTRUCTIONS:

Unless directed otherwise elsewhere in these specifications, the Contractor shall compile and bind three sets of all manufacturer's instructions and descriptive literature on all items of equipment furnished under this work. These instructions shall be delivered to the Engineer for approval prior to final inspection. Instructions shall include operating and testing procedures and a parts list of all equipment. The Contractor shall instruct the Owner's personnel in the proper operation of all systems and equipment. The front and side of the binder shall be titled "Electrical Operating and Maintenance Instructions", with name of the job and firm name of the Contractor.

WARRANTY:

The Contractor shall submit upon completion of the work, a warranty by his acceptance of the contract, that all work installed will be free from defects in workmanship and materials. If, during the period of one year, or as otherwise specified from date of Certificate of Completion and acceptance of work, any such defects in

workmanship, materials, or performance appear, the Contractor shall, without cost to the Owner, remedy such defects within reasonable time to be specified in notice from the Architect. In default, the Owner may have such work done and charge cost to Contractor.

END OF SECTION

END OF SPECIFICATIONS

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

PART 1: GENERAL

SCOPE OF WORK:

This document provides specifications to be used in conjunction with network design drawings for installation of voice and for data cabling.

The Contractor shall furnish all labor, materials, tools, equipment and services necessary for and reasonably incidental to installation of specific voice and/or data cabling communications infrastructure. Work shall include all components for both a voice and data horizontal and riser cable plant from workstation outlet termination to wire closet termination. All cable plant components such as outlets, wiring termination blocks, racks, patch cables, etc. will be furnished, installed, and tested by the Contractor. The data cable plant is designed to support a 10BASE-T Ethernet building-wide computer network.

The scope of work includes all activities needed to complete the wiring and network intelligent hub equipment installation described in this document and the drawings.

The successful Bidder must be able to provide and install new equipment and materials in compliance with specifications contained in this document and accompanying drawings.

Any and all overtime (outside school hours) required to complete the scope of work within the time frame specified shall be included in the quoted price.

VOICE AND DATA WIRING PLAN OVERVIEW:

The cable system is based on the universal cabling concept. The same cables are installed to all workstations; connectors, adapters, and interconnections determine how the cable operates.

COMMUNICATIONS DESIGN (CD) DRAWINGS:

Communications design drawings show voice and data CNO locations, cable routing, and wire closet layout plans.

WORK SCHEDULE:

The contractor will coordinate all work schedules with the Architect. All efforts should be made to complete cable installation prior to the installation of ceiling tile in new or modernized construction.

DEFINITIONS:

The term “Bidder” refers to those parties who are submitting proposals for the work set forth in this document. The term “Contractor” refers to the successful Bidder and to any work or issues after the award of the contract.

The term “Owner” refers to Pitt County Schools or its designated agent.

A “Communications Network Outlet” (CNO) refers to a specific communications termination location with “two or four port communications outlet”, defined as a CNO containing 2 or 4 modular RJ-45 connectors. A “jack” refers to one modular RJ-45 connector. A “faceplate” is a decorative cover that covers the non-exposed portion of the jack and attaches to the outlet.

"Riser" refers to the cables interconnecting the wiring closets. Please note that in most cases the riser cables are physically a horizontal run between two closets.

GENERAL REFERENCE STANDARDS:

The installation shall comply with the following:

1. National Fire Protection Agency (NFPA) No.70, National Electric Code 2005 Edition
2. State and Local Building codes
3. National Fire Protection Agency (NFPA) No. 101, Life Safety Code, latest edition.
4. TIA/EIA 568A, 568B, 606, 607, and 569.
5. Building Industry Consulting Service International's (BICSI) Telecommunications Distribution Methods Manual

CONSTRUCTION SUBMITTAL:

In addition to the submittal requirements the Contractor must submit the following information during the execution of the project.

1. The Contractor must submit the manufacturer and model number for all suggested substitution of equipment specified for the work contracted. The Owner will determine acceptability of equipment at their discretion. For all cable components, the Owner will require certification that components are accepted for use in Ethernet networks, and meet all specifications as described.
2. The Contractor shall submit for approval samples of voice and data cable, fiber optic cable, patch cords, patch panels, faceplates and jacks. Samples shall be returned upon written request. The Owner shall have the right to reject any submittal that does not meet the specifications and intended use as determined by Owner.
3. Shop drawings showing proposed cable routing, closet detail design, rack design, MDF layout and other design details not specified in this document or Communications Design Drawings shall be submitted prior to any portion of the system installation for approval and to demonstrate compliance with the contract documents. Any departures from the original contract drawings should show details of such departures including changes in related portions of the project and the reasons therefore submitted with the shop drawings. Shop drawings must be provided showing details of all proposed fire-stops for four-hour rated walls. Approved departures recommended by the Contractor shall be made at no additional cost to Owner or shall result in a net decrease in cost. The Owner shall obtain the benefits of any cost reductions of these changes.
4. The Contractor shall submit as-built design drawings of the installed cable system including any design which deviates from the specified routes. As-built drawings shall include cable routes and labeling, patch panel configurations, IDC and MDF configurations, cross connect details, riser system, patch cord details, riser system, fiber storage and labeling. As-builts shall be turned over to the Owner as each section of the work is completed.

PART 2: PRODUCTS

STANDARD FOR MATERIALS:

Furnish and install new and undamaged materials conforming to the applicable standard. The standards and publications of the following entities and applicable to materials specified herein:

1. Underwriters Laboratories (UL)
2. Institute of Electrical and Electronic Engineers (IEEE)
3. American National Standards Institute (ANSI)
4. Electronics Industry Association (EIA)
5. Telecommunications Industry Association
6. Electronics Testing Laboratories, Inc. (ETL)

Materials referenced by manufacturer or trade name are cited for the quality of the product and are not intended to limit competitive bidding. The Bidder, at their option, may bid to furnish alternative products which are equal in quality and performance; however, all substitutions must be approved by Owner.

COMPLETENESS OF WORK:

Furnish all material, labor, transportation, tools, equipment, and supervision to install and leave ready for operation a complete communications systems in accordance with these specifications and the accompanying drawings.

All offsets, bends fittings pull boxes, stems and supports for the complete installation are not indicated on the drawings. It shall be the Contractor's responsibility to furnish and install all offsets, bends, devices, raceway supports, and equipment for the complete installation.

COMPATIBILITY:

Provide products which are compatible with other components in the system with which they must interface. Components and materials must fit into the confines indicated, leaving adequate clearance as required by applicable codes or manufacturer for adjustment, repair, or replacement.

PRODUCT HANDLING, DELIVERY, STORAGE:

Ensure that all system equipment, devices, and materials arrive at the designated installation site in good condition, intact in factory package or crate. Any equipment found to be damaged will be removed from the project site and will be replaced by the Contractor at their expense.

Storage - Store all equipment, devices and materials in their factory containers or package until ready for use. Storage facilities will be a clean, dry and indoor space which provides protection against the weather. Avoid damage by condensation by providing temporary heating when required. Large reels of cable may be stored outdoors provided there is adequate protection from physical damage and the cable ends are properly sealed to prevent moisture ingress. The Bidder shall state how much space and floor loading will

be required. Storage related costs will be the responsibility of the Contractor. Coordinate all storage of materials and equipment with the Owner.

Handling - Handle all equipment, devices and materials carefully to prevent breakage, denting or scoring of the finish or cable jackets. Damaged materials will be removed from the project site, and replaced by the Contractor at no additional cost. No sheath cuts will be accepted. All cables must be installed with sheath intact to the point of termination.

The Bidders should note that strict limitations will be enforced on the size, weight, and arrangement of cable reels. In general, cable reels must be of a size to be lifted on the interior freight elevator, and fit through standard doorways.

Any cable found to be damaged or defective shall be replaced by the Contractor at no additional cost to the Owner.

DATA CABLE INFRASTRUCTURE

A. Twisted Pair Cable

1. Cabling shall be unshielded twisted pair (UTP) and shall meet EIA/TIA-568, TSB-36 requirements for Category 6 (HVAC Controllers, Data Ports Drops and Access Door Control) or 6A (Security/Cameras and Wireless Access Points). Provide UTP cable with the following minimum features:

    a. Conductors: 24 AWG solid copper, 4 pair;

    b. Impedance: 100 ohms +/-15% at 1-100 MHz;

    c. DC Resistance: 25.7 ohms/1000 ft. maximum at 20 degrees C;

    d. Mutual Capacitance: 14 pF/ft. nominal at 1 MHz;

    e. Attenuation (per 1000 ft):

        i. 2.0 dB at 1 MHz

        ii. 3.7 dB at 4 MHz

        iii. 6.0 dB at 10 MHz

        iv. 7.6 dB at 16 MHz

        v. 8.6 dB at 20 MHz

        vi. 10.8 dB at 31.25 MHz

        vii. 15.5 dB at 62.5 MHz

        viii. 20.2 dB at 100 MHz

        ix. 25.8 dB at 155 MHz

        x. 29.8 dB at 200 MHz

        xi. 41.2 dB at 300 MHz

2. Provide one "homerun" UTP cable between each data outlet port indicated on the drawings and the appropriate Local 100/1000 Switch

3. UTP cables shall not exceed 90 meters from the data outlet port to the appropriate 100/1000 Switch

4. Provide cable sheathing in colors to match owner's existing standards. Basis of Design: Provide the following color schemes in the absence of a standard:
   - Security/Cameras: Purple
   - Data: Blue
   - Patch Cables: Blue
   - HVAC Controls: White
   - Wireless Access: Blue
   - Door Access Control: Yellow

D. Data Station Outlet

1. Face plates
   a. Provide Data Station Outlets as indicated on the drawings with the following features:

      i. Single gang, flush mountable, stainless steel construction;

      ii. Shall accept data, telephone, fiber optic, VGA, video, audio and blank insert modules;

      iii. Shall have the capability to accept up to six individual ports;

      iv. Inserts shall snap in and out from the front of the Data Station Outlet;

      v. Face plates shall be supplied with pressure-sensitive icon labels;

2. Inserts

   a. Provide Data Port inserts with the following features:

      i. RJ-45 type rated for Category 6;

      ii. RJ-45 insert shall be configured to EIA-568A wiring standards;

      iii. Attenuation through the RJ-45 port at 10/16 MHz shall be less than .015/.025 dB;

      iv. Provide 110 style IDC terminations for all eight conductors of a UTP cable;

   b. Provide Telephone Inserts with the following features:

      i. RJ-45 type rated for Category 6;

      ii. RJ-45 insert shall be configured to USOC wiring standards;

      iii. Provide 110 style IDC terminations for all six conductors of a UTP phone cable;

c. Provide HDMI & Data inserts with the following features for all new wall mounted Monitors and Teacher's Stations:

i. Premanufactured HDMI Cables and inserts

ii. RJ-45 type rated for Category 6;

E. Patch Panels

1. Patch panels shall be provided at each new IDF room and/or switch closet for termination of all UTP and fiber optic cables. Patch panels shall have the following features:

2. Patch Panels for Twisted Pair Cable

a. Panels shall be mountable in EIA standard 19" equipment racks;

b. Panels shall be rated for Category 6;

c. Each panel shall provide a minimum of twenty-four RJ-45 ports in one rack space position (1RU);

d. Each RJ-45 port shall provide 110 style IDC terminations for all eight conductors of a UTP cable;

e. RJ-45 ports shall be configured to EIA-568A wiring standards;

f. Attenuation through the RJ-45 port at 10/16 MHz shall be .015/.025 dB;

g. Clearly label each patch point with the location of its associated data station port;

3. Provide a three (3) foot minimum Category 6 UTP patch cable for every Category 6 UTP data cable terminated at a patch panel. Install and neatly route patch cables between the panel and the hubs utilizing cable management hardware.

4. Patch Panels for Fiber Optic Cables

a. Panels shall be mountable in EIA standard 19" equipment racks;

b. Panels shall provide LC-LC feed-through connectors for termination of fiber optic strands;

c. Panels shall provide space for at least three feet of fiber optic cable management and excess patch cable storage in a pull-out drawer;

d. Clearly label each fiber optic LC patch position with the location of its origin;

5. Provide a 6-foot minimum fiber optic patch cable for every fiber hub or switch port in the system. Install and neatly route patch cables between the panel and the hubs, utilizing cable management hardware.

6. Provide horizontal cable management panels between each patch panel for twisted pair cable and vertical cable management panels for each data rack. Cable management panels shall be Panduit "WMP" series, or equal.

7. Provide fiber management systems at the panel location.

F. Ethernet Switch at IDF and Switch Closet Locations or as shown on the drawings

G. Certification

1. Systems Contractor shall be factory certified to install the Data Cabling Infrastructure. The Systems Contractor shall include a copy of the factory-provided certification with his submittal.

PART 3: EXECUTION

Perform the work in accordance with acknowledged industry and professional standards and practices, and the procedures specified herein. Furnish and install all materials, devices, components, and equipment for complete operational systems.

DEVIATIONS:

No deviations shall be made from the drawings or specifications. Should the Contractor find at any time during the progress of the work, that in his judgement, conditions made desirable or necessary modifications in the requirements covering any particular item or items, he shall report such matters promptly to the Owner for his decision and instruction.

COOPERATION BETWEEN TRADES:

The communications work shall be scheduled with the work of the other trades to avoid delays, interference's, and unnecessary work. All other shall be notified of all openings, hangers, excavations and similar operations for the installation of communications work, is required under this section of the specifications. The work of other trades shall not be cut without first consulting the Owner. Any work damaged by those employed in the work under this section of the specifications shall be repaired using the services of the trade whose work is damaged at the cost of the Contractor.

The plans are diagrammatic and reference must be made to structural, architectural, and mechanical systems plans and actual construction. Work under this section shall be coordinated with the different trades so that interference between electrical raceways, piping, equipment, architectural, and structural work shall be avoided.

Clearly and completely specify all items and actions relative to the installation and operation of the proposed equipment that the Owner will be responsible for providing and/or performing.

The successful Bidder's project manager will be responsible for providing written reports to the Owner at the beginning of every week for the previous week's work completed and upcoming week's planned. Maintain a competent supervisor and supporting technical personnel, acceptable to the Owner, during the entire installation. Change of the supervisor during the project shall not be acceptable without prior written approval from the Architects.

Dress and permanently label all cables at each end using approved labels to ensure a neat and organized appearance.

Do not splice or otherwise re-terminate any cable used to fulfill the requirements of this specification other than at the main distribution frame and intermediate distribution cabinet. Riser cables will not contain intermediate splices.

Coordinate work with any other communications parties on-site, specifically, the LAN Installer, the Computer Installer, and other third parties whose work may affect or be affected by the cabling systems described herein.

During installation, the Owner and/or Representative will conduct periodic inspections to verify that cable installation is proceeding according to the guidelines specified in this document. Any deficiencies found will be properly corrected within 7 days by the Contractor at no additional expense to the Owner upon notification to the Contractor.

It is expected that overtime may be required to complete the scope of work in the time allocated. The Bidder must include all overtime in his price and no additional overtime charges will be accepted.

The Contractor will control litter at all times by keeping it in containers. The Contractor will remove any installation debris from the site and dispose of it properly. Major trash will be removed daily by the Contractor. All other cable-related trash, dust, dirt, etc. must be removed and cleaned prior to acceptance.

INSTALLATION OF SYSTEMS

A. Device Locations

Locate all apparatus requiring adjustments, cleaning, or similar attention so that is shall be accessible for such attention. Equipment racks shall be positioned to permit full access for operation and service.

B. Blank and Custom Panels

Finish of blank panels and custom assembly panels shall match adjacent equipment panels as closely as possible.

C. Markings

Switches, connectors, jacks, receptacles, outlets, cables, and cable terminations shall be logically and permanently marked. Custom panel nomenclature shall be engraved, etched, or screened. Marking for these items are purposely detailed on the drawings to ensure consistency and clarity. Verify any changes in working type size, and/or placement with the Architect prior to marking.

D. Environment

The equipment specified herein is designed to operate in environments of normal humidity, dust, and temperature. Protect equipment and related wiring during installation where extreme environmental conditions can occur.

ELECTRICAL POWER

A. Grounding

Review and coordinate electrical power system installation including grounding, with the Division 16 Prime Contractor to ensure proper operation of the system. All racks, cable tray, and devices shall be grounded to a common isolated grounding bar within each MDF or IDF. Additional grounding shall be installed where directed by the engineer.

B. Verification

Verify that all AC power circuits designated for the system are properly wired, phased, and grounded. Report in writing any discrepancies found to the Division 16 Prime Contractor for corrective action.

C. Equipment Rack

Provide distribution of electrical power within the equipment racks with a minimum of two spare AC receptacles per branch circuit, used in the racks. ICS Contractor shall provide and install 20 amp power strips in each data rack.

CLEANING

Clean all junction and terminal box interiors thoroughly before installing plates, panels, or covers.

WIRING METHODS & PRACTICES

A. Identification

All wires shall be permanently identified at each wire by marking with "E-Z" tape marker or equivalent.

B. Terminal Blocks

All terminal block connections shall be readily accessible. Not more than two wires connected to one terminal. Spare terminal blocks, equivalent to 10% of those in actual use shall be provided.

C. Splicing

Splicing of cables shall not be permitted between terminations of specified equipment.

D. Pulling Cable

Do not pull wire or cable through any box fitting or enclosure where change of raceway alignment or direction occurs. Do not bend conductors to less than recommended radius. Employ temporary guides, sheaves, rollers, and other necessary items to protect cables from excess tension, abrasion, or damaging bending during installation. All cables not in conduit shall be installed in J Hooks spaced no more that 5 feet apart.

E. Cable Tie

Form in a neat and orderly manner all conductors in enclosures and boxes, wire ways, and wiring troughs, providing circuit and conductor identification. Tie as required using T & B "Ty-Raps" (or equivalent) of appropriate size and type. Limit Spacing between ties to six inches and provide circuit and conductor identification at least once in each enclosure.

F. Service Loops

Provide ample service loops at each termination so that plates, panels, and equipment can be demounted for service and inspection.

G. Wiring Harnesses

1. All wires and cables used in assembling custom panels and equipment racks shall be formed into harnesses which are tied and supported in accordance with accepted Engineering practice.

2. Harnessed cables shall be formed in either a vertical or horizontal relationship to equipment, controls, components, or terminations.

EQUIPMENT RACKS

A. General

The equipment racks shall be considered as custom assemblies and shall be assembled, wired, and tested in a properly equipped shop maintained by the ICS Contractor. Assembly of racks on site shall not be permitted. Racks shall be B-Line model SB556084X-UFB or equal. Data closets shall have 18" B Line (or equal) ladder tray installed to allow for adequate cable support and service loops.

B. Equipment Location

Placement of equipment in equipment racks, as indicated in the drawings, is for maximum operator convenience. Verify any changes in placement prior to assembly. All system components and related wiring shall be located with due regard for the minimization of induced electromagnetic and electrostatics noise, for the minimization of wiring length, for proper ventilation, and to provide reasonable safety and convenience for the operator.

C. Rack Installation

Racks shall be installed plumb and square without twists in the frames or variations in level between adjacent racks.

D. Identification

All terminal blocks, rack mounted equipment, and active slots of card frame systems shall be clearly and logically labeled as to their function, circuit, or system as appropriate. Labeling on manufactured equipment shall be engraved plastic laminate with white lettering on black or dark background that is similar to panel finish.

PART 4: TESTING

TOOLS AND TEST EQUIPMENT

The Contractor will provide all tools and test equipment required for installation and testing work. Test equipment will be maintained in accurate calibration and will display the dates of the last calibration and next scheduled calibration. The Contractor is responsible for performing all tests indicated at the end of each section.

For all tests, the Owner or its agent must be present at the beginning of testing and at such times as the owner deems appropriate. The Contractor shall be responsible for correcting any problems or defects discovered during testing.

DATA CABLE INFRASTRUCTURE TESTING

1. Test each twisted pair cable segment (example: from the data station port through the patch bay and patch cable to the hub port connector). Publish a log of each test to verify that the cable segment passes the EIA/TIA-568 TEB-36 requirements for Category 6

compliance. Bind the test log in a booklet and turn the booklet over to the Owner. The test shall include:

a. Connector/cable continuity – line mapping;

b. Cable segment length;

c. Dual near end cross talk (NEXT);

d. Attenuation at 100 MHz;

e. Attenuation per foot;

f. Pass/fail results of each portion of the test above.

2. Test each fiber optic strand segment (From each classroom or switch location to the MDF). Publish a log of each test to verify that the fiber segment passes the EIA/TIA-526-14 optical power loss measurement test. Bind the test log in a booklet and turn the booklet over to the Owner.

PART 5: COMMISSIONING

SYSTEM DOCUMENTATION

A. Prior to final acceptance tests, submit to the Architect, three copies of an operating and maintenance manual for the system that has been installed. These manuals shall be used during the final acceptance testing of the system. Each manual shall contain the following information:

1. As-built drawings

2. Operations and maintenance manuals

3. Single line diagrams showing levels throughout system and impedances

ACCEPTANCE TESTING

A. The Acceptance Testing shall be performed by the Owner or the Owner's agent. Coordinate this period so that free access, work lighting, and electrical power is available on the site.

B. Be prepared to verify the performance of any portion of the ICS system by demonstration, listening and viewing tests, and instrumented measurements.

C. Make additional mechanical and electrical adjustments within the scope of work and which are deemed necessary by the Owner as a result of the acceptance test.

See also Specification Section 17900: Tests, Commissioning and Project Closeout

END OF SECTION

RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions, and General Requirements, and Division 1 specifications that apply to the work specified in this Section.

Part 1 – General

1.01 Additional Information

A. Refer to Section 17000 for the following Part 1 General information

1) References
2) Definitions / Terms / Acronyms
3) Submittal Requirements
4) Contractor Qualifications
5) Manufacturer Qualifications
6) Bidder Qualifications
7) Testing Agency Qualifications
8) Delivery, Storage and Protection
9) Project conditions
10) Sequencing
11) Continuity of Service and Scheduling of Work
12) Protection of Work and Property
13) Warranty

1.02 Products Installed but not Supplied Under This Section

A. All conduit and EMT required for Communications cabling pathway in/out of cross connect closets and in/out of wall cavities at the work area. EMT or Conduit for pathways shall have no more than two 90 degree bends and no continuous section over 100'.

B. All core holes and poke through devices in the floor for the installation of Communications cabling.

C. All core holes and EMT sleeves between floors for the routing of Communications cabling.

D. Basket tray or ladder racking to support main pathway cable bundles.

1.03 Backbone Cabling Description

A. Backbone cabling system will provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in telecommunication rooms or at the entrance facilities.

1.04 Work Included

A. The Work of this Section shall consist of the labor, materials and equipment required for furnishing and installing backbone cabling as part of a complete and operating telecommunications cabling system.

B. All items specified or included in this section shall be furnished and installed by Telecommunications Contractor, wired and connected by Telecommunications Contractor and tested by Telecommunications Contractor, unless noted otherwise. “Contractor” as used herein shall mean Telecommunications Contractor or Telecommunications Contractor’s sub-contractor.

C. All items specified or included in this section shall be furnished and installed by Electrical Contractor, wired and connected by Electrical Contractor and tested by Electrical Contractor, unless noted otherwise. “Contractor” as used herein shall mean Electrical Contractor or Electrical Contractor’s sub-contractor.

1.05 Submittals

A. Submit for approval in accordance with specified submittal procedures:

1.06 Coordination

A. Contractor shall furnish and install the following:

1) Inside plant copper backbone cables.
2) Inside plant fiber optic backbone cables.

B. Electrical Contractor shall furnish and install the following:

1) Telecommunications raceways within the building as indicated and/or as required by the electrician’s sub-contractor for a complete and operational system.

Part 2 – Products

2.01 Multi-Pair Cables

A. Multi-pair Cable Specification - Inside Plant, Category 3 25 pair

1) Acceptable Manufacturer: Berk-Tek.

2) Cable type: Category 3 CMR.

3) Jacket Material: Fire retardant PVC

4) Jacket Markings: Manufacturer’s identification, pair count, wire AWG, sequential footage.

5) Conductors: Solid 24 AWG copper

6) Twisted pairs with varying lay lengths, quantity of pairs as indicated on Drawings.

7) Conductor Insulation:
   a. CMR – Polyolefin or PVC.

8) Industry standard color coding, with colored binder tape for cables greater than 25-pair.

9) Jacket Color: Varies per application. See schedule on IC001.

10) Electrical Characteristics: Meets TIA/EIA-568B requirements for Category 6 rated cables.

11) CMR rated cable suitable for installation in vertical risers and conduit.

2.02 Fiber Optic Cables

A. Acceptable Manufacturer: Berk-Tek.

B. Cable may be either of composite cable construction or standard cable containing single-mode fibers in one cable sheath and multi-mode fibers in a separate cable sheath. Contractor shall verify raceway fill requirements when furnishing and installing two standard cable constructions to meet composite strand count requirements.

C. Fiber Cable Specification – Contractor shall provide 6 strand OS2 Single-Mode Fiber with LC Connectors, fiber distribution enclosures, termination panels and jumpers as required.

D. Fiber Optic Cable Shipping Requirements

1) All cabled optical fibers > 1000 meters in length shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel.

2) Top and bottom ends of the cable shall be available for testing on the shipping reel.

3) Both ends of the cable shall be sealed to prevent the ingress of moisture.

4) Each reel shall have a weather resistant reel tag attached identifying the reel and cable. The reel tag shall include the following information:
   a. Cable Number, Gross Weight
   b. Shipped Cable Length in Meters, Job Order Number
   c. Manufacturer Product Number, Customer Order Number
   d. Date Cable was Tested, Manufacturer Order Number
   e. Cable Length Markings, Item Number
      i Top (inside end of cable)
      ii Bottom (outside end of cable)

5) Each cable shall be accompanied by a cable data sheet. The cable data sheet shall include the following information:
   a. Manufacturer Cable Number, Manufacturer Product Number
   b. Manufacturer Factory Order Number, Customer Name
   c. Customer Purchase Order Number
   d. Mark for Information Ordered Length
   e. Maximum Billable Length, Actual Shipped Length
   f. Measured Attenuation of Each Fiber Bandwidth Specification (for lengths > 1000 m)

E. The cable manufacturer shall provide installation procedures and technical support concerning the items contained in this specification.

Part 3 – Execution

3.01 Installation

A. General

1) All cable and associated hardware shall be placed so as to make efficient use of available space in coordination with other uses. All cable and associated hardware shall be placed so as to not impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing).

2) Where cable is placed in ceiling areas or other non-exposed areas, cables shall be installed in cable trays or in non-continuous cable support system. Non-continuous cable supports shall be placed at random intervals no greater than 60 inches. Cables in non-continuous support systems shall be bundled using hook and loop type fasteners. Cable sag between supports shall not exceed 3 inches. Attaching wire to pipes or other mechanical items is not permitted. Cables shall not be bundled or tied in conduits, and in cable trays above ceilings.

3) All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, network equipment, mechanical equipment access doors and covers, switches or electrical panels, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser at a later time by maintaining a working distance from these openings. All cable shall be installed to allow for simple installation and removal of cables in the future.

4) Unless noted, all interior wiring shall be installed in raceways, Raceway Specification No. 2, one inch minimum. Wiring above accessible ceilings may be installed in cable tray and exposed on "J" hooks.

5) All cables not in raceways shall be riser or plenum rated.

6) All cables running outside the building shall be rated for outside plant installation.

7) Backbone cables shall be grouped separately from horizontal distribution cables. Cable for other systems shall be grouped separately from cables for telephone and data.

8) All inside cable shall be installed neatly above accessible ceilings using cable tray and "J" hooks supported from building structure. Do not attach to pipes, conduits, ducts, etc. Do not allow cable to rest on pipes, conduits, ducts, ceiling tiles, etc. Do not attach to wires used for supporting suspended ceilings. Do not use tie wires or bridle rings.

9) All wires shall be marked at all junction boxes, pull boxes, cabinets, boxes and terminations. Each cable run between terminating locations shall be one continuous cable (no splices or connections).

10) The Contractor shall install cable in such a manner as to prevent stretching, kinking or sharp bends. Cable damaged during installation or not passing required testing shall be removed and replaced at no additional cost to Owner.

11) The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over twisted pairs at terminations, and too much jacket removed.

12) Minimum bend radius and maximum pulling tension for all cables shall be maintained during and after installation. Install cable in accordance with manufacturer's ratings and instructions.

13) Cables shall not be installed near power sources or other items where interference could develop. Cables shall not be placed within 18 inches of light fixtures and within 3 feet of motors, transformers, copy machines, or solid state motor starters unless cable is installed in conduit. Contractor shall furnish and install a grounding conduit system where these minimum clearances cannot be maintained.

14) In telecommunications spaces, cables shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate wall or backboard space is available for

current and future equipment and for cable terminations. Cables shall not be tie-wrapped to existing electrical conduit or other equipment. Minimum bend radius shall be observed.

15) Dress and attach cables to the backboard along the shortest possible route run square (horizontal and vertical) to the backboard. Bundle similarly routed cables together and attach by means of clamps or distribution rings. Cable dress and attachment shall minimize obstruction to future installations of equipment, backboard, or other cables.

16) Cables shall be neatly bundled with hook and loop type fasteners. Nylon tire wraps are not acceptable. Cables must be neatly bundled in the telecommunications spaces and at the cable service loop.

17) Cable service loops shall be provided at both ends of backbone cable runs.
    a. At the telecommunications room, provide a minimum 6 foot service loop stored in the cable tray above the racks/cabinets.
    b. At the telecommunications room, provide sufficient slack to properly dress and terminate cables at the racks and cabinets.
        i Provide sufficient slack so that swing gate type racks and cabinets can open fully
        ii Provide sufficient slack so that cables do not catch or bind at swing gate type rack or cabinet hinge and the cables do not pull taught across the hinge or edge.
    c. A minimum 25 foot service loop shall be maintained at each building entrance and exit.

18) All interior fiber optic cables shall be installed in riser rated innerduct above accessible ceilings.
    a. Innerduct shall be installed to within 12 inches of termination enclosure.
    b. Install pull boxes, 12” x 12” minimum, as required to limit cable pulls to two 90 degree bends or 150 feet.
    c. Innerduct shall not be kinked or tightly bent in any way.

19) All exterior fiber optic cables shall be installed in innerduct.

20) A break-away link shall be used for installation of cables with a cable-puller or winch. The break-away link shall be designed to separate at or below the recommended maximum tension of the cable being installed.

21) Any damage to Owner’s existing cabling or existing cable owned by others, caused as a result of work performed under this scope, shall be brought to the Owner’s attention and repaired or replaced within 48 hours.

22) Contractor shall use only cable lubricants recommended by the manufacturer for use with the specific cable construction.

23) Should a cable become kinked, skinned or stretched during installation, the cable shall be removed and replaced at no additional cost to the Owner. Splicing at points other than those specified will not be acceptable.

3.02 Copper Cable Testing

A. Unshielded Twisted Pair Testing Equipment:

1) Cable tester will be NRTL certified for EIA/TIA TSB95.

2) The cable tester will have a wide variety of preprogrammed cable types as an integral part of its testing system and have the ability to test cables less than 6 feet (6ft.) from the test point.

3) All balanced twisted-pair field testers will be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate will be provided for review prior to the start of testing.

4) Testing will be accomplished using level III or higher field tester that is loaded with the most current version of test software by the manufacturer of the test equipment.

5) Provide factory calibration report of field test equipment.

B. Testing Procedures:

1) Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded and reversed pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.

2) Test each UTP cable and passive components. Provide certification that entire installation of UTP cabling, equipment and jacks are NRTL certified meeting or exceeding a minimum of category performance specified on all four pairs of conductors.

3) Tests will be based on each pair of conductors and not the aggregate multiple pair results.

4) Test all installed cable segments end-to-end, from each telecommunications room backbone patch panel/cross-connect block panel to respective main cross connect, with a Signal Injector, Graphical Link Testing Meter and Time Domain Reflectometer (TDR) for compliance to latest TIA/EIA performance requirements, as well as NEXT, ELFEXT, structural return loss, alternating power sum, opens, shorts, continuity, cable length, and characteristic impedance.

5) Provide report indicating failures and what actions were taken to ensure a passing horizontal cable and its terminations. Any cable failing the certification test (Fail, Fail* or, Pass*) must have remedial work done to provide a full pass test result; Remediation may include retermination or replacement of the cable, which fails. No cables passing within tolerance only (Conditional Pass*) will be accepted.

C. Test results:

1) The test results information for each link will be recorded in the memory of the field tester upon completion of the test. The tester will be capable of storing test data in either internal or external memory. The external media used will be left to the discretion of the user.

2) Test results saved by the tester will be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.

3) Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm).

4) Test Results will include the following:
   a. Applicable room number of jack location (room number per Contract Documents)
   b. Applicable Telecommunications Room number
   c. Circuit I.D. number with corresponding jack identifier
   d. Wire Map – will include the following:
      i Continuity to the remote end
      ii Shorts between any two or more conductors
      iii Crossed pairs
      iv Reversed pairs
      v Split pairs
      vi Any other miswiring
   e. Length
   f. Insertion Loss
   g. Near-end Crosstalk (NEXT) Loss
   h. PS-NEXT (Power Sum Near End Cross Talk)
   i. ELFEXT (Equal Level Far End Cross Talk)
   j. PS-ELFEXT (Power Sum Equal Level Far End Cross Talk)
   k. Propagation Delay
   l. Delay Skew
   m. Return loss

5) The Owner and Engineer reserve the right to observe testing and/or randomly sample completed links for conformance to project specifications.

3.03 Fiber Optic Cable Testing

A. Fiber Optic Cable Test Equipment:

1) Cable tester will be NRTL certified for TIA/EIA TSB95.

2) Cable testers will be Optical Power Meter and High Resolution Optical Time Domain Reflectometer (OTDR). The cable tester will be NRTL certified for compliance to latest TIA/EIA Standard 568B performance requirements at 850, 1300 and 1550 nm.

3) Testers will have been calibrated at least one year prior to use on this project. Contractor to provide proof to Owner if requested.

4) All testing equipment (OTDR, Light Loss, Splicer etc.) will be owned by the Contractor. Contractor must prove ownership of equipment if requested.

B. Cable segments and links will be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).

C. The system will not be considered certified until the tester has acknowledged that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.

D. Testing Procedures:

1) Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test

parameters and manufacturer's written recommendations. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths.

2) Prior to testing, all connectors will be properly cleaned with an approved product manufactured specifically for this purpose.

3) Prior to beginning testing, confirm that all testing equipment is fully charged or operating on building power. If the test equipment power levels drop below 50%, recharge unit or continue testing with a different (fully charged) tester.

4) Initially test optical cable with a light source and power meter utilizing procedures as stated in TIA TSB-140, ANSI/TIA/EIA-526-7, ANSI/TIA/EIA-526-14A, OFSTP-14A Optical Power Loss Measurements of Installed Multi-mode Fiber Cable Plant and ANSI/TIA/EIA-526-7 Measurement of Optical Power Loss in installed Single-Mode Fiber cable plant.

5) Measured results will be plus/minus 1 dB of submitted loss budget calculations. If loss figures are outside this range, test cable with Optical Time Domain Reflectometer (OTDR) to determine cause of variation. Correct improper splices and replace damaged cables at no charge to the Owner.

E. Multi-Mode Fiber Optic Cables:

1) Will be tested bi-directionally for length and attenuation at both the short and long wavelengths for Multi-Mode (850 and 1300 nm). This is Tier 1 testing as specified in TIA TSB-140. Test all Multi-Mode strands to ensure they are capable of transmitting 10 Gigabit Ethernet speeds.

2) The maximum insertion loss measured at 23 degrees C. will be 3.75dB/km @ 850 nm and 1.5 dB/km @ 1300 nm.

F. All cables will be tested after termination using a cable certification tester that contains the test equipment manufacturer’s most current version of firmware.

G. Test all fiber optic cable segments end-to-end from the fiber optic backbone patch panel in the Equipment Room to each fiber optic backbone patch panel in each Telecommunications Room.

H. Broken or faulty strands will not be accepted. Any cable not fully functional with all strands usable will be replaced at no cost to the Owner.

I. Upon completion of testing, all connectors will be capped with a product made for that specific function by the connecting hardware manufacturer to prevent the contamination of the fiber from construction debris or other foreign objects.

J. Test Results:

1) The test results information for each link will be recorded in the memory of the field tester upon completion of the test. The tester will be capable of storing test data in either internal or external memory. The external media used will be left to the discretion of the user.

2) Test results saved by the tester will be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.

3) The test results information for each link will be recorded in the memory of the field tester upon completion of the test. The tester will be capable of storing test data in either internal or external memory. The external media used will be left to the discretion of the user.

4) Test results saved by the tester will be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.

5) Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm).

6) Test results will include the following:
    a. Telecommunications Room number
    b. Location of fiber pull i.e. (Equipment Room # to Telecom Room #)
    c. Patch panel # and location
    d. Connector type
    e. Distance
    f. Wavelength tested
    g. Technician who performed the testing

K. The Owner and Engineer reserve the right to observe testing and/or randomly sample completed links for conformance to project specifications.

End of Section

SECURITY SYSTEM

Furnish and install all labor, materials and programming to provide complete and operational building security system.

The Scope of Work shall include:

a. Access Control Contractor shall use intrusion software compatible with existing systems currently being utilized at the existing facility. Verify with owner prior to bid.

b. Access Control Contractor shall include (1) range testing device for each type of wireless security device, if wireless devices are provided, and verify all devices are within operational range of their controlling device. Make provision for supplying additional controllers as required to provide a fully operational system.

c. Provide dual technology sensors with passive infrared motion and microwave sensing where required for a fully protected facility and as a minimum in all corridors, connectors, Gyms, Multi-Purpose Rooms, Activity Rooms, and dining areas

d. Receive coded signal from Fire Alarm panel (excluding “trouble status”).

e. Provide coded signal from Fire Alarm panel (excluding “trouble status”) to indicate alarm status on GFAA.

f. Communicator programmed to contact Owner’s specified monitoring service.

g. Vandal-proof controller enclosure.

h. Security Cameras shall be Panasonic to match existing cameras. Equals as approved by owner and engineer. Basis of design, Field verify actual existing equipment prior to bid:

   a. Exterior – 360 Fixed Dome HDTV 1080 with HDMI (WV-S455OL)
   b. Interior/Hallway – Multi-Direction Selectable HDTV (WV-X4170)
   c. Vandal Resistant Dome – (WV-S2531LN)
   d. Compact Dome – (WV-S3531L)
   e. Pendant Kit (Where Necessary)
   f. Wall Mount Bracket (Where Necessary)
   g. Corner Mount Bracket (Where Necessary)

i. Provide Video Insight recorders with 24 Terra-Byte (TB) storage and software as necessary to accommodate the quantity of inputs required on the job. Include all mounting hardware and software. Also include analog to digital encoders as necessary to accommodate the existing cameras that are to remain.

The Access Control Scope of Work shall include:

a. All accessories, equipment, programming and installation needed for a door access control system capable of controlling the specific doors as indicated on the electrical/security/IC plans and in the architect’s door hardware schedule.

b. Multi-Class HID Readers, SE RP10 or equal. Black in color.

c. Single multi-conductor plenum rated cable from Nodes to doors.

d. Door Access Cables shall be Cat 6, Plenum rated and match existing in color.

e. Camera Cables shall be Cat 6A, Plenum rated and match existing in color.

f. A “Lock-Down” door over-ride push/pull mushroom button. Pull to activate.

g.. All associated door contacts and request to exit switches. Wired normally closed.

Basis of design: Provide the following in necessary quantities to meet the requirements of the plans and schedules or a more current version of the listed equipment:

1.S2 Netbox	S2-NN-E2R-WM
2.HID Reader	S2-900PTNNEK00460-S2EC
3.Door Recessed Switch	GRI 195-12WG-W
4.Armored Door Cords	Enforcer SD-969-S18Q
5.Lock Conversion Kit	Von Duprin QEL 958003-00
6.Req to Exit Switch	Von Duprin 0502521
7.Key Lock Power Supply	Schlage PS906-KL
8.Battery Back-Up Board	Schlage 900-BB
9.Relay Board	Schlage 900-4R

Access Control and Security System shall be installed by a S2 factory-authorized service organization with minimum five years of successful public school installation experience and licensed in N.C.

Access Control System shall be S2 and associated components shall be match existing system equipment or as listed above if there is no existing component to match..

END OF SECTION

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

ACCEPTANCE CRITERIA:

The Owner will verify that all required activities have been performed in a final joint walk-through with the Contractor prior to system acceptance.

There shall be no provisions for automatic acceptance. A phased acceptance test maybe performed; however, acceptance of any phase is conditional on the acceptance of the project as a whole. Full payment will only be made after full and complete acceptance of the entire system. Acceptance shall only occur based on the written notification to the Contractor from the Owner. The following criteria must be met:

1. All cables have been tested and shown as meeting all specifications to the satisfaction of the Owner. All test reports required shall have been submitted and approved by the Owner assigned project manager.

2. All outlets are completely installed and operational in the specified locations.

3. All required patch panels are installed and operational.

4. All patch cables, cross connects, and extension cables have been delivered.

5. Final as-built documentation has been provided by the contractor.

6. Training and tools have been provided to the Owner cable management personnel in the maintenance and use of the installed cabling systems.

7. Each fiber has been tested end-to-end and a written report of signal loss and continuity has been provided.

8. All fire-stops have been installed.

9. The site is clean and neat, ready for permanent use by the Owner.

After the interior wiring system is completed and at such time as the Engineer or Owner’s representative may direct, the Contractor shall conduct an operating test for approval. The tests shall be performed in the presence of the authorized representative of the Engineer and the installation shall be demonstrated to operate in accordance with the requirements of this specification. The Contractor shall furnish all instruments and personnel required for the test. The Contractor shall have sufficient tools and personnel available at the scheduled inspection to remove panel fronts, device plates, etc., as required for proper inspection of equipment, devices and wiring installation as may be required by the inspectors. Any material or workmanship which does not meet with approval of the engineer shall be promptly removed, repaired or replaced as directed, at no additional cost to the Owner.

CLEANING AND PAINTING:

Prior to final inspection, all equipment having factory finishes shall be thoroughly cleaned inside and outside. All damaged surfaces shall be replaced or refinished by Contractor, with paint same as original manufacturer. Engineer shall determine whether the damaged surface is to be replaced or painted.

RECORD DRAWINGS AND DOCUMENTATION PACKAGE:

1. Record Drawings

    a. The Contractor shall maintain accurate records of all deviations in work as actually installed from work indicated on the drawings. On completion of the project, two (2) complete sets of marked-up prints shall be delivered to the Architect.

2. Documentation package

    a. The successful bidder shall provide one (1) system documentation package on CD and one (1) system documentation paper copy for the installed integrated system. The documentation package shall provide the owner with a comprehensive guide for all operation and maintenance procedures for the “as installed” system. A system block diagram shall indicate the functional relationship between all sub-systems and all elements within individual sub-systems. A cabling schematic shall indicate interconnect wiring with respective numbering or other identification codes and termination block assignment. If requested, schematic drawings shall be provided for each active and passive circuit used in the completed system. All schematic drawings shall indicate the electrical value of each component and its circuit by use of standard electronic symbols.

TRAINING:

A. ICS System

1. Training shall include a minimum of 16 hours of user training for the end user. Training shall be provided at the school or owner designated location in a classroom setting. Training shall be divided into two (2) groups, system administrator and teacher. Training shall also include a video and/or audio format on CD-Rom and shall be formatted for use on individual CD-Rom.

B. Telephone

1. Training shall include a minimum of 8 hours of user training for the end user. Training shall be provided at the school or owner designated location in a classroom setting.

OPERATING AND MAINTENANCE INSTRUCTIONS:

Unless directed otherwise elsewhere in these specifications, the Contractor shall compile and bind two sets of all manufacturer's instructions and descriptive literature on all items of equipment furnished under this work. These instructions shall be delivered to the Engineer for approval prior to final inspection. Instructions shall include operating and testing procedures and a parts list of all equipment. The Contractor shall instruct the Owner's personnel in the proper operation of all systems and equipment. The front of the binder shall be titled "Technology Systems Operating and Maintenance Instructions", with name of the job and firm name of the Contractor.

WARRANTY:

The Contractor shall submit upon completion of the work, a warranty by his acceptance of the contract that all work installed will be free from defects in workmanship and materials. If, during the period of one year, or as otherwise specified from date of Certificate of Completion and acceptance of work, any such defects in workmanship, materials, or performance appear, the Contractor shall, without cost to the

Owner, remedy such defects within reasonable time to be specified in notice from the Architect. In default, the Owner may have such work done and charge cost to Contractor.

END OF SECTION
END OF SPECIFICATIONS