BIDDING DOCUMENTS

MIDDLE FORK GREENWAY

BOONE GORGE PARK

WATAUGA COUNTY, NORTH CAROLINA

INTERFACE ENVIRONMENTAL CONSULTING

WARREN CONSULTING &DESIGN, PLLC

P-1005

850 9TH AVENUE NW
HICKORY NC

NORTH CAROLINA PROFESSIONAL SEAL 49380 ENGINEER PATRICK WARREN 4/9/25

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ADVERTISEMENT FOR BIDS
WATAUGA COUNTY
MIDDLE FORK GREENWAY BOONE GORGE PARK

Sealed bids for the project entitled Middle Fork Greenway, Boone Gorge Park will be received by Watauga County until local time 3:00pm on May 7th in the Watauga County office building located at 814 W. King Street Boone, North Carolina. At said place and time, all Bids that have been duly received will be publicly opened and read aloud.

A mandatory pre-bid meeting for this project will be held on April 24th at 1:00 at the project site located at Old Blowing Rock Road in Boone, North Carolina (36.1897798, -81.6572662), North Carolina. All questions must be submitted in writing by April 28th, at 5:00pm. Please remit all questions to catharine@interfaceenv.com.

THE PROJECT GENERALLY CONSISTS OF: Clearing/grubbing and removal of specified trees at the project site. Grading and construction of a paved parking area, sidewalk and recreational area, adjacent retaining walls and stormwater control measures, on-site utility installation, trail adjoining to existing trail system, instillation two (2) pedestrian bridges, construction of

boardwalks, and construction of three (3) structures (restroom, pavilion, kiosk).

The Bidding Documents for the project may be examined at the Watauga County offices between the hours of 9:00am and 5:00pm Monday through Friday. Digital copies of the Bid Documents are located on the Watauga County website for download and printing (if preferred) by the Bidder.

Each bid shall be accompanied by a cash deposit or certified check drawn on a bank or trust company insured by the FDIC or a Bid Bond prepared on the form of Bid Bond contained in the Bidding Documents or a Surety Company's standard form and properly executed by a corporate surety licensed under the laws of North Carolina to execute such bonds. The amount of the bid bond shall be equal to five (5) percent of the total of the bid. The bid deposit shall be retained by the Owner if the successful bidder fails to execute the contract or fails to provide the required bonds, as stated above, within ten (10) days after the proper notice of award of the contract.

Bidders must comply with the requirements of the State of North Carolina and be appropriately licensed as a Contractor as provided in General Statutes Chapter 87.

Bidders are encouraged to only secure project bid documents as noted above. Neither the Owner nor the Engineer will be responsible for full or partial sets of Bidding Documents, including any Addenda, obtained from

any source other than the Engineer. Each Bidder shall be responsible for the review of all addenda for the project and shall acknowledge the addenda on the bid form.

The Owner reserves the right to reject any and all bids, to waive informalities, or to reject non-conforming, non-responsive or non-conditional bids. The Owner reserves the right to award a contract to the lowest, responsive, responsible bidder or bidders, taking into consideration quality, performance and time.

_____
Mr. Deron Geouque – County Manager
Watauga County

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

INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

Prepared By

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INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office*—The office from which the Bidding Documents are to be issued, and which registers plan holders.

B. *Disadvantaged Business Enterprise (DBE)* A business meeting on of the following criteria

1. Minority Business Enterprise (MBE)- a qualified socially and economically disadvantaged minority-owned business certified by any state and/or Federal agency.

2. Women's Business Enterprise (WBE)- A qualified independent business at least 51% owned by a woman or women and certified by any state and/or Federal agency

C. *Unbalanced Bid*- An unbalanced is one that meet s the following criteria:

1. A mathematically unbalanced Bid is one that contains lump sum or unit bid items that do not appear to reflect reasonable actual costs. Those reasonable actual costs would include a reasonable proportionate share of the Bidder's anticipated profit, overhead costs, and other indirect costs that the Bidder anticipates for the performance of the items in question. 2.

2. A materially unbalanced Bid is one that produces a reasonable doubt that Award to the low Bidder, who submitted the mathematically unbalanced Bid, would result in the lowest ultimate cost to the Owner.

D Responsible Bidder - A bidder who has demonstrated the attribute of trustworthiness, as well as quality, fitness, capacity, and experience to satisfactorily perform the work described in the Contract Documents.

ARTICLE 2—BIDDING DOCUMENTS

2.01 Complete sets of bidding documents may be obtained from the issuing office upon payment of the fee stated in the advertisement or invitation to bid. The fee is non-refundable.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.

2.03 Plan rooms (including construction information subscription services, and electronic and virtual plan rooms) may distribute the Bidding Documents, or make them available for examination. Those prospective bidders that obtain an electronic (digital) copy of the Bidding Documents from.

2.04 *Electronic Documents*

A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.

1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and within **30** days of Owner's request, Bidder must submit the following information:

A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.

B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.

C. Bidder's state or other contractor license number, if applicable.

D. Subcontractor and Supplier qualification information.

E. Other required information regarding qualifications.

3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

3.04 Bidders shall comply with all applicable laws regulating the practice of general contracting as provided in chapter 87 of the General Statutes of the State of North Carolina and be properly licensed as a contractor.

ARTICLE 4—PRE-BID CONFERENCE

4.01 A mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Proposals will not be accepted from Bidders who do not attend the conference. It is each Bidder's responsibility to sign in at the pre-bid conference to verify its participation. Bidders must sign in using the name of the organization that will be submitting a Bid. A list of qualified Bidders that attended the pre-bid conference and are eligible to submit a Bid for this Project will be issued in an Addendum.

4.02 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

5.02 *Existing Site Conditions*

A. *Subsurface and Physical Conditions; Hazardous Environmental Conditions*

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:

a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.

b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

4. *Geotechnical Baseline Report/Geotechnical Data Report:* The Bidding Documents contain a Geotechnical Baseline Report (GBR) and Geotechnical Data Report (GDR).

    a. As set forth in the Supplementary Conditions, the GBR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations ("Baseline Conditions"). The GBR is a Contract Document.

    b. The Baseline Conditions in the GBR are intended to reduce uncertainty and the degree of contingency in submitted Bids. However, Bidders cannot rely solely on the Baseline Conditions. Bids should be based on a comprehensive approach that includes an independent review and analysis of the GBR, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are baselined.

    c. Nothing in the GBR is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.

    d. As set forth in the Supplementary Conditions, the GDR is a Contract Document containing data prepared by or for the Owner in support of the GBR.

B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

5.03 *Other Site-related Documents*

A. In addition to the documents regarding existing Site conditions referred to in Paragraph 5.02.A, the following other documents relating to conditions at or adjacent to the Site are known to Owner and made available to Bidders for reference:

Owner will make copies of these other Site-related documents available to any Bidder on request.

B. Owner has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.

C. The other Site-related documents are not part of the Contract Documents.

D. Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.

E. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.

B. A Site visit is included with the pre-bid conference to be held at Old Blowing Rock Road, Boone NC

C. A Site visit is scheduled for April 24th at 1:00pm at the project location specified in Part B of this Section.

D. Bidders visiting the Site are required to arrange their own transportation to the Site.

E. All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following Owner or Engineer contact for visiting the Site: **Watauga County.** Bidders must conduct the required Site visit during normal working hours.

F. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

G. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.

H. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

I. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 *Owner's Safety Program*

A. Site visits and work at the Site may be governed by an Owner safety program. If an Owner safety program exists, it will be noted in the Supplementary Conditions.

5.06 *Other Work at the Site*

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Express Representations and Certifications in Bid Form, Agreement*

A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing by April 28th 2025 at 5:00. Contact information and submittal procedures for such questions are as follows:

A. Ms. Catharine Milner

Interface Environmental Consulting, LLC.

catharine@interfaceenv.com

7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven days prior to the date for opening of Bids may not be answered.

7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

8.01 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.

8.02 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the

Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.03 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.

9.02 Bidder must set forth in the Bid the time by which Bidder must achieve Substantial Completion, subject to the restrictions established in Paragraph 13.07 of these Instructions. The Owner will take Bidder's time commitment regarding Substantial Completion into consideration during the evaluation of Bids, and it will be necessary for the apparent Successful Bidder to satisfy Owner that it will be able to achieve Substantial Completion within the time such Bidder has designated in the Bid. The Successful Bidder's time commitments will be entered into the Agreement or incorporated in the Agreement by reference to the specific terms of the Bid.

9.03 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those "or-equal" or substitute or materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an "or-equal" or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer within 10 days of the issuance of the Advertisement for Bids or invitation to Bidders. Each such request must comply with the requirements of Paragraphs 7.05 and 7.06 of the General Conditions, and the review of the request will be governed by the principles in those paragraphs. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an Addendum issued to all registered Bidders. Bidders cannot rely upon approvals made in any other manner.

10.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.01 A Bidder must be prepared to retain specific Subcontractors and Suppliers for the performance of the Work if required to do so by the Bidding Documents or in the Specifications. If a prospective

Bidder objects to retaining any such Subcontractor or Supplier and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.

11.02 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work within five days after Bid opening.

11.03 If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

11.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

ARTICLE 12—PREPARATION OF BID

12.01 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."

12.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

12.03 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.

12.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

12.05 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

12.06 A Bid by an individual must show the Bidder's name and official address.

12.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

12.08 All names must be printed in ink below the signatures.

12.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.

12.11 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 *Lump Sum*

A. Bidders must submit a Bid on a lump sum basis as set forth in the Bid Form.

13.02 *Unit Price*

A. Bidders must submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.

B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity", which Owner or its representative has set forth in the Bid Form, for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

13.03 *Allowances*

A. For cash allowances the Bid price must include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

ARTICLE 14—SUBMITTAL OF BID

14.01 The Bidding Documents include one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.

14.02 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid must be addressed to

Watauga County Office

Attn. Deron Geoque

814 W King Street

Boone NC 28607

14.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

15.01 An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.

15.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, the Bidder may withdraw its Bid,

and the Bid security will be returned. Thereafter, if the Work is rebid, the Bidder will be disqualified from further bidding on the Work.

ARTICLE 16—OPENING OF BIDS

16.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

17.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

18.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.

18.05 *Evaluation of Bids*

A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

B. For determination of the apparent low Bidder(s) when sectional bids are submitted, Bids will be compared on the basis of the aggregate of the Bids for separate sections and the Bids for combined sections that result in the lowest total amount for all of the Work.

C. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.

18.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for

those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

18.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 19—BONDS AND INSURANCE

19.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by required bonds and insurance documentation.

19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20—SIGNING OF AGREEMENT

20.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

BID FORM FOR CONSTRUCTION CONTRACT

The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to:

Watauga County, attn. Deron Geoque

814 West King Street

Boone, NC 28607

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2—ATTACHMENTS TO THIS BID

2.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security;

B. List of Proposed Subcontractors;

C. List of Proposed Suppliers;

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;

E. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;

F. Required Bidder Qualification Statement with supporting data including three (3) examples with references of recently completed work (prior 36 months) similar in scope, nature and terrain with Client references.

ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

3.01 *Lump Sum Bids*

A. Bidder will complete the Work in accordance with the Contract Documents for the following lump sum (stipulated) price(s), together with any Unit Prices indicated in Paragraph 3.02:

1. Lump Sum Price (Single Lump Sum)

Lump Sum Bid Price	$

3.02 *Unit Price Bids*

A. Bidder will perform the following Work at the indicated unit prices:

B. Bidder acknowledges that:

1. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and

2. estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 4—TIME OF COMPLETION

4.01 The Work will be substantially complete on or before **June 1st 2026**, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before **September 30th 2026**.

4.02 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

4.03 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 5—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

The non-discrimination clause contained in Section 202 (Federal) Executive Order 11246, as amended by Executive Order 11375, relative to Equal Employment Opportunity for all persons without regard to race, color, religion, sex or national origin, and the implementing rules and regulations prescribed by the Secretary of Labor, are incorporated herein.
The Contractors agree not to discriminate against any employees or applicant for employment because of physical or mental handicap in regard to any position for which the employees or applicant is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based

upon their physical or mental handicap in all employment practices.

5.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

5.02 *Instructions to Bidders*

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Title
1	12.13.2022
2	10.21.2023

Middle Fork Greenway, Boone Gorge Park

BID FORM

SITE PREP, ESC, RETAINING WALLS, PAVING/HARDSCAPES, GRADING, DRAINAGE

Description	QUANTITY	UNITS	UNIT PRICE	TOTAL PRICE
SITE PREPERATION				
Mobilization Section 1	1	EA		
Mobilization Section 2	1	EA		
Mobilization Section 3	1	EA		
EROSION CONTROL				
Clearing & Grubbing	1.50	AC		
Construction Access	579	LF		
Construction Entrance	3	EA		
Silt Fence	2,600	LF		
Construction Fencing at Septic Fields	1	EA		
Wattle	35	EA		
Stone Barrier Break	36	EA		
Tree protection (>18" dbh)	2	EA		
Tree Removal (>18" dbh)	33	EA		
Temporary Earthen Berm	533	LF		
Diversion Swales	545	LF		
Swale Matting Liner (NAG SC150BN)	953	SQ YD		
Skimmer Sediment Basin	1	EA		
Hardware Cloth & Gravel Inlet Protection	16	EA		
Rock Pipe Inlet Protection	3	EA		
Slope Drain	2	EA		
Temporary Seeding- Hydraseed Tall Fescue	134	LB		
Temporary Seeding- Rye	192	LB		
Permanent Seeding- Native Deterntion Area Mix	6	LB		
Permanent Seeding- Deer Resistant Meadow Mix	39	LB		
Permanent Seeding (Mountains FACW Mix)	31	LB		
Stream Ford	2	EA		
Slope Matting (NAG SC150BN)	4,800	SQ YD		

Middle Fork Greenway, Boone Gorge Park

BID FORM

SITE PREP, ESC, RETAINING WALLS, PAVING/HARDSCAPES, GRADING, DRAINAGE

Description	QUANTITY	UNITS	UNIT PRICE	TOTAL PRICE
RETAINING WALLS				
Low Boulder Retaining Wall (Section 1A, 2A/B)	454	SF		
Retaining Wall (Keystone Segmental; RW 1-4)	4,038	SF		
Retaining Wall Seat (RW 2)	115	LF		
PAVING, HARDSCAPES				
Asphalt Paving (Trailhead Parking)	2,624	SQ YD		
Pavement Markings, Detectable Warning, Parking Signs	1	EA		
Concrete Sidewalk (5', Trailhead)	123	SQ YD		
Concrete Pad (Trailhead)	495	SQ YD		
Concrete Pads (Benches)	4	EA		
Curb and Gutter (24")	220	LF		
ConcreteTurndown Sidewalk (Trailhead)	264	LF		
Trail Paving				
Paving, Hardscapes Section 1a				
Trail Paving (8.5')	208	SQ YD		
Paving, Hardscapes Section 1b				
Trail Paving (8.5')	265	SQ YD		
Paving, Hardscapes Section 2a				
Trail Paving (8.5')	187	SQ YD		
Paving, Hardscapes Section 2b				
Trail Paving (8.5')	623	SQ YD		
Paving, Hardscapes Section 3				
Trail Paving (8.5')	2,428	SQ YD		

Middle Fork Greenway, Boone Gorge Park

BID FORM

SITE PREP, ESC, RETAINING WALLS, PAVING/HARDSCAPES, GRADING, DRAINAGE

Description	QUANTITY	UNITS	UNIT PRICE	TOTAL PRICE
EARTHWORK				
Grading Section 1				
Rough Grading (Cut Onsite)	171	CY		
Rough Grading (Compacted Fill Onsite/Offsite)	123	CY		
Finish Grading	1	EA		
Boulder Movement (Payne Branch Rd)	1	EA		
Grading Section 2a				
Rough Grading (Cut Onsite)	95	CY		
Rough Grading (Compacted Fill Onsite/Offsite)	27	CY		
Finish Grading	1	EA		
Grading Section 2b				
Rough Grading (Cut Onsite)	681	CY		
Mass Rock Excavation	681	CY		
Rough Grading (Compacted Fill Onsite/Offsite)	283	CY		
Finish Grading	1	EA		
Grading Section 3				
Rough Grading (Cut Onsite)	7,000	CY		
Rough Grading (Compacted Fill Offsite)	7,000	CY		
Rough Grading (Compacted Fill Onsite/Offsite)	6,500	CY		
Finish Grading	1	EA		
Topsoil				
Cut and Move	3,704	CY		

Middle Fork Greenway, Boone Gorge Park				
BID FORM				
SITE PREP, ESC, RETAINING WALLS, PAVING/HARDSCAPES, GRADING, DRAINAGE				
Description	**QUANTITY**	**UNITS**	**UNIT PRICE**	**TOTAL PRICE**
DRAINAGE				
Drainage Pipe 6" PVC SCHED 40 w/Class A Bedding	201	LF		
Drainage Pipe 12" HDPE w/ Class A Bedding	525	LF		
Drainage Pipe 18" HDPE w/ Class A Bedding	20	LF		
Drainage Pipe 24" HDPE w/Class A Bedding	340	LF		
Grade Dip Apron	6	EA		
Grate Yard Inlet	3	EA		
Grate Inlet	9	EA		
Riser Spillway Inlet	1	EA		
Curb Inlet	2	EA		
Rip-rap Apron w/ESC Measure	10	EA		
SUBTOTAL				

Middle Fork Greenway, Boone Gorge Park

BID FORM

STREAM RESTORATION, LANDSCAPE

Description	QUANTITY	UNITS	UNIT PRICE	TOTAL PRICE
STREAM RESTORATION				
Boulder Steps	1	EA		
Toe Wood	105	LF		
Boulder Cluster	4	EA		
Invasive vegetation removal	130	LF		
Log Vane	2	EA		
Sloping	525	LF		
Streambank Slope Matting Liner Coir Fiber Matting	584	SQ YD		
LANDSCAPING				
Large Trees				
Red Maple 2.5' B&B	9	EA		
White Oak 2.5' B&B	11	EA		
Chestnut Oak 2.5' B&B	12	EA		
American Beech 2.5' B&B	10	EA		
Yellow Birch 2.5' B&B	12	EA		
Yellow Poplar 2.5' B&B	8	EA		
American hornbeam 2.5' B&B	8	EA		
Small Trees				
Smooth Alder B&B	12	EA		
Shrubs				
Elderberry B&B	13	EA		
Silky Dogwood B&B	13	EA		
Silky Willow B&B	13	EA		
Winterberry Holly B&B	13	EA		
Chokeberry B&B	13	EA		
Carolina Rose B&B	25	EA		
St John Wort B&B	25	EA		
Spicebush B&B	11	EA		
SUBTOTAL				

Middle Fork Greenway, Boone Gorge Park

BID FORM

WATER, SEWER, POWER

Description	QUANTITY	UNITS	UNIT PRICE	TOTAL PRICE
Mobilization	1	EA		
Ultra Pure Blue CTS SDR9 1 1/2"	50	LF		
4" PVC Sch 40 Sewerline with Cleanouts	160	LF		
Water Line Connection to Existing Well	1	EA		
Copper Wire (size as required); 2" PVC Electrical Conduit	35	LF		
4" Gutter for Picnic Shelter (Powder Coat to Match Restroom Gutters)	72	LF		
HVAC Mini Split	1	EA		
SUBTOTAL				

Middle Fork Greenway, Boone Gorge Park

BID FORM

STRUCTURES, AND INSTALLATION OF PRE-PURCHASED STRUCTURES

Description	QUANTITY	UNITS	UNIT PRICE	TOTAL PRICE
STRUCTURES				
Restroom	1	EA		
Pavilion	1	EA		
E-TW 6' Table from Carolina Recreation w/anchoring provided by Contracto	5	EA		
E-TW 8' ADA Table w/anchoring provided by Contractor	1	EA		
Boardwalk	443	LF		
Sign Kiosk	1	EA		
Bridge 1	1	EA		
Bridge 2	1	EA		
Security Fence	300	LF		
Split Rail Fence	142	LF		
Safety Handrail	561	LF		
Swing Boon Gate	1	EA		
Bollard	1	EA		
Septic Field and Tank	1	EA		
INSTALLATION OF PRE-PURCHASED STRUCTURES				
Middle Fork Greenway Bench + Delivery (Charleston Forge, Boone, NC)	4	EA		
Sign Kiosk	1	EA		
TOTAL				

Middle Fork Greenway, Boone Gorge Park BID FORM	TOTALS
SITE PREP, ESC, RETAINING WALLS, PAVING/HARDSCAPES, GRADING, DRAINAGE	
WATER, SEWER, POWER	
STRUCTURES AND INSTALLATION OF PRE-PURCHASED STRUCTURES AND AMENITIES	
STREAM RESTORATION, LANDSCAPE	
COMBINED PROJECT GRAND TOTAL	

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Bidder's Representations*

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.
7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.

2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.

3. Bidder has not solicited or induced any individual or entity to refrain from bidding.

4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:

a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.

b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.

c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.

d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

BIDDER hereby submits this Bid as set forth above:

Bidder:

_____

(typed or printed name of organization)

By: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's Contractor License No.: (if applicable) _____

BID BOND (PENAL SUM FORM)

Bidder	**Surety**
Name:	Name:
Address	Address
Owner	**Bid**
Name: **Watauga County**	Project Middle Fork Greenway, Boone Gorge Park Old Blowing Rock Road Boone, NC 28607 BK 30 PG 349, BK 30 PG 350, BK 82 PG 487, BK 2272 PG 781 Bid Due Date:
Bond	
Penal Sum:	
Date of Bond:	

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

Bidder	Surety
_____	_____
(Full formal name of Bidder)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature) (Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title:	Title:

Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
    3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
    3.2. All Bids are rejected by Owner, or
    3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

NOTICE OF AWARD

Date of Issuance:		
Owner:	Watauga County	Owner's Project No.:
Engineer:	Patrick Warren, P.E.	Engineer's Project No.:
Project:	Middle Fork Greenway Boone Gorge Park	
Contract Name:	Middle Fork Greenway Boone Gorge Park	
Bidder:		
Bidder's Address:		

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

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

One unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☒ Drawings will be delivered separately from the other Contract Documents.

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

1. Deliver to Owner **one** counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

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

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

Owner: **Watauga County**

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Copy: Engineer

AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between **Watauga County** ("Owner") and _____("Contractor").

Effective date of agreement_____

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 **CONTRACTOR SHALL COMPLETE ALL WORK AS SPECIFIED OR INDICATED IN THE CONTRACT DOCUMENTS. THE WORK IS GENERALLY DESCRIBED AS FOLLOWS:**

Clearing/grubbing and removal of specified trees at the project site. Grading and construction of a paved parking area, sidewalk and recreational area, adjacent retaining walls and stormwater control measures, on-site utility installation, trail adjoining to existing trail system, and construction of three (3) structures (restroom, pavilion, kiosk).

ARTICLE 2—THE PROJECT

2.01 **THE PROJECT, OF WHICH THE WORK UNDER THE CONTRACT DOCUMENTS IS A PART, IS GENERALLY DESCRIBED AS FOLLOWS:**

The project site is being developed as a recreational park including parking, restrooms, and picnic shelters for public access and use. Development also includes an a trail with boardwalks and bridges.

ARTICLE 3—ENGINEER

3.01 The Owner has retained Warren Consulting & Design, PLLC ("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by Engineer.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Dates*

A. The Work will be substantially complete on or before **June 1st 2026** and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before **September 30th 2026**.

4.05 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner $**500.00** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $**500.00** for each day that expires after such time until the Work is completed and ready for final payment.

4. Liquidated damages for failing to timely attain Milestones, Substantial Completion, and final completion are not additive, and will not be imposed concurrently.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. For all Work other than Unit Price Work, an amount equal to the percentage completed of specific items of work provided by the Contractor as a schedule of values for the Lump Sum work.

B. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item).

The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the **25th day** of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. **95** percent of the value of the Work completed (with the balance being retainage).

1) If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **97.5** percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **250** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.

2. Bonds:

a. Performance bond (together with power of attorney).

b. Payment bond (together with power of attorney).

3. General Conditions.
4. Supplementary Conditions.
5. Specifications as listed in the table of contents of the project manual (copy of list attached).
6. Drawings (not attached but incorporated by reference) consisting of **32** sheets with each sheet bearing the following general title:

CS Cover Sheet
X- Overall
C1.0-C1.1- Trail Section 1
C2.0-C2.5- Trail Section 2
C3.0-C3.11- Trail Section 3
C4.0-C4.4- Trailhead Design
C5.0-C5.3- Stream Restoration
C6.0-C6.12- Construction Details
X1.0-X3.2- ESC Plans
X4.0-X4.7- ESC Details
L1.0-L1.1- Landscape Plans
Structural Plans by Others:
Arete: PRJ4026- Middle Fork Greenway Boone Gorge Park Boardwalk
Arete: PRJ3676- Middle Fork Greenway Boone Gorge Park Bridge 1 (upstream bridge)
Arete: PRJ3676- Middle Fork Greenway Boone Gorge Park Bridge 2 (downstream bridge)
Drye-McGlamery: PRJ2025045- New Restroom
Drye-McGlamery: PRJ2025045- Pavilion

8. Exhibits to this Agreement (enumerated as follows):
    a. **Geotechnical Engineering Report December 13, 2022 by Arete' Engineers, PLLC**
    b. **Report of Geotechnical Evaluation of Foundation Subgrade October 21, 2023 by Solid Rock Engineering, PLLC**
10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.
    d. Field Orders.
    e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.

2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on **[indicate date on which Contract becomes effective]** (which is the Effective Date of the Contract).

Owner:	Contractor:
_____	_____
(typed or printed name of organization)	*(typed or printed name of organization)*
By: _____	By: _____
(individual's signature)	*(individual's signature)*
Date: _____	Date: _____
(date signed)	*(date signed)*
Name: _____	Name: _____
(typed or printed)	*(typed or printed)*
Title: _____	Title: _____
(typed or printed)	*(typed or printed)*
	*(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*
Attest: _____	Attest: _____
(individual's signature)	*(individual's signature)*
Title: _____	Title: _____
(typed or printed)	*(typed or printed)*
Address for giving notices:	Address for giving notices:
_____	_____
_____	_____
_____	_____
Designated Representative:	Designated Representative:
Name: _____	Name: _____
(typed or printed)	*(typed or printed)*
Title: _____	Title: _____
(typed or printed)	*(typed or printed)*
Address:	Address:
_____	_____
_____	_____
_____	_____
Phone: _____	Phone: _____
Email: _____	Email: _____
*(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*	License No.: _____
	(where applicable)
	State: _____

PERFORMANCE BOND

Contractor	**Surety**
Name:	Name:
Address	Address
Owner	**Contract**
Name: **Watauga County**	Project Middle Fork Greenway, Boone Gorge Park
Mailing address	Old Blowing Rock Road Boone, NC 28607
814 W King Street	BK 30 PG 349, BK 30 PG 350, BK 82 PG 487, BK 2272 PG 781
Boone NC	Contract Price:
28607	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____	_____
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature)(Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:

    3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;

    3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

    3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

    5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

    5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

    5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

    5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows:

PAYMENT BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **Watauga County**	Description *(name and location)*: Middle Fork Greenway Boone Gorge Park Old Blowing Rock Road Boone, NC 28607 BK 30 PG 349, BK 30 PG 350, BK 82 PG 487, BK 2272 PG 781
Mailing address *(principal place of business)*: **814 W. King Street Boone NC 28607**	Contract Price:
	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond will arise after the following:

5.1. Claimants who do not have a direct contract with the Contractor

5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).

5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

7.2. Pay or arrange for payment of any undisputed amounts.

7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be

performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

16.1. *Claim*—A written statement by the Claimant including at a minimum:

16.1.1. The name of the Claimant;

16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

16.1.4. A brief description of the labor, materials, or equipment furnished;

16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: **NONE**

ATTACH INSURANCE CERTIFICATES HERE

CERTIFICATE OF OWNER'S ATTOURNEY

I, the undersigned, _____, the duly authorized and acting legal representative of The Town of West Jefferson, do hereby certify the following:

I have examined the attached contact(s) and performance and payment boned(s) and the manner of execution thereof. I am of the opinion that each of the aforesaid agreements are adequate and have been duly executed by the Owner acting through its duly authorized representative, who has full power and authority to execute agreements on behalf of the Owner, and that the foregoing agreements constitute valid and legally binding obligations upon the Owner executing the same in accordance with the terms, conditions and provisions thereof.

Signature_____

Date_____

NOTICE TO PROCEED

Owner:	Watauga County	Owner's Project No.:	
Engineer:	Patrick Warren, P.E.	Engineer's Project No.:	
Contractor:		Contractor's Project No.:	
Project:	Middle Fork Greenway, Boone Gorge Park		
Contract Name:	Middle Fork Greenway, Boone Gorge Park		
Effective Date of Contract:			

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

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

In accordance with the Agreement:

The date by which Substantial Completion must be achieved is _____ and the date by which readiness for final payment must be achieved is _____

Owner:	**Watauga County**
By *(signature)*:	
Name *(printed)*:	
Title:	
Date Issued:	

Copy: Engineer

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

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

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

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

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

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

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

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

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

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

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

10. *Claim*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

46. *Technical Data*

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

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

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

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

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

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

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

1.02 *Terminology*

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

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

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

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

1. does not conform to the Contract Documents;

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

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

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

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

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

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

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

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

ARTICLE 2—PRELIMINARY MATTERS

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

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

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

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

2.02 *Copies of Documents*

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

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

2.03 *Before Starting Construction*

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

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

2. a preliminary Schedule of Submittals; and

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

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

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

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

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

2.05 *Acceptance of Schedules*

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

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

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

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

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

2.06 *Electronic Transmittals*

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

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

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

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

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

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

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

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

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

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

G. Nothing in the Contract Documents creates:

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

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

3.02 *Reference Standards*

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

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

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

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

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

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

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

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

B. *Resolving Discrepancies*

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

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

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

3.04 *Requirements of the Contract Documents*

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

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

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

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

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

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

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

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

4.02 *Starting the Work*

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

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

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

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

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

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

4.05 *Delays in Contractor's Progress*

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

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

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

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

2. Abnormal weather conditions;

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

4. Acts of war or terrorism.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

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

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

5.02 *Use of Site and Other Areas*

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

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

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

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

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

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

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

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work;

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, “Paragraph SC-4.05.”

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

ARTICLE 2—PRELIMINARY MATTERS

SC2.06 *Electronic Transmittals*

D. *Requests by Contractor for Electronic Documents in Other Formats*

1. Release of any Electronic Document versions of the Project documents in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be at the sole discretion of the Owner.

2. To extent determined by Owner, in its sole discretion, to be prudent and necessary, release of Electronic Documents versions of Project documents and other Project information requested by Contractor (“Request”) in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be subject to the provisions of the Owner’s response to the Request, and to the following conditions to which Contractor agrees:

a. The content included in the Electronic Documents created by Engineer and covered by the Request was prepared by Engineer as an internal working document for Engineer’s purposes solely, and is being provided to Contractor on an “AS IS” basis without any warranties of any kind, including, but not limited to any implied warranties of fitness for any purpose. As such, Contractor is advised and acknowledges that the content may not be suitable for Contractor’s application, or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.

b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Engineer to Contractor under the request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor’s sole risk and the Contractor waives any claims against Engineer or Owner arising from use of data in Electronic Documents covered by the Request.

c. Contractor shall indemnify and hold harmless Owner and Engineer and their subconsultants from all claims, damages, losses, and expenses, including attorneys' fees and defense costs arising out of or resulting from Contractor's use, adaptation, or distribution of any Electronic Documents provided under the Request.

d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Engineer, unless such distribution is specifically identified in the Request and is limited to Contractor's subcontractors. Contractor warrants that subsequent use by Contractor's subcontractors complies with all terms of the Contract Documents and Owner's response to Request.

3. In the event that Owner elects to provide or directs the Engineer to provide to Contractor any Contractor-requested Electronic Document versions of Project information that is not explicitly identified in the Contract Documents as being available to Contractor, the Owner shall be reimbursed by Contractor on an hourly basis (at $**150** per hour) for any engineering costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Engineer.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

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

SC5.03 *Subsurface and Physical Conditions*

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely. This report is contained within Bid Documents.

Report Title	Date of Report	Technical Data
Geotechnical Engineering Report	12/13/2022	**Arete' Engineers, PLLC (#P-1904)**
Report of Geotechnical Evaluation of Foundation Subgrade	10/21/2023	**Solid Rock Engineering, PLLC. (#P-1523)**

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
		]

SC5.06 *Hazardous Environmental Conditions*

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely: **[If there are no such reports, so indicate in the table]**

Report Title	Date of Report	Technical Data
No Such Reports		

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely: **[If there are no such drawings, so indicate in the table]**

Drawings Title	Date of Drawings	Technical Data
No Such Drawings		

ARTICLE 6—BONDS AND INSURANCE

SC6.01 *Performance, Payment, and Other Bonds*

1. *Required Performance Bond Form:* The performance bond that Contractor furnishes will be in the form of EJCDC® C-610, Performance Bond (2010, 2013, or 2018 edition).
2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (2010, 2013, or 2018 edition).

SC6.03 *Contractor's Insurance*

D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following:

E. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Jones Act (if applicable)	

Workers' Compensation and Related Policies	Policy limits of not less than:
Bodily injury by accident—each accident	$
Bodily injury by disease—aggregate	$
Employer's Liability	
Each accident	$
Each employee	$
Policy limit	$
Stop-gap Liability Coverage	
For work performed in monopolistic states, stop-gap liability coverage must be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	$

F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.
    b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
4. Underground, explosion, and collapse coverage.
5. Personal injury coverage.
6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.

7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
2. Any exclusion for water intrusion or water damage.
3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
4. Any exclusion of coverage relating to earth subsidence or movement.
5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
6. Any limitation or exclusion based on the nature of Contractor's work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	**Policy limits of not less than:**
General Aggregate	$2,000,000
Products—Completed Operations Aggregate	$2,000,000
Personal and Advertising Injury	$1,000,000
Bodily Injury and Property Damage—Each Occurrence	$1,000,000

J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	**Policy limits of not less than:**
Bodily Injury	
Each Person	$
Each Accident	$
Property Damage	
Each Accident	$
[or]	
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000

K. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$3,000,000
General Aggregate	$3,000,000

L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of $**3,000,000** after accounting for partial attribution of its limits to underlying policies, as allowed above.

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. *Builder's Risk Requirements:* The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

    a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.

    b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.

2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent

constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).

4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier). If this coverage is subject to a sublimit, such sublimit will be a minimum of $**500,000**.

5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of $**500,000**.

6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.

7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.

8. include performance/hot testing and start-up, if applicable.

9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.

10 include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

ARTICLE 8—OTHER WORK AT THE SITE

ARTICLE 9—OWNER'S RESPONSIBILITIES

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:

1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings

(but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.

3. *Liaison*

    a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

    b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

    c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.

4. *Review of Work; Defective Work*

    a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.

    b. Observe whether any Work in place appears to be defective.

    c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

5. *Inspections and Tests*

    a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.

    b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

6. *Payment Requests:* Review Applications for Payment with Contractor.

7. *Completion*

    a. Participate in Engineer's visits regarding Substantial Completion.

    b. Assist in the preparation of a punch list of items to be completed or corrected.

    c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

    d. Observe whether items on the final punch list have been completed or corrected.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11—CHANGES TO THE CONTRACT

ARTICLE 12—CLAIMS

ARTICLE 13—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCCEPTANCE OF DEFECTIVE WORK

ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.03 *Substantial Completion*

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

ARTICLE 18—MISCELLANEOUS

GEOTECHNICAL ENGINEERING REPORT

MIDDLE FORK SOUTH FORK NEW RIVER PEDESTRIAN BRIDGES

WATAUGA COUNTY, NORTH CAROLINA

PREPARED FOR:

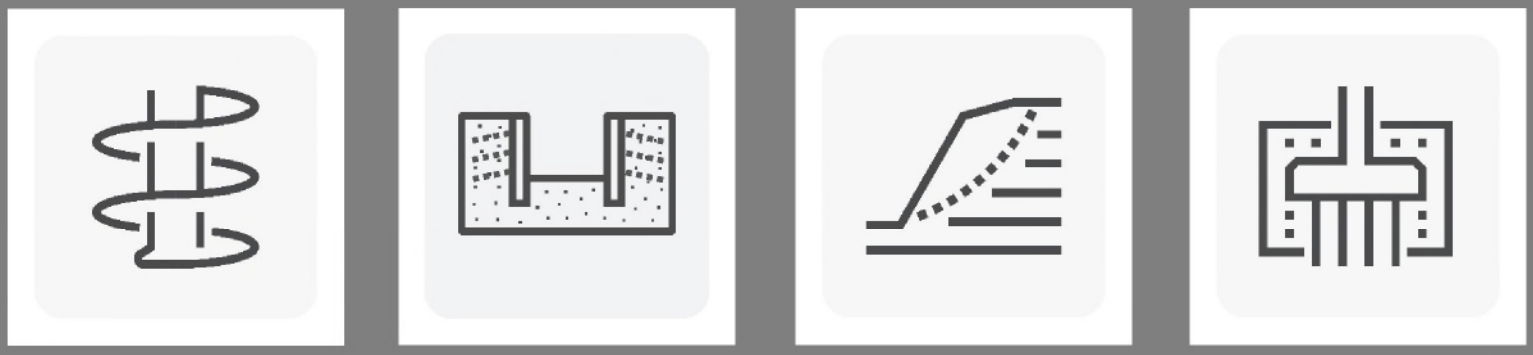
ARETE ENGINEERS, PLLC

7688 VALLEY BOULEVARD

BLOWING ROCK, NORTH CAROLINA 28605

DECEMBER 13, 2022

CG2 PROJECT NUMBER: 240022151



CAROLINAS GEOTECHNICAL GROUP

CAROLINAS GEOTECHNICAL GROUP

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December 13, 2022

Mr. Shawn Ausel, P.E.
Arete Engineers, PLLC
7668 Valley Boulevard
Blowing Rock, North Carolina 28605

REFERENCE:

Geotechnical Engineering Report
Middle Fork South Fork New River Greenway Pedestrian Bridges
Boone, Watauga County, North Carolina
CG2 Project No.: 240022151

Dear Mr. Ausel:

Carolinas Geotechnical Group, PLLC (CG2) has completed the subsurface exploration for the proposed project in Boone, North Carolina. Our services were performed in general accordance with our proposal (CG2 No. 2022214) dated October 4, 2022. This report contains the results of our subsurface exploration for the completed borings, site characterization, geotechnical engineering analyses, and recommendations for the proposed project.

We have enjoyed assisting you and look forward to working with you again on future projects. If you have any questions concerning this report, please contact us.

Sincerely,
Carolinas Geotechnical Group, PLLC

DocuSigned by:
Sierra N. Patterson
1249E0C0637E485...
Sierra N. Patterson, P.G.
Project Geologist

DocuSigned by:
D. Matthew Brewer
386129C0A4C1462...
D. Matthew Brewer, P.E.
Senior Project Engineer
N.C. Registration No. 041986

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Appendix

SCOPE OF WORK

CG2 was requested to perform a subsurface exploration and provide geotechnical engineering recommendations for the referenced project in Boone, North Carolina. This report presents our exploration and testing procedures, findings, and geotechnical engineering recommendations, and includes the following:

- A brief description of the project site.
- Information on the site conditions encountered during the exploration and geologic information relevant to the project area.
- A description of the field exploration methodology and findings.
- Our geotechnical engineering recommendations for site preparation and testing during construction activities.

The scope of this geotechnical exploration did not include an environmental site assessment (ESA), or wetlands delineation. Consequently, this report does not include any information regarding the presence or absence of toxic or hazardous waste or information regarding wetland issues.

PROJECT AND SITE INFORMATION

Our understanding of the project is based upon the following:

- Preliminary Boone Gorge Site Plans prepared by the Blue Ridge Conservancy, dated 2021

Based on a review of the referenced document, we understand the Blue Ridge Conservancy has plans to construct two new pedestrian bridges over Middle Fork South Fork New River for a future greenway. The proposed locations for the bridges are located to the west of US Highway 321, as shown on the "Site Location Plan", Figure No. 1 in the Appendix. We understand the bridges will be single-span bridges. We understand that current plans are to construct the Bridge 1 end bents on a pile supported end bent. Bridge 2 will likely be supported on a pile supported end bent at End Bent 2 and a spread footing keyed into bedrock at End Bent 1. The sites are heavily wooded and clearing of select vegetation was required to access the boring locations. No additional information has been provided at this time.

Details regarding bridge length, final end bent locations, bottom of cap elevations, or any other pertinent information was not available at the time of this report. Should this information become available, or if the information discussed in this report is inaccurate, we request the opportunity to revise this report according.

Allowable axial loading for the pile foundations and spread footings were provided to us and are presented in Table No. 1. Based on discussions with Arete, the longitudinal and transverse lateral loads are minimal. We also understand that the preference is to have either HP 10x42 or HP 12x53 steel piles installed vertically utilizing driven or drilled-in pile installation techniques.

Table No. 1: Pedestrian Bridge Foundation Loading (Provided by Arete)

Load Description	Foundation Loading
Maximum Allowable Axial Load Per Pile	50 kips
Allowable Bearing Capacity for Spread Footing	4,000 psf

EXPLORATION SUMMARY AND PROCEDURES

Soil Test Borings

The subsurface exploration included a total of three Standard Penetration Test (SPT) soil borings and rock core borings (BR1_EB1, BR1_EB2, BR2_EB2) at the approximate locations shown on the attached "Boring Location Plan," Figure No. 2. A track-mounted Diedrich D-50 drill rig, equipped with an automatic hammer, was used to mechanically advance hollow-stem augers to auger refusal depths. Proposed test location BR2_EB1 was inaccessible to our drilling equipment due to steep terrain, as such, a hand auger boring was performed to refusal depth followed by rock coring utilizing a portable rock core drill. CG2 utilized a GPS to obtain northings and eastings for each of the boring locations, however, no elevation measurements were obtained by CG2. We have been informed that the site and boring locations will be surveyed by others. The site survey information was unavailable to CG2 at the time of this report.

The SPT borings were performed in general accordance with ASTM D-1586, "Penetration Test and Split-Barrel Sampling of Soils." At regular intervals, the drilling tools were removed, and soil samples were obtained with a standard 1.4-inch I.D., 2.0-inch O.D., split-spoon sampler. The sampler was first seated six inches and then driven an additional twelve inches with blows of a 140-pound hammer falling approximately 30 inches. The number of hammer blows required to drive the sampler the final twelve inches is designated the "Penetration Resistance" or N-value. The penetration resistance, when properly interpreted, is an index to the soil strength and density. The borings were terminated upon encountering auger refusal at each boring location at depths ranging from approximately 16.7 to 18.2 feet below existing ground surface (bgs) . Soil samples were classified by a CG2 representative in general accordance with ASTM D-2488 "Description and Identification of Soils (Visual-Manual Procedure)." Utilities were located by NC 811 One-Call prior to our mobilization to the project site.

Upon encountering refusal materials at the boring locations, rock coring was performed to obtain samples of the refusal material. Rock coring was performed using an NQ core-barrel equipped with a wireline, except for Boring BR2_EB1 as discussed. Recovered samples of the materials obtained by rock coring were boxed and are presented on photographic logs included in the Appendix.

Soil test boring records, included in the Appendix, graphically show the N-Values, groundwater levels, and present the soil descriptions for the collected samples. The stratification lines and depth designations on the

soil test boring records represent the approximate boundaries between different soil types, which may not be representative of the actual boundaries.

LABORATORY SERVICES

Three soil samples were selected for Atterberg limits, grain size analysis (with hydrometer), and natural moisture content testing. The laboratory test results are shown below in Table No. 2 and included on each of the respective soil test boring records included in the Appendix.

Table No. 2: Soil Classification Laboratory Results

Boring ID	Depth (ft.)	USCS CLASS.	L.L. (%)	P.I. (%)	% By Weight			Natural Moisture (%)
					Gravel	Sand	Silt & Clay	
BR1_EB2	3.5–5.0	SM	NP	NP	3.7	78.7	17.6	17.6
BR2_EB2	1.0-2.5	ML	35	6	13.9	16.2	69.9	28.0
BR2_EB2	13.5–15.0	ML	NP	NP	0.8	8.3	90.9	27.6

NP=Non-plastic

Two rock samples were selected for unconfined compressive strength testing. The laboratory test results are shown below in Table No. 3 and included on each of the respective soil test boring records included in the Appendix.

Table No. 3: Rock Unconfined Compressive Strength Laboratory Results

Boring ID	Sample ID	Depth (ft.)	Unit Weight (pcf)	Unconfined Compressive Strength (psi [ksf])
BR1_EB1	RS-1	18.4-18.9	177.5	18,900 [2,722]
BR2_EB1	RS-2	1.6-1.9	172.3	8,290 [1,194]

SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered within the borings are shown on the soil test boring records in the Appendix. These records represent our interpretation of the subsurface conditions based upon field data. Stratification lines on the soil test boring records represent approximate boundaries between soil behavior types; however, the actual transition may be gradual. The general subsurface conditions encountered in all the CG2 borings performed at the site and their pertinent characteristics are discussed in the following sections.

Local Physiographic Conditions and Geology

The project site is located within the Blue Ridge Physiographic Province of North Carolina (Blue Ridge). In general, the majority of the project area is moderately wooded with intermittent mountainous slopes and ridges intertwined with an established system of draws and streams, consistent with the Blue Ridge. The Blue

Ridge is predominately underlain by igneous rock (formed from molten material) and metamorphic rock (formed by heat, pressure and/or chemical action). According to the 1970 Geology of the Grandfather Mountain window vicinity, North Carolina and Tennessee, the project site is located within the Grandfather Mountain Formation. In proximity to the project area, this Upper Precambrian formation consists of schistose to massive interlayered Meta-Sedimentary rock, Meta-Arkose, and Mafic Volcanic Rock.

Much of the topography found throughout the Blue Ridge has developed from differential weathering of predominantly igneous and metamorphic rock formations. Due to the continued chemical and physical weathering, the parent rock in the Blue Ridge is generally covered with a mantle of soil that has weathered in-place from the parent rock below. These soils have variable thicknesses and are commonly referred to as residual soils. Residual soils in this area typically contain higher fines content near the ground surface due to more advanced weathering and contain larger particle sizes with increasing depth becoming more coarse-grained as the amount of weathering decreases. As weathering decreases with depth, residual soils generally retain the overall appearance, texture, gradation, and foliations of the parent rock. The boundary between soil and rock is not sharply defined and is termed "partially weathered rock" (PWR). PWR is normally found overlying the parent bedrock. PWR is defined, for engineering purposes, as residual material with N-Values in excess of 50 blows per 6 inches, or 100 blows per foot (bpf). Weathering is facilitated by fractures, joints, and the presence of less resistant rock types. The profile of PWR and bedrock is quite irregular and erratic, even over short horizontal distances. It is also common to find lenses and boulders of hard rock and zones of PWR within the soil mantle above the general bedrock level.

Groundwater

Groundwater level measurements were attempted at the completion of drilling in each boring, at which time groundwater was encountered in Borings BR1_EB2 and BR2_EB2 at approximate depths of 9.0 and 15.5 feet below ground surface (bgs), respectively. Subsequent water level measurements were not attempted due to our demobilization from the project site. The borings were backfilled with auger cuttings prior to demobilization from the site. Groundwater levels tend to fluctuate with seasonal and climatic variations, as well as with some types of construction operations. Therefore, groundwater may be encountered during construction at depths not indicated by the borings.

The moisture descriptions of the soil samples encountered in the borings were noted as moist. Sometimes, the presence of wet soils can indicate the proximity to the natural groundwater elevation. Also, soils that are observed to be moist to wet sometimes require additional manipulation of the soil moisture during construction to obtain the specified level of compaction.

Interpreted Subsurface Profile

Subsurface conditions as indicated by the borings generally consist of topsoil underlain by alluvial or residual soils and PWR. The generalized subsurface conditions at the site are described below and are graphically

depicted on the soil test boring records in the Appendix. For more detailed soil descriptions and stratifications at a particular test location, the associated soil test boring record should be reviewed.

A topsoil layer ranging in thickness between approximately 8 to 12 inches thick was encountered in three of the four borings (BR1_EB1, BR1_EB2, BR2_EB2). The thickness of topsoil or similar organic-laden surface materials may be greater or less between the boring locations.

The alluvial soils were encountered underlying the topsoil in Borings BR1_EB1, BR1_EB2, and BR2_EB2 and at the ground surface in Boring BR2_EB1. The alluvial soils encountered generally consist of medium stiff to hard sandy silts and sandy clays. The coarse-grained alluvial soils encountered generally consist of very loose to very dense sandy gravels, gravelly sands, and silty sands. Alluvial soils were encountered at depths ranging from 1 to 13.5 feet. N-values obtained in the alluvial soils encountered in the borings were 4 to greater than 100 bpf. SPT N-values in excess of 100 bpf encountered within the alluvial soils were likely influenced by the presence of rock fragments such as gravel or boulders.

Residual soils were encountered underlying the alluvium in Boring BR2_EB2. The residual soils encountered generally consist of stiff to very stiff silts. N-values obtained in the residual soils encountered were 10 to 25.

PWR was encountered underlying the residual and alluvial soils in three borings (BR1_EB1, BR1_EB2, BR2_EB2) at approximate depths ranging from approximately 6 to 24 feet bgs. When sampled, the PWR generally breaks down into sandy silts with trace amounts of gravel-sized rock fragments and mica.

Auger refusal is defined as material that could not be penetrated with the drilling equipment used for the exploration. Auger refusal material may consist of large boulders, rock ledges, lenses, seams, or the top of parent bedrock. Auger refusal was encountered at Borings BR1_EB2 and BR1_EB1 at approximate depths of 12.4 and 15.7 feet bgs, respectively. Boring BR2_EB1 encountered hand auger refusal materials at approximately 1.0 feet bgs. Rock coring was performed within Boring BR1_EB1 utilizing an NQ size (1.875-inch diameter) core barrel. Boring BR2_EB1 utilized portable rock coring equipment with an approximate 1.5-inch diameter core barrel to perform rock coring. Bedrock was encountered underlying the alluvium in Boring BR2_EB1, and the PWR in Boring BR1_EB1 at approximate depths of 1.0 and 15.6 feet bgs, respectively. The bedrock encountered consisted of hard to very hard, fresh, Biotite Meta-siltstone. Approximately 10 feet of rock was cored in borings BR1_EB1 and BR2_EB1.

SITE PREPARATION AND EARTHWORK

Vegetation, root systems, topsoil, loose soils, boulders, and other deleterious non-soil materials should be stripped from proposed construction areas. After clearing and stripping, areas intended to support structures, including new fill, should be carefully assessed by a qualified geotechnical engineer or their representative.

Excavations created below subgrade levels during the construction should be backfilled with compacted soil or aggregate fill placed in accordance with the recommendations of this report.

We recommend proof rolling subgrades for roadways and areas to receive compacted fill (if practical) as discussed below to identify soft subgrade areas. Proof rolling should be done after a suitable period of dry weather to avoid degrading an otherwise acceptable subgrade. Proof rolling should be performed with a heavily loaded dump truck or with similar approved construction equipment. The proof rolling equipment should make at least four passes over each section, with the last two passes perpendicular to the first two where practical.

We recommend exposed subgrades and proof rolling operations be observed and documented by qualified geotechnical personnel. We recommend actual subgrade stabilization requirements, if deemed necessary, be determined at the time of site preparation, based on observations of the subgrade and the stability of the subgrades as determined during proof rolling or other methods determined at time of construction. Loose, soft, organic, highly plastic, excessively wet soils that pump, rut, or wave during site grading or proof rolling operations should be removed or stabilized.

If soft soils are encountered in roadway areas, they are typically mitigated by undercutting the soft soils to expose competent soils and then backfilling with compacted fill to plan subgrade levels or by undercutting poor subgrade soils to some depth and then placing a high-modulus geotextile, geogrid and/or layer of aggregate to establish a stable platform upon which to backfill with compacted fill.

Fine-grained silty and clayey soils that may be encountered near the ground surface will not support construction traffic as they get wet. Therefore, where these soils are encountered the contractor should anticipate additional subgrade stabilization will be required during and shortly after wet periods to repair fine-grained soil subgrade areas damaged by construction traffic.

Alluvium

Alluvium was encountered in all borings at both proposed bridge sites at depths ranging from 1 to 13.5 feet bgs. Alluvial soils are naturally variable in consistency, character, and often contain organics. Since the project site is located along the Middle Fork South Fork New River; alluvial soils may be encountered during site development that were not encountered during this exploration.

We recommend that the extent and consistency of alluvial soils materials be thoroughly evaluated during construction through test pits or other methods. We recommend that bridge foundations extend through the alluvium and bear on PWR or clean sound rock.

Fill Placement and Compaction

Prior to fill placement, representative samples of the proposed structural fill material(s) should be collected and tested by a qualified testing firm to determine the material's moisture-density characteristics (including, the maximum dry density, optimum water content, gradation, and Atterberg limits). These tests will aid in the quality control during construction.

Fill in structural areas should be relatively free of organics, roots, or other deleterious materials and should generally not be used in structural areas if the soils:

- Contain more than five percent (by weight) organic material;
- Have a liquid limit (LL) greater than 50 or plasticity index (PI) greater than 30;
- Contain particles greater than 4 inches in diameter; or
- Have a maximum dry density less than 90 pounds per cubic foot based on standard Proctor (ASTM D 698).

Soils meeting the criteria listed above may be used in landscaped or non-structural areas. Compacted structural fill should consist of material classified as CL, ML, SC, SM, or GW per ASTM D-2487. High plasticity soils such as CH and MH materials are generally not recommended for use as structural fill due to their low strength characteristics and moisture sensitivity. Soils imported from off-site sources should also meet similar classification requirements, not contain more than 30% fines (material passing the No. 200 sieve) and be approved by the geotechnical engineer prior to use. Successful reuse of the excavated, on-site soils as compacted structural fill will depend on the water content and the plasticity of the soils encountered during excavation.

During fill placement, a qualified soils technician should perform field density tests to document the degree of compaction being obtained in the field. Structural fills should be placed in thin, 8-inch loose lifts and compacted to the following recommendations:

- Upper 24 inches below the final subgrade elevation:
  - 100% of the soil's standard Proctor maximum dry density (ASTM Test Method D-698) at or near optimum water content: maximum deviation of ±3 percent.
- Depths below 24 inches:
  - 95% of the soil's standard Proctor maximum dry density (ASTM Test Method D-698) at or near optimum water content: maximum deviation of ±3 percent.

Moisture conditioning may be required by the contractor during the construction to obtain the required percent compaction. Regular field verification should be performed to ensure the most representative Proctor curve is being selected. Density testing should be performed at regular intervals on a full-time basis by a qualified field technician working under the direction of a qualified construction testing firm.

Drainage Control

Proper drainage of the construction area is important to the integrity of the subgrade soils. If free water is permitted to stand on stable subgrade soils, these soils can absorb water, swell, and experience a reduction in their support capability. As a result, we recommend that the subgrade surface be graded to provide positive drainage away from the construction areas and towards suitable drainage handling areas, such as a perimeter ditch, French drain, or culvert.

The contractor should exercise care after structural fills have been placed and compacted. If water is permitted to stand on the surface, these soils may become saturated. Excess movement of construction traffic on saturated subgrades can cause rutting and damage the surface integrity of the structural fill. Once the integrity of the subgrade is destroyed, mobility of construction traffic may become difficult or impossible. Therefore, the fill surface should be sloped to achieve positive drainage and to minimize water from ponding on the surface.

Excavation Characteristics

Based on the results of the soil test borings, medium stiff to hard and very loose to very dense alluvial soils with boulders, stiff to very stiff residual soils, PWR, and bedrock will be encountered during general excavation. Our results from the soil test borings indicate that PWR is present at depths ranging from approximately 6 to 24 feet bgs and bedrock is present at depths ranging from approximately 1.0 to 15.6 feet bgs.

Borings were terminated either upon encountering auger refusal on or in bedrock at depths ranging from approximately 16.7 to 18.2 feet bgs. Therefore, we anticipate that PWR, intermittent rock lenses, boulders and/or parent bedrock may be encountered during general site grading and excavation for the installation of foundations.

The depth to and thickness of, PWR and rock lenses or seams, can vary dramatically in short distances and between boring locations; therefore, PWR or bedrock may be encountered during construction at locations or depths, between boring locations, not encountered during this exploration.

It has been our experience in this geological area that materials having N-values of less than 50 blows per 0.4 foot can generally be excavated using pans and scrapers by first loosening with a single tooth ripper attached to a suitable sized dozer, such as a Caterpillar D-8 or D-9. On earthwork projects requiring ripping, a controversy sometimes develops as to whether the materials can be removed by ripping or whether blasting is required. It should be noted that ripping is dependent on the equipment and techniques used as well as the operator's skill and experience. The success of the ripping operation is dependent on finding the proper combinations for the conditions encountered. Excavation of the PWR is typically much more difficult in confined excavations. Jackhammering or blasting is anticipated to be required for materials having N-values in excess of 50 blows per 0.2 foot, or at or near the level that auger refusal is encountered.

Cut and Fill Slopes

We recommend that construction of any cut and fill slopes should be no steeper than 2H:1V (horizontal to vertical). If steeper slopes are required, detailed slope stability analyses should be performed. The tops and bases of all slopes should be located a minimum of 10 feet from structural limits and a minimum of 5 feet from pavement limits. To prevent shallow surface failures on the exposed slope faces, we also recommend that the soils exposed on all slope faces be compacted with track-mounted equipment prior to final seeding and mulching. Surface water runoff should be directed away from the slopes.

Temporary Excavations

Excavations required for construction of this project must be performed in accordance with the United States Department of Labor, Occupational Safety and Health Administration (OSHA) guidelines (29 CFR 1926, Subpart P, Excavations) or other applicable jurisdictional codes for permissible temporary side-slope ratios and/or shoring requirements. The OSHA guidelines require daily inspections of excavations, adjacent areas and protective systems by a "competent person" for evidence of situations that could result in cave-ins, indications of failure of a protective system, or other hazardous conditions. All excavated soils, equipment, building supplies, etc., should be placed away from the edges of the excavation at a distance equaling or exceeding the depth of the excavation. CG2 cautions that the actual excavation slopes will need to be evaluated frequently each day by the "competent person" and flatter slopes or the use of shoring may be required to maintain a safe excavation depending upon excavation specific circumstances. The contractor is responsible for providing the "competent person" and all aspects of site excavation safety. CG2 can evaluate specific excavation slope situations if we are informed and requested by the owner, designer, or contractor's "competent person."

FOUNDATION SUPPORT

The recommendations presented in this section of the report are based specifically on the conditions encountered in the borings of our subsurface investigation. The soil test borings indicate that the subsurface conditions are generally favorable for steel H-pile supported end bents or spread footings. Our recommendations are discussed in more detail in the following sections.

We recommend Bridge #1 End Bent 1 and End Bent 2 bridge caps be supported on pile foundations due to the encountered alluvial soils and variable depth to PWR and bedrock at the end bent locations. Given the depth to PWR at Bridge #1 End Bent 1, driven piles and drilled-in piles are both viable options, and we have provided general recommendations for both of these options. We recommend utilizing drilled-in piles at Bridge #1 End Bent 2. At Bridge #2, we recommend utilizing spread footings at Bridge #2 End Bent 1, and at Bridge #2 End Bent 2, either driven piles or drilled-in piles are viable options. Our recommendations are summarized in greater detail below.

At this time, CG2 has not been provided existing ground elevations or bottom of cap elevations at Bridge #1 or Bridge #2. However, CG2 understands that Arete has requested preliminary pile lengths, estimated

tip elevations, and preliminary bearing capacities based on the provided assumption that top of pile elevations will be approximately 1 foot above existing grades at the boring test locations.

Bridge #1 End Bent 1 - Driven Pile Foundations

Driven steel H-piles may be utilized for foundation support at Bridge #1 End Bent 1. An allowable pile capacity of approximately 50 kips (25 tons) for HP steel piles is anticipated at this project site. The piles will be driven or installed with an ultimate capacity of 100 kips (50 tons). This value is based on a factor of safety of 2. The expected long-term performance and pile installation procedures play a significant role in confirming the piles have achieved the ultimate pile capacity. In addition, driven piles should be spaced a minimum of 3-pile diameters within the pile cap to optimize the pile group effect. Our summary is included below in Table No. 4:

Table No. 4: Estimated Pile Information and Quantities (Driven Piles) – Bridge #1 End Bent 1

Allowable Pile Capacity: 25 tons (50 kips) Ultimate Pile Capacity: 50 tons (100 kips)	**End Bent 1**
Estimated Pile Embedment into Cap (ft)	1
Estimated Penetration into PWR/bedrock (ft)	2
Estimated Pile Penetration, bgs (ft)	15.5
Estimated Pile Length (ft) per pile	16.5
Average Pile Length (ft) per pile	**20**

Bridge #1 End Bent 1 and End Bent 2 - Drilled-in Pile Foundations

A summary table, for drilled-in piles at Bridge #1, with estimated pile depths, is included in Table No. 5:

Table No. 5: Estimated Pile Information and Quantities (Drilled-in Piles)

Allowable Pile Capacity: 25 tons (50 kips) BR2_EB: 50 tons (100 kips)	**End Bent 1**	**End Bent 2**
Estimated Pile Embedment into Cap (ft)	1	1
Estimated Penetration into PWR/bedrock (ft)	3.0	4.5
Estimated Pile Penetration, bgs (ft)	16.5	10.0
Estimated Pile Length (ft) per pile	17.5	11.0
Average Pile Length (ft) per pile	**20**	**15**

Bridge #2 End Bent 1 - Spread Footings

The soil and rock profiles encountered in the vicinity of BR1_EB1 appear generally suitable for the use of shallow foundations. Based on the provided loading conditions and the subsurface conditions encountered near the bottom of footing elevation, it is our opinion that the end bent footings bearing on clean sound rock will adequately support an allowable bearing pressure of 4,000 pounds per square foot (psf). We estimate that the total and differential settlement potentials for the foundations bearing on rock will be negligible. We

recommend the structural engineer confirm the footing meets eccentricity limits once foundation dimensions are known.

Bridge #2 End Bent 2 – Driven Piles

Driven steel H-piles may be utilized for foundation support at Bridge 2 End Bent 2. An allowable pile capacity of approximately 50 kips (25 tons) for HP steel piles is anticipated at this project site. The piles will be driven or installed with an ultimate capacity of 100 kips (50 tons). This value is based on a factor of safety of 2. The expected long-term performance and pile installation procedures play a significant role in confirming the piles have achieved the ultimate pile capacity. In addition, driven piles should be spaced a minimum of 3-pile diameters within the pile cap to optimize the pile group effect.

Please note that at Bridge #2 End Bent 2, boulders and hard drilling were encountered within the soil test boring performed in this area. In order to avoid pile damage during driving, pile excavation through the boulder layer should be considered prior to driving piles to the required ultimate pile capacity. We recommend including 12 feet of pile excavation per pile for Bridge #2 End Bent 2 in the contract documents. Our summary is included below in Table No. 6:

Table No. 6: Estimated Pile Information and Quantities (Driven Piles) – Bridge 2 End Bent 2

Allowable Pile Capacity: 25 tons (50 kips) Ultimate pile capacity: 85 tons (170 kips)	**End Bent 2**
Estimated Pile Embedment into Cap (ft)	1
Estimated Penetration into PWR/bedrock (ft)	2
Estimated Pile Penetration, bgs (ft)	26.0
Estimated Pile Length (ft) per pile	29.0
Average Pile Length (ft) per pile	**30**

Driven Pile Construction Considerations

The pile capacity will be achieved by driving each pile until the measured driving resistance demonstrates the ultimate pile capacity has been achieved. For this site, we anticipate individual piles will achieve the required capacity through a combination of both end bearing and skin friction resistance. In areas where PWR is encountered during driving, we anticipate the piles will need to penetrate up to approximately 1 to 2 feet into PWR or penetrate several inches in bedrock to achieve the ultimate pile capacity of the pile.
Based on the anticipated pile lengths, we anticipate pile splicing will not be required. If required, pile splicing should be accounted for in the base bid pricing, and not a "per splices" fee during construction.

In areas where relatively shallow PWR or hard driving is anticipated, we recommend using pile points or driving shoes for harder driving conditions in order to protect the pile tip. During construction, the pile capacity may be limited by pile impedance during installation. Pile impedance is a function of pile size, the driving system (hammer, hammer cushion, etc.), and the soil conditions. We request the contractor submit the driving system to the owner prior to mobilization to the site to ensure the pile driving system is capable

of achieving the required pile capacity without damaging or overdriving the piles. CG2 can provide a review of the proposed pile driving system and assist with that determination, if requested.

The ultimate pile capacity of the piles should be verified in the field by a qualified engineering testing firm during pile driving by observing the driving resistance, or "set" for each individual pile. The final set or driving criteria for pile foundations are usually determined by a load testing program with the aid of a wave equation analysis. We recommend a wave equation analysis be performed to determine the initial pile driving criteria and to determine if the proposed pile driving system is capable of obtaining the design working loads without damaging the piles. We recommend that the wave equation analysis be performed by a registered geotechnical engineer using the contractor's proposed pile driving system. If PDA testing is performed, CG2 recommends testing a minimum of 1 production pile.

Drilled-in Pile Construction Considerations

The pile excavation hole diameter should have a minimum of 3 inches of clearance around the entirety of the steel H-pile. We recommend installing drilled-in piles a minimum of 10 feet below the bottom of cap elevation and at least 2 to 3 feet into PWR or bedrock. The bottom five feet of the excavation should be filled with concrete. The remainder of the open excavation may be filled with flowable fill, such as lean concrete, #57 stone, or sand up to the ground surface.

Spread Footing Construction Considerations

Suitable bearing should be documented in the actual footing during construction. Loose boulders and/or rock encountered within the footprint of the footing should be removed prior to the placement of reinforcement and/or concrete. There is potential for an irregular rock surface at the footing location, and we recommend that the near-surface rock be exposed, leveled, and cleaned prior to placement of reinforcement and concrete. Excavations in this area could encounter water and dewatering measures may be warranted depending on the water level in the river at the time of construction.

We recommend utilizing a sliding friction factor of 0.5 for concrete on clean, sound rock Depending on the end bent footing size and sliding resistance requirements, additional sliding resistance of the footing may be required. This can be achieved by keying the footing 6 to 12 inches into bedrock or installing dowels for shear resistance into the exposed rock surface.

Bridge End Bent Wall Considerations

The construction may require end bent walls in some locations depending on the final design. Retaining walls that are unrestrained and free to bend or rotate outward to mobilize soil strength may consider the active earth pressure coefficient (K_a). However, we anticipate potential end bent walls for this project will be restrained due to the frame action of the end bent-bridge superstructure connections. For this scenario, the at-rest earth pressure coefficient (K_0) should be considered. We recommend project end bent walls be provided with adequate drainage to prevent the buildup of hydrostatic pressure. We recommend the

following parameters displayed in Table No. 7 be utilized for development of lateral earth pressures against end bent walls:

Table No. 7: Recommended Lateral Earth Pressure Coefficients

Material	Friction Angle (ϕ) degrees	Unit Weight (γ) pcf	K_a	K_0
Compacted Structural Fill	26	120	0.39	0.56
Graded Aggregate	38	145	0.24	0.40
#57 Stone	40	105	0.22	0.36

Foundation Notes on Plans

CG2 recommends incorporating the following within Project Drawings for Bridge #1:

1. FOR PILES, SEE PILES CONSTRUCTION SPECIFICATIONS.
2. PILES AT END BENT 1 AND END BENT 2 ARE DESIGNED FOR AN ALLOWABLE PILE CAPACITY OF 25 TONS.
3. INSTALL VERTICAL PILES AT END BENT 1 AND END BENT 2 TO AN ULTIMATE PILE CAPACITY OF 50 TONS.
4. STEEL PILE POINTS ARE REQUIRED FOR DRIVEN PILES AT END BENT 1.
5. IT HAS BEEN ESTIMATED THAT A PILE DRIVING HAMMER WITH AN EQUIVALENT RATED ENERGY IN THE RANGE OF 5,000 FT-LBS TO 15,000 FT-LBS PER BLOW WILL BE REQUIRED TO DRIVE PILES AT END BENT 1. THIS ESTIMATED ENERGY RANGE DOES NOT RELEASE THE CONTRACTOR FROM PROVIDING DRIVING EQUIPMENT IN ACCORDANCE WITH THE PILES CONSTRUCTION SPECIFICATIONS.
6. VERTICAL DRILLED-IN PILES MAY BE UTILIZED IN LEIU OF VERTICAL DRIVEN PILES FOR END BENT 1 AND ARE REQUIRED FOR END BENT 2. EXCAVATE HOLES AT PILE LOCATIONS WITH A MINIMUM PENETRATION OF 3 FEET INTO WEATHERED ROCK AND/OR ROCK AND AT LEAST 10 FEET BELOW THE BOTTOM OF CAP. FOR PILE EXCAVATION SEE PILES CONSTRUCTION SPECIFICATIONS.
7. CONCRETE IS REQUIRED TO FILL HOLES FOR PILE EXCAVATION AT END BENT 1 AND END BENT 2.
8. END BENT SLOPES SHALL BE COVERED WITH RIP RAP SLOPE PROTECTION. PLACE SLOPE PROTECTION FROM THE TOE OF SLOPE TO BERM TO PROTECT THE APPROACH EMBANKMENT FROM SCOUR.
9. NO WAITING PERIOD IS REQUIRED BEFORE BEGINNING END BENT CONSTRUCTION.

CG2 recommends incorporating the following within Project Drawings for Bridge #2:

1. FOR PILES, SEE PILES CONSTRUCTION SPECIFICATIONS.
2. PILES AT END BENT 2 ARE DESIGNED FOR AN ALLOWABLE PILE CAPACITY OF 25 TONS.
3. INSTALL VERTICAL PILES AT END BENT 2 TO AN ULTIMATE PILE CAPACITY OF 50 TONS.
4. IT HAS BEEN ESTIMATED THAT A PILE DRIVING HAMMER WITH AN EQUIVALENT RATED ENERGY IN THE RANGE OF 5,000 FT-LBS TO 15,000 FT-LBS PER BLOW WILL BE REQUIRED TO DRIVE PILES AT END BENT 2. THIS ESTIMATED ENERGY RANGE DOES NOT RELEASE THE CONTRACTOR FROM PROVIDING DRIVING EQUIPMENT IN ACCORDANCE WITH THE PILES CONSTRUCTION SPECIFICATIONS.
5. PILE EXCAVATION IS REQUIRED AT END BENT 2. EXCAVATE HOLES AT PILE LOCATIONS WITH A MINIMUM PENETRATION OF 12 FEET BELOW BOTTOM OF CAP. FOR PILE EXCAVATION SEE PILES CONSTRUCTION SPECIFICATIONS. UPON COMPLETION OF PILE EXCAVATION, STAND AND DRIVE PILES.
6. THE SPREAD FOOTING AT END BENT 2 IS DESIGNED FOR AN ALLOWABLE BEARING CAPACITY OF 4,000 PSF. THE FOOTING SHALL BEAR ON CLEAN, SOUND ROCK. CHECK FIELD CONDITIONS FOR THE REQUIRED ALLOWABLE BEARING CAPACITY OF 4,000 PSF JUST BEFORE PLACING CONCRETE.
7. END BENT SLOPES SHALL BE COVERED WITH RIP RAP SLOPE PROTECTION. PLACE SLOPE PROTECTION FROM THE TOE OF SLOPE TO BERM TO PROTECT THE APPROACH EMBANKMENT FROM SCOUR.
8. NO WAITING PERIOD IS REQUIRED BEFORE BEGINNING END BENT CONSTRUCTION.

LIMITATIONS OF REPORT

The recommendations presented herein have been developed on the basis of the subsurface conditions encountered during the field investigation and our understanding of the proposed construction. Should changes in the project criteria occur or additional information becomes available, a review must be made by CG2 to determine if modifications to our recommendations will be required.

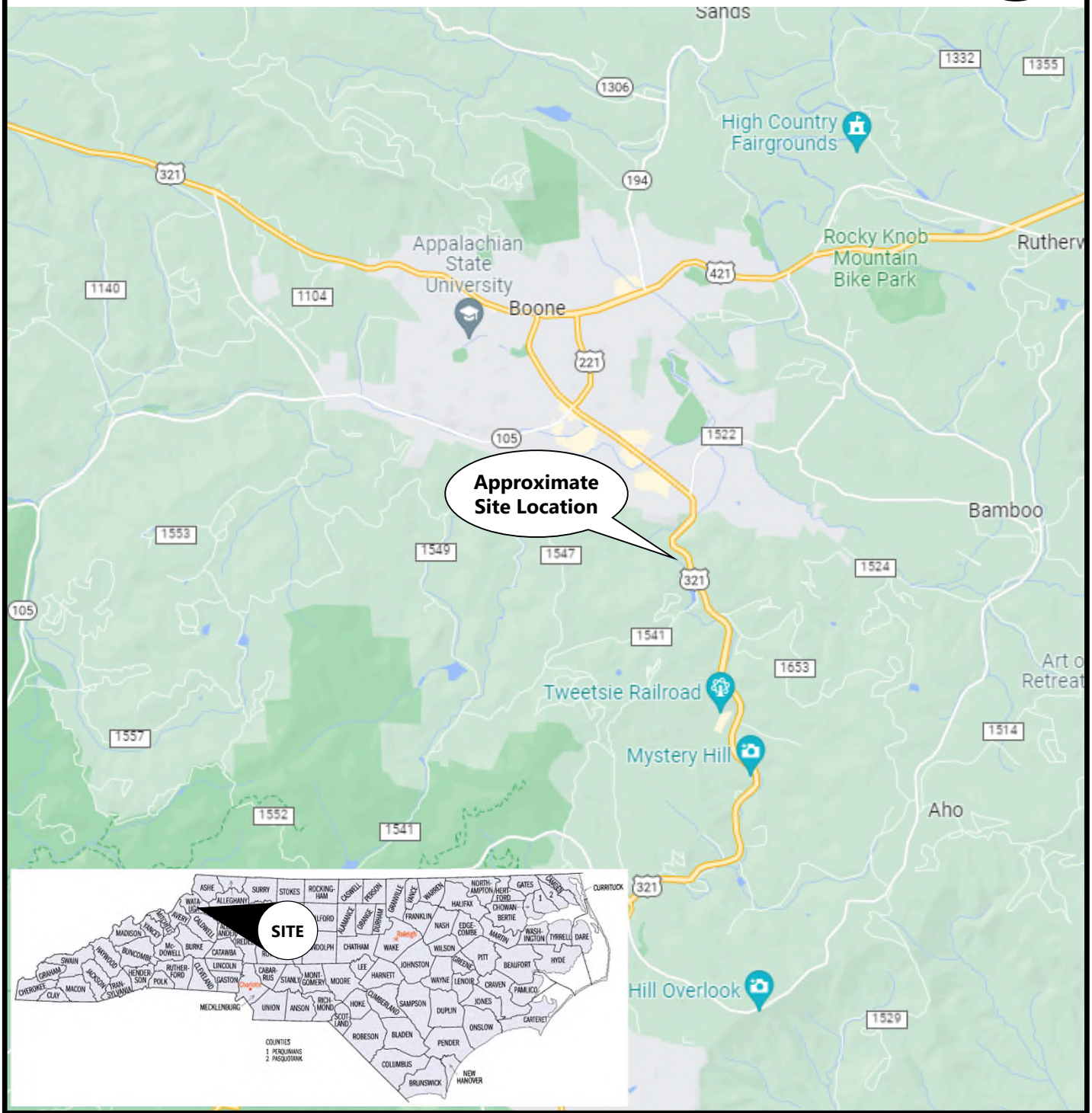
CG2 should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, 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. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project 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.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless CG2 reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX



	SITE LOCATION PLAN **Middle Fork South Fork New River Greenway** **Pedestrian Bridges** Watauga County, North Carolina	SCALE: NTS DRAWN BY: SNP CHECKED BY: DMB	FIGURE NO. 1
	PROJECT NO.: 240022151	DATE: 12/5/2022	

BORING LOCATION PLAN

Middle Fork South Fork New River Greenway

Pedestrian Bridges

Watauga County, North Carolina

PROJECT NO.:	240022151
SCALE:	NTS
DRAWN BY:	SNP
CHECKED BY:	DMB
DATE:	12/5/2022
FIGURE NO.	2

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KEYS TO SYMBOLS

LITHOLOGIC SYMBOLS (Unified Soil Classification System)


ASPHALT: Asphalt


BLDRCBBL: Boulders and cobbles


CH: USCS High Plasticity Clay


CL: USCS Low Plasticity Clay


CL-CH: USCS Low to High Plasticity Clay


CLG: USCS Low Plasticity Gravelly Clay


CL-ML: USCS Low Plasticity Silty Clay


CLS: USCS Low Plasticity Sandy Clay


FILL: Fill


GC: USCS Clayey Gravel


GM: USCS Silty Gravel


GP: USCS Poorly-graded Gravel


GP-GC: USCS Poorly-graded Gravel with Clay


GP-GM: USCS Poorly-graded Gravel with Silt


GPS: USCS Poorly-graded Sandy Gravel


GW: USCS Well-graded Gravel


GW-GC: USCS Well-graded Gravel with Clay


GW-GM: USCS Well-graded Gravel with Silt


GWS: USCS Well-graded Sandy Gravel


MH: USCS Elastic Silt


ML: USCS Silt


MLG: USCS Gravelly Silt


MLS: USCS Sandy Silt


PARTIALLY WEATHERED ROCK


SC: USCS Clayey Sand


SC-SM: USCS Clayey Sand


SM: USCS Silty Sand


SP: USCS Poorly-graded Sand


SPG: USCS Poorly-graded Gravelly Sand


SP-SC: USCS Poorly-graded Sand with Clay


SP-SM: USCS Poorly-graded Sand with Silt


SW: USCS Well-graded Sand


SWG: USCS Well-graded Gravelly Sand


SW-SC: USCS Well-graded Sand with Clay


SW-SM: USCS Well-graded Sand with Silt


TOPSOIL: Topsoil

ABBREVIATIONS

LL - Liquid Limit
PI - Plastic Index
W - Moisture Content (%)
DD - Dry Density (PCF)
NP - Non-Plastic
UC - Unconfined Compression
-200 - Percent Passing No.200 Sieve

▽ - Water Level at Time Drilling, or as Shown
▼ - Water Level at End of Drilling, or as Shown
▼ - Water Level After 24 Hours, or as Shown

Correlation of Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Consistency	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Medium Dense	5 - 8	Medium Stiff
30 - 50	Dense	9 - 15	Stiff
over 50	Very Dense	16 - 30	Very Stiff
		over 30	Hard

SAMPLER SYMBOLS


Auger Cuttings


Rock Core


Standard Penetration Test


Split Spoon


Shelby Tube

Boundary Classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols

SILT or CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 ¾" 3" 12"

U.S. Standard Sieve Size

Reference: "Classifications of Soils for Engineering Purposes (United Soil Classification System) ASTM D 2487, and/or "Description and Identification of Soils" (Visual-Manual Procedure), ASTM D 2488.

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BORING NUMBER BR1_EB1

CLIENT Arete Engineers, PLLC
PROJECT NAME Middle Fork South Fork New River Pedestrian Bridges
PROJECT NUMBER CG2 No. 240022151
PROJECT LOCATION Boone, NC
DATE STARTED 11/3/22 **COMPLETED** 11/3/22
GROUND ELEVATION _____ **HOLE SIZE** 6 inches
DRILLING CONTRACTOR CG2 Exploration, LLC - Diedrich D-50 - 76%
GROUND WATER LEVELS:
DRILLING METHOD SPT Core Boring
0-HR WATER LEVEL --- N/A
LOGGED BY S. Patterson **CHECKED BY** M. Brewer, P.E.
STABILIZED WATER LEVEL --- FIAD
NOTES Topsoil ~ 8 inches
NORTHING 898142 ft **EASTING** 1216036 ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS (N VALUE)	Moisture Description
0		**ALLUVIUM:** Medium Stiff, Tan-Gray-Brown, Fine to Coarse Sandy CLAY (CL), contains subangular to subrounded gravel and organics	SS 1	8	2-2-4 (6)	M
5		Medium Dense, Tan-Gray, Silty Fine to Coarse SAND (SM), contains subangular to subrounded gravel	SS 2	18	4-5-9 (14)	M
		Hard, Orange-Tan-Gray, Fine to Coarse Sandy CLAY (CL)	SS 3	12	6-12-22 (34)	M
10		Dense, Orange-Gray, Fine to Coarse Sandy GRAVEL (GP)	SS 4	10	20-29-15 (44)	M
15		**PARTIALLY WEATHERED ROCK:** (BIOTITE METASILTSTONE) Sampled as Brown-Green-Gray, Fine Sandy SILT, contains mica and gravel-sized rock fragments	SS 5	4	50/4"	
		Auger Refusal and Begin Coring at 15.7 feet	SS 6	1	50/1"	
20		**CRYSTALLINE ROCK:** Fresh, Hard to Very Hard, White-Blue-Gray, (BIOTITE METASILTSTONE), with Close to Moderately Close Fracture Spacing and Thinly Laminated to Very Thickly Bedded and near-vertical bedding fabric REC=95% RQD=91% GSI=70-80 RS-1: 18.4-18.9' Unit Weight: 177.5 pcf Unconfined Compressive Strength: 18,900 psi (2,722 ksf)	RC 1			
25						

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80
FINES CONTENT (%)
20 40 60 80

Boring terminated at a depth of 25.7 feet.

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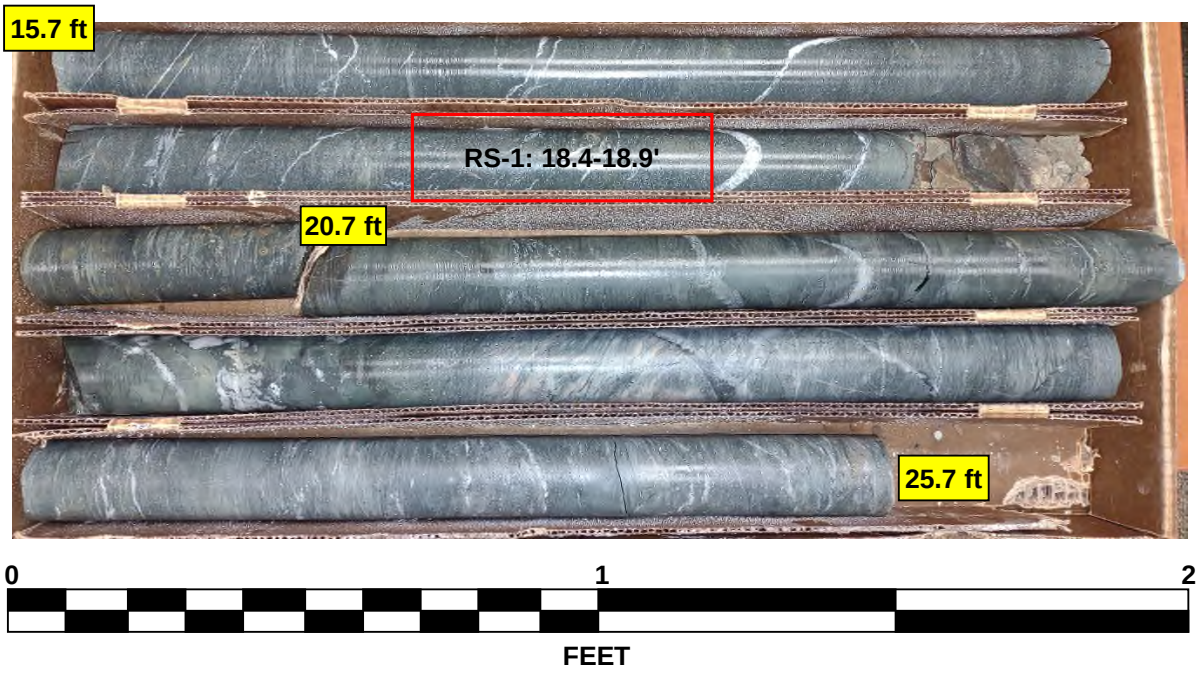
Middle Fork South Fork New River Greenway Pedestrian Bridges
Watauga County, NC

Rock Core Photographs

Boring: BR1_EB1

15.7 to 25.7 Feet



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BORING NUMBER BR1_EB2

CLIENT Arete Engineers, PLLC
PROJECT NAME Middle Fork South Fork New River Pedestrian Bridges
PROJECT NUMBER CG2 No. 240022151
PROJECT LOCATION Boone, NC
DATE STARTED 11/4/22 **COMPLETED** 11/4/22
GROUND ELEVATION _____ **HOLE SIZE** 6 inches
DRILLING CONTRACTOR CG2 Exploration, LLC - Diedrich D-50 - 76%
GROUND WATER LEVELS:
DRILLING METHOD H.S. Augers
▼ **0-HR WATER LEVEL** 9.00 ft
LOGGED BY S. Patterson **CHECKED BY** M. Brewer, P.E.
STABILIZED WATER LEVEL --- FIAD
NOTES Topsoil ~ 12 inches
NORTHING 898063 ft **EASTING** 1215985 ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS (N VALUE)	Moisture Description	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
0		**ALLUVIUM:** Very Loose to Loose, Brown, Silty Fine to Coarse SAND (SM), contains subangular to subrounded gravel LL: NP PI: NP %Passing No. 200: 17.6% Moisture Content: 17.1%	SS 1	8	2-2-2 (4)	M	
5			SS 2	10	2-3-2 (5)	M	
		PARTIALLY WEATHERED ROCK: (BIOTITE METASILTSTONE) Sampled as Blue-Green-Gray, Fine Sandy SILT, contains mica and gravel-sized rock fragments	SS 3	9	43-50/3"		>>
10		▼ 0-hr Cave-in: 11.0 ft	SS 4	1	50/2"		>>
		Auger Refusal at 12.4 feet Boring terminated at a depth of 12.4 feet.	SS 5	0	50/0"		>>

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BORING NUMBER BR2_EB1

CLIENT Arete Engineers, PLLC
PROJECT NAME Middle Fork South Fork New River Pedestrian Bridges
PROJECT NUMBER CG2 No. 240022151
PROJECT LOCATION Boone, NC
DATE STARTED 11/3/22 **COMPLETED** 11/3/22
GROUND ELEVATION _____ **HOLE SIZE** 6 inches
DRILLING CONTRACTOR CG2 Exploration, LLC
GROUND WATER LEVELS:
DRILLING METHOD Hand Auger/Portable Core Drill
0-HR WATER LEVEL --- N/A
LOGGED BY S. Patterson **CHECKED BY** M. Brewer, P.E.
STABILIZED WATER LEVEL --- FIAD
NOTES Utilized portable core drill as test location inaccessible to drill rig.
NORTHING 897297 ft **EASTING** 1216931 ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS (N VALUE)	Moisture Description	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
0		**ALLUVIUM:** Brown, Fine to Coarse Sandy SILT (ML), contains gravel and organics Hand Auger Refusal at 1 foot.					
		CRYSTALLINE ROCK: Fresh, Hard to Very Hard, White-Blue-Gray, (BIOTITE METASILTSTONE), with Close to Moderately Close Fracture Spacing and Thinly Laminated and near-vertical bedding fabric	RC 2				
5		REC=80% RQD=36% GSI=30-35 RS-2: 1.6-1.9' Unit Weight: 172.3 pcf Unconfined Compressive Strength: 8,290 psi (1,194 ksf)					
10		*Note: Rock quality and strength test results could be influenced by the drilling methods utilized and the sample diameter of the recovered rock samples. Interpretations made regarding RQD/ GSI may be approximated.					

Boring terminated at a depth of 11.0 feet.

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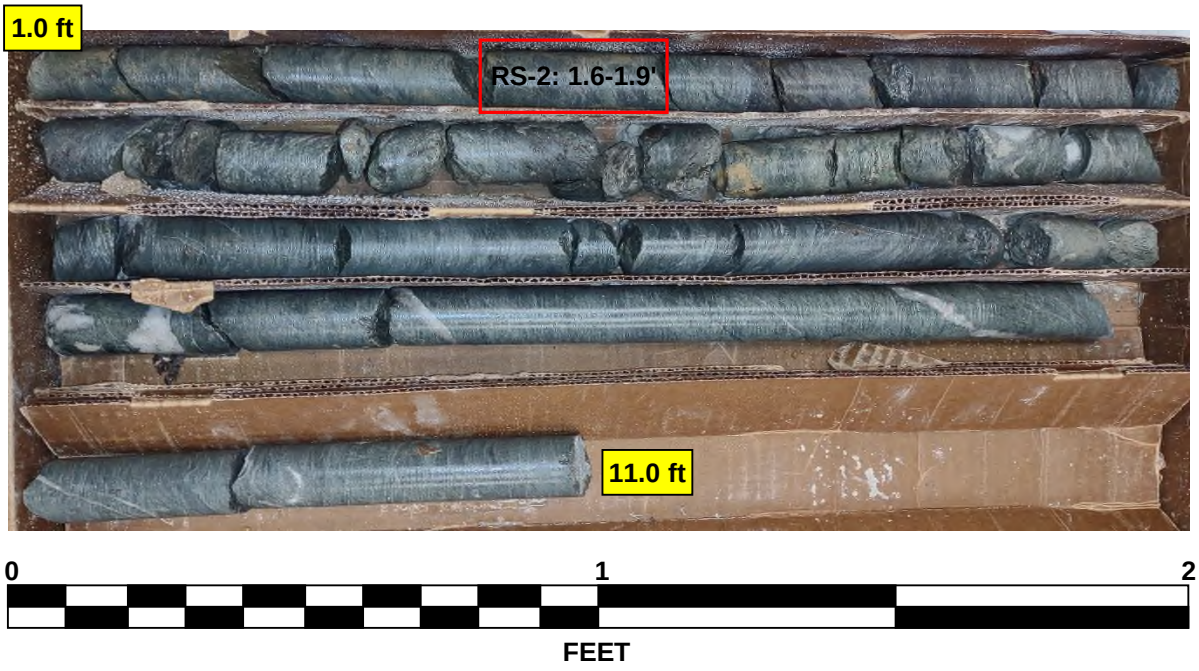
Middle Fork South Fork New River Greenway Pedestrian Bridges
Watauga County, NC

Rock Core Photographs

Boring: BR2_EB1

1.0 to 11.0 Feet



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CAROLINAS GEOTECHNICAL GROUP

BORING NUMBER BR2_EB2

CLIENT Arete Engineers, PLLC
PROJECT NAME Middle Fork South Fork New River Pedestrian Bridges
PROJECT NUMBER CG2 No. 240022151
PROJECT LOCATION Boone, NC
DATE STARTED 11/3/22 **COMPLETED** 11/3/22
GROUND ELEVATION _____ **HOLE SIZE** 6 inches
DRILLING CONTRACTOR CG2 Exploration, LLC - Diedrich D-50 - 76%
GROUND WATER LEVELS:
DRILLING METHOD H.S. Augers
▼ **0-HR WATER LEVEL** 15.50 ft
LOGGED BY S. Patterson **CHECKED BY** M. Brewer, P.E.
STABILIZED WATER LEVEL --- FIAD
NOTES Topsoil ~ 9 inches
NORTHING 897190 ft **EASTING** 1216956 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS (N VALUE)	Moisture Description
0	**ALLUVIAL:** Medium Stiff, Orange-Brown, Fine to Coarse Sandy SILT (ML), contains gravel LL: 35 PI: 6 %Passing No. 200: 69.9% Moisture Content: 28.0%	SS 1		2-3-5 (8)	M
5	Very Dense, Orange-Brown, Gravelly Fine to Coarse SAND (SW), contains alluvial boulders and gravel	SS 2		7-12-50/2"	
	Dense, Brown-Gray, Fine to Coarse Sandy Gravel (GP)	SS 3		19-14-19 (33)	M
10		SS 4		23-17-17 (34)	M
	RESIDUAL: Stiff to Very Stiff, Blue-Tan-Gray, SILT (ML) LL: NP PI: NP %Passing No. 200: 90.9% ▼ Moisture Content: 27.6%	SS 5		4-4-6 (10)	M
15					
20		SS 6		8-12-13 (25)	M
25	**PARTIALLY WEATHERED ROCK:** (BIOTITE METASILTSTONE) Sampled as Blue-Gray, Fine Sandy SILT, contains mica and gravel-sized rock fragments 0-hr Cave-in: 27.0 ft	SS 7		18-27-50/5"	
30		SS 8		22-50/2"	
	Boring terminated at a depth of 33.6 feet.	SS 9		50/1"	

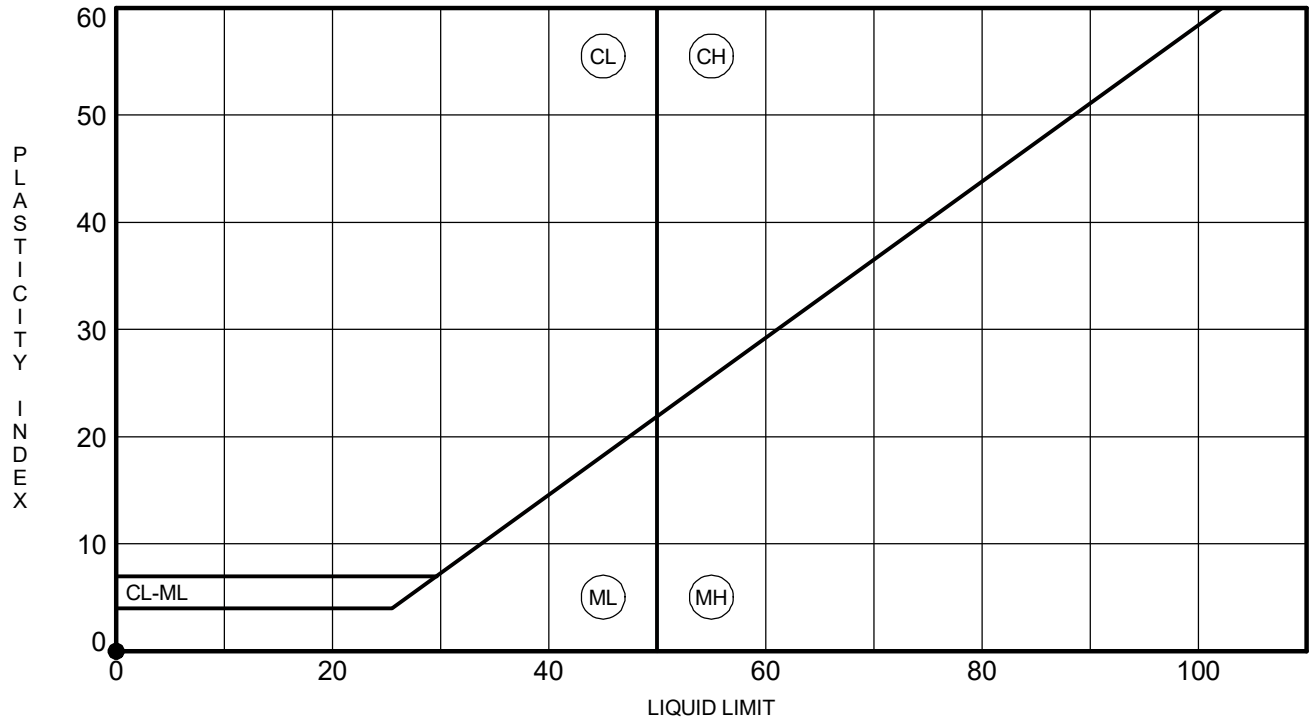
SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

12/13/22 17:16 - C:\USERS\MBREWER\ONEDRIVE - CAROLINAS GEOTECHNICAL GROUP, PLLC\PROJECTS\0151 - MIDDLE FORK SOUTH FORK PEDESTRIAN BRIDGES\CADD_GEOTECH\GEOTECH\BOONE PED BDG USCS.GPJ

ATTERBERG LIMITS' RESULTS

PROJECT ID C8806 - Task 00022 **PROJECT NAME** Middle Fork/South Fork Pedestrian Bridges

PROJECT LOCATION - Boone, North Carolina

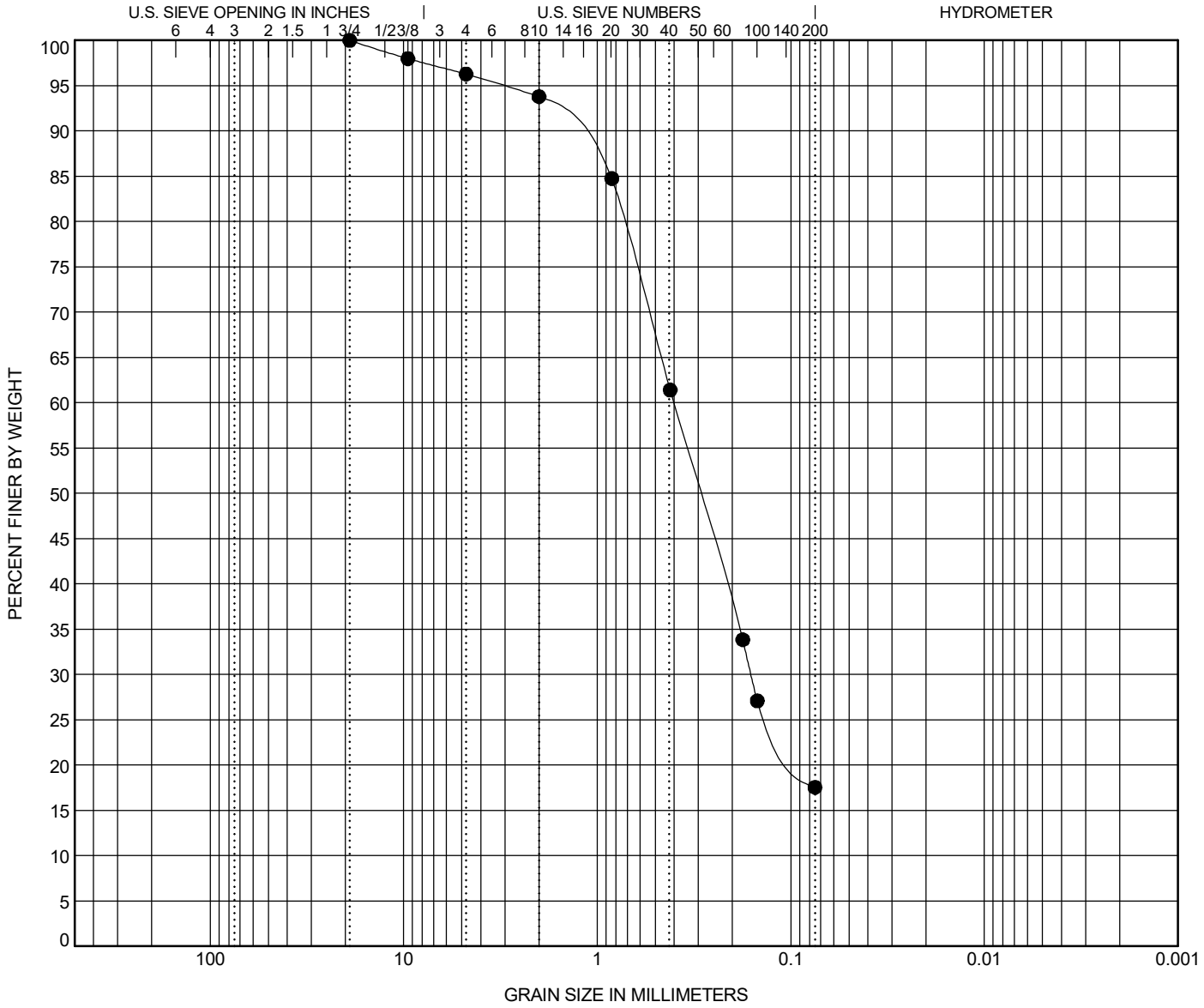


	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**BR1_EB2**	**5.0**	**NP**	**NP**	**NP**	**18**	**SILTY SAND (SM/A-2-4)**

GRAIN SIZE DISTRIBUTION

PROJECT ID C8806 - Task 00022 **PROJECT NAME** Middle Fork/South Fork Pedestrian Bridges

PROJECT LOCATION - Boone, North Carolina



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

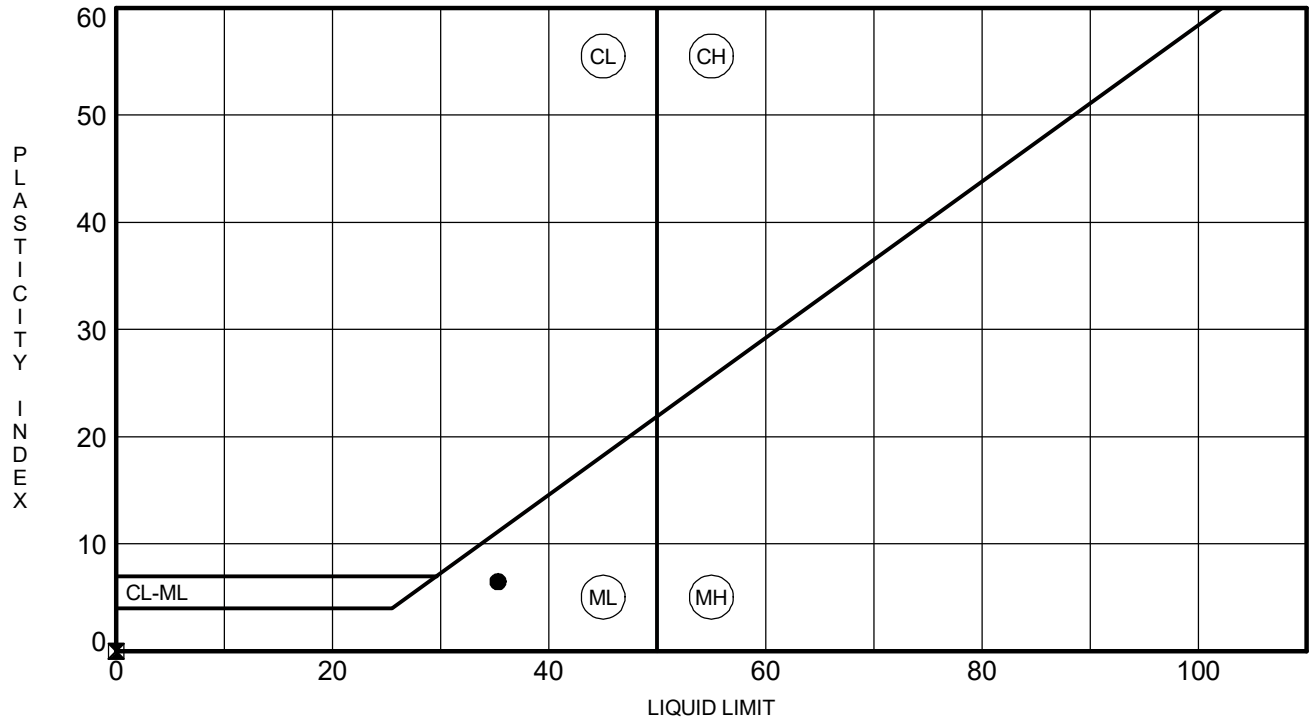
BOREHOLE	DEPTH	Classification	MC%	LL	PL	PI	Cc	Cu
● **BR1_EB2**	**5.0**	**SILTY SAND (SM/A-2-4)**	**17.1**	**NP**	**NP**	**NP**		

BOREHOLE	DEPTH	D100	D95	D50	D10	%Gravel	%Sand	%Silt	%Clay
● **BR1_EB2**	**5.0**	**19**	**3.036**	**0.294**		**3.7**	**78.7**	**17.6**	

ATTERBERG LIMITS' RESULTS

PROJECT ID C8806 - Task 00022 **PROJECT NAME** Middle Fork/South Fork Pedestrian Bridges

PROJECT LOCATION - Boone, North Carolina

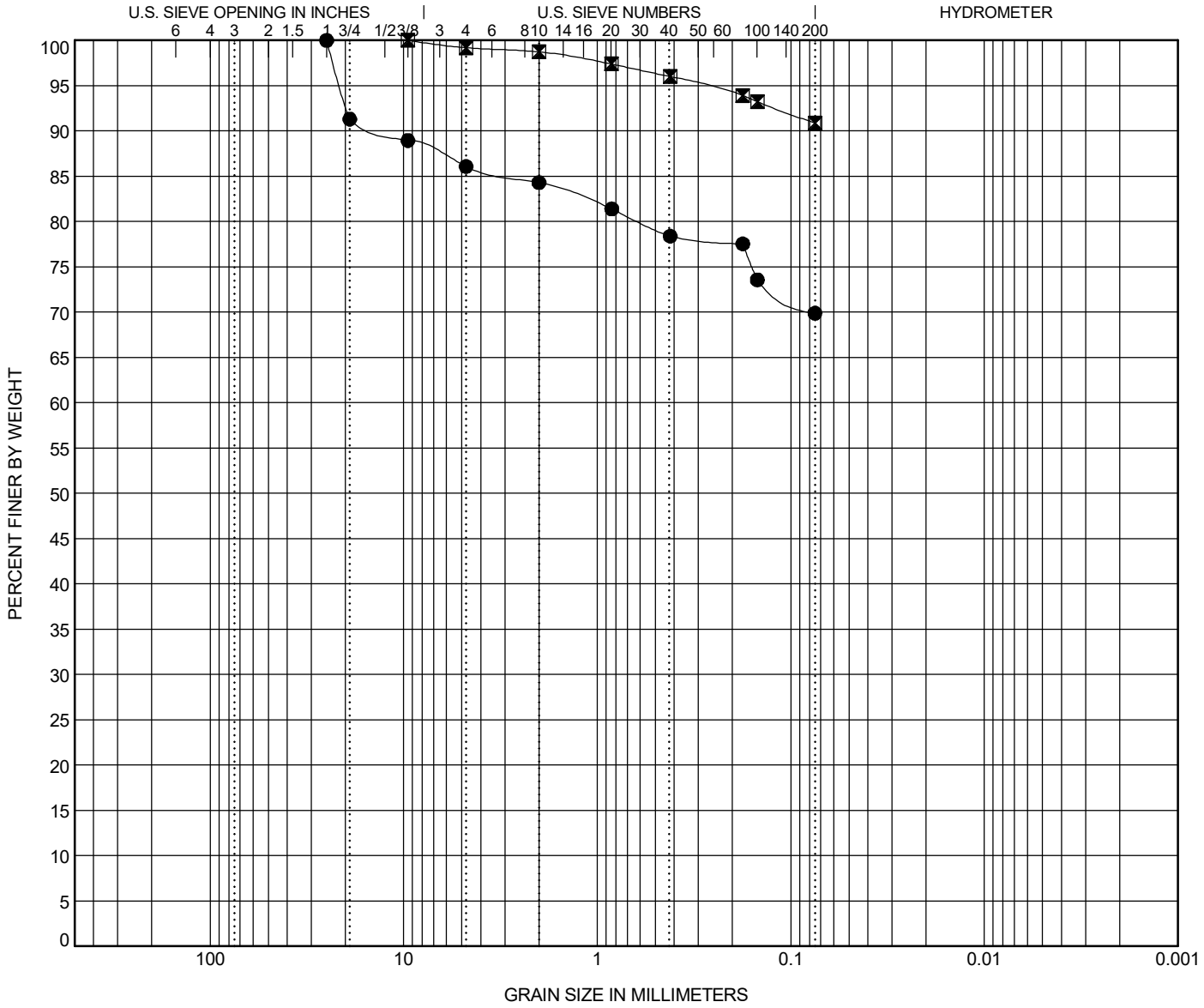


	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**BR2_EB2**	**2.5**	**35**	**29**	**6**	**70**	**SANDY SILT (ML/A-4)**
⊠	**BR2_EB2**	**15.0**	**NP**	**NP**	**NP**	**91**	**SILT (ML/A-4)**

GRAIN SIZE DISTRIBUTION

PROJECT ID C8806 - Task 00022 **PROJECT NAME** Middle Fork/South Fork Pedestrian Bridges

PROJECT LOCATION - Boone, North Carolina



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BR2_EB2**	**2.5**	**SANDY SILT (ML/A-4)**	**28.0**	**35**	**29**	**6**		
⊠	**BR2_EB2**	**15.0**	**SILT (ML/A-4)**	**27.6**	**NP**	**NP**	**NP**		

	BOREHOLE	DEPTH	D100	D95	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	**BR2_EB2**	**2.5**	**25**	**21.345**			**13.9**	**16.2**	**69.9**	
⊠	**BR2_EB2**	**15.0**	**9.51**	**0.276**			**0.8**	**8.3**	**90.9**	

GRAIN SIZE - F&ME C8806 - TASK 00022 - MIDDLE FORK-SOUTH FORK PEDESTRIAN BRIDGES.GPJ FME2017.GDT 11/18/22

F&ME

CONSULTANTS

3112 Devine Street

Columbia, South Carolina 29205

GEOTECHNICAL / ENVIRONMENTAL / MATERIALS

ROCK CORE COMPRESSION TEST

Project Name:	Middle Fork & South Fork Pedestrian Bridge	Project Number:	C8806 Task 00011
Sampled By:	CG2	Date Sampled:	--
Tested By:	A. Abernethy	Date Tested:	11/21/2022
Sampled Number:	22-3106		

Boring Number	BR1_EB1					
Rock Core Number	RS-1					
Depth (ft)	18.4 - 18.9					
Length (in)	4.416					
Diameter (in)	1.854					
Cross Sectional Area (in^2)	2.700					
Load (lb)	51,016					
Compressive Strength (psi)	18,900					

Signature: Jerry P. Hines

Remarks:

F&ME

CONSULTANTS

3112 Devine Street

Columbia, South Carolina 29205

GEOTECHNICAL / ENVIRONMENTAL / MATERIALS

ROCK CORE COMPRESSION TEST

Project Name:	Middle Fork & South Fork Pedestrian Bridge	Project Number:	C8806 Task 00011
Sampled By:	CG2	Date Sampled:	--
Tested By:	A. Abernethy	Date Tested:	11/21/2022
Sampled Number:	22-3107		

Boring Number	BR2_EB1					
Rock Core Number	RS-2B					
Depth (ft)	1.6 - 1.9					
Length (in)	3.022					
Diameter (in)	1.384					
Cross Sectional Area (in^2)	1.504					
Load (lb)	12,478					
Compressive Strength (psi)	8,290					

Signature: Jerry P. Hess

Remarks:


CAROLINAS
GEOTECHNICAL
GROUP

SOLID ROCK ENGINEERING, PLLC

NCBELS #P-1523

WWW.SOLIDROCKENGINEERINGNC.COM

JEFFREY D. HOLCHIN, P.E. FOUNDER, OWNER & PRINCIPAL ENGINEER

October 21, 2023

Mr. Shawn Ausel, PE
Areté Engineers, PLLC
7668 Valley Blvd.
P.O. Box 745
Blowing Rock, NC 28605

Re: Report of Geotechnical Evaluation of Foundation Subgrade
Boardwalk, Slump and Stream Crossing areas of the Middle Fork Greenway Trail
MFG between Payne Branch Rd and Boone Gorge Park, Boone North Carolina
SRE Project # 23-ARETE-1

Dear Mr. Ausel, PE:

Solid Rock Engineering, PLLC (SRE) is pleased to provide this report of geotechnical evaluation of the foundation subgrade at the Boardwalk, slump area and stream crossing areas for the Middle Fork Greenway project, for the section between Payne Branch Road and Boone Gorge Park in Boone, North Carolina. This work was performed in general accordance to SRE proposal 23-ARETE-1p dated May 8, 2023, although evaluation of the stream crossing and slump areas was added to the scope of work at the request of Interface Environmental Consultants (IEC). The purposes of this geotechnical evaluation are to (1) define the subsurface conditions at the three areas and (2) provide specific geotechnical data for the design and construction of the foundations for the planned Boardwalk section plus the stream crossing area, and provide a boulder retaining wall detail for support the lower portion of the trail in the existing slump area. The following sections of this report provide a project description, details from SRE's field work with results, and our engineering recommendations.

GENERAL PROJECT DESCRIPTION

The three portions of the proposed Middle Fork Greenway that were evaluated by SRE are located on the slope south of the stream that is heavily vegetated with trees and rhododendron; boulders and bedrock outcrops are present, along with concrete pillars from the old metal pipeline that had carried water from Payne Branch Dam to Boone. The attached drawing from Arete' Engineers show the proposed Boardwalk in plan with existing topography and in sections – there will be two abutments and nine (9) piers along the same alignment as the old pipeline. At each of these eleven locations, the Boardwalk will be supported by a reinforced-concrete beam over two reinforced-concrete piers. The attached drawing from IEC shows the two additional areas evaluated by SRE to aid in the design of an additional boardwalk section to cross two minor streams and an existing slump area that will need a boulder retaining wall to support the lower portion of the trail. The following photos show the amount of vegetation present at these areas:

.

These photos show the remnants of the old pipeline at the new Boardwalk alignment:

SRE FIELD WORK RESULTS

The sloping terrain and heavy vegetation forced SRE to use hand equipment for the subgrade evaluation at the three areas, instead of the preferred use of a drilling rig for test borings or a small excavator for test pits. SRE used a shovel and 3-inch diameter steel hand auger for this subgrade evaluation, with limited effect because of the presence of rocks in the subgrade.

1. **Planned Boardwalk Alignment** – SRE used a shovel and hand-auger to evaluate the two abutment and nine pier locations, as shown in the following photos:

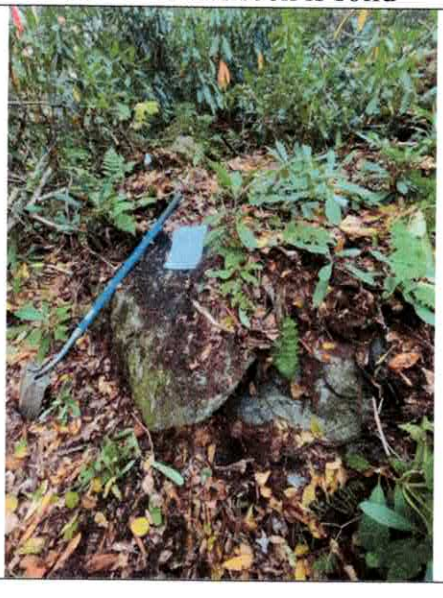
Abutment 1 – note trench for old pipe

Abutment 1 – note bedrock on left

Abutment 1 – fill material

Pier 1 – upper rock is loose

Pier 1 – lower rock is solid



Pier 1

Pier 2 – close to concrete pillar	Pier 2 – also close to old metal pipe
	

Pier 3 – on hard rock	Pier 3 – bedrock outcrop
	

Pier 4 – on hard rock	Pier 4 – on hard rock
	

Pier 5 – on hard rock

Pier 5 – on hard rock

Pier 6 – on hard rock

Pier 6 – on hard rock

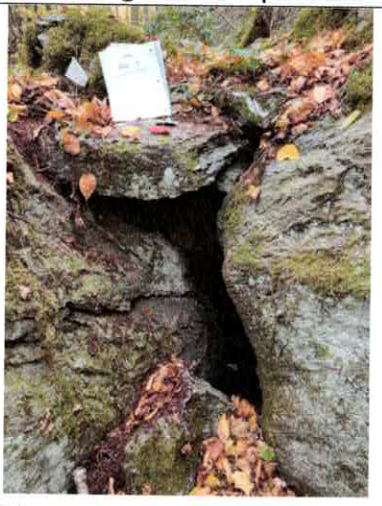
Pier 6 – looking back

Pier 6 – looking back

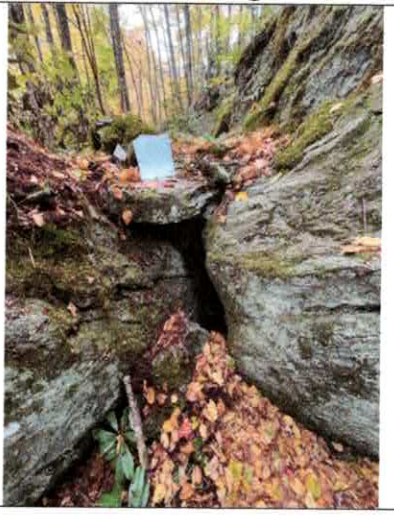
Pier 7 – on hard rock

Pier 7 – on hard rock

Pier 7 – looking back – top rock is loose



Pier 7 – looking back



Pier 8 – next to concrete pillar

Pier 8 – on hard rock

Pier 9 – next to conc pillar	Pier 9 – in soil
	

Abutment 2	Abutment 2 – in soil
	

2. **Additional Boardwalk at stream crossing** – SRE evaluated the area of two minor streams with a shovel and hand-auger, where an additional boardwalk may be located. The attached drawing from IEC shows the area in plan view, while the following photos show the specific area:

Stream area – looking upslope

Adjacent to old concrete pillar

Hand-auger boring

Hand-auger boring

SRE attempted three hand-auger borings in this area and was only able to reach a depth of 12 inches at these locations. The surficial soil consists of approximately 3-4 inches of root mat and black topsoil, which is underlain by a brown sandy non-plastic silt (ML) and silty fine sand (SM) with rocks, which SRE identified as a colluvial soil that has moved downslope previously. SRE could not penetrate

the rocks in the upper soil layer to reach competent residual soi, and/or partially weathered bedrock (PWR) or bedrock.

3. **Existing Slump area** – SRE evaluated an approximately 100 feet long area using a shovel and hand-auger, as requested by Ms. Carrie Caviness of IEC. Note that the heavy vegetation may be concealing additional slump areas. The attached drawing from IEC shows the area in plan view, while the following photos show the specific area:

Slump area – looking downstream

Slump area – looking upstream

Notice the rocks on surface

Hand-auger boring

SRE attempted four hand-auger borings in this area and was only able to reach a depth of 18 inches at one location and 12 inches at the other locations. The surficial soil consists of approximately 3-4 inches of root mat and black topsoil, which is underlain by a brown sandy non-plastic silt (ML) and silty fine sand (SM) with rocks, which SRE identified as a colluvial soil that has moved downslope previously. This colluvial soil layer is NOT a suitable material to support the boulder retaining wall. SRE could not penetrate the rocks in the colluvial soil layer to reach competent residual soi, and/or partially weathered bedrock (PWR) or bedrock.

SRE Engineering Recommendations

The following engineering recommendations are based on the results of subgrade evaluation using hand equipment at the three areas, and SRE experience with similar projects in the area. Note that SRE recommends further evaluation of the subgrade at these three areas using an excavator to dig test pits with SRE present, once construction begins and construction equipment can access the three locations. Arete' Engineers should understand that SRE may have to revise our subgrade bearing capacity and depth of excavation recommendations for foundations design for both Boardwalk locations and the boulder retaining wall at the slump area, if the test pits using an excavator reveal significantly different subgrade conditions that were encountered in this evaluation using hand equipment.

SRE recommends the following allowable bearing capacities and excavation depths for the three areas that were evaluated:

1. **Foundations at the planned Boardwalk alignment** – SRE recommends the following:

Location	Bearing material	Allowable bearing capacity (psf)	Depth of excavation (inches)
Abut. 1	Bedrock (1)	6000	Top of rock (2)
Pier 1	Bedrock (3)	6000	Top of rock (2)
Pier 2	Bedrock	6000	Top of rock (2)
Pier 3	Bedrock	6000	Top of rock (2)
Pier 4	Bedrock	6000	Top of rock (2)
Pier 5	Bedrock	6000	Top of rock (2)
Pier 6	Bedrock	6000	Top of rock (2)
Pier 7	Bedrock (3)	6000	Top of rock (2)
Pier 8	Bedrock	6000	Top of rock (2)
Pier 9	Residual soil	3000	24
Abut. 2	Residual soil	3000	24

Notes: 1 – remove the fill material above the bedrock
2 – use rock pins to prevent slippage on the sloping surface
3 – remove unstable rock above the solid rock outcrop

2. **Foundations at the additional Boardwalk at stream crossing** – SRE recommends an allowable bearing capacity of 3000 psf for competent residual soil, under any surficial alluvial soil, at an expected depth of 24 inches (to be confirmed by test pits).

3. **Foundation for boulder retaining wall at the existing Slump area** – SRE recommends an allowable bearing capacity of 3000 psf for competent residual soil, under any surficial colluvial soil, at an expected depth of 36-48 inches (to be confirmed by test pits).

Thank you for this opportunity for SRE to provide professional engineering services for your project. Let us know if there are any questions about this report, or if SRE can provide additional engineering services for this project.

Sincerely,

SOLID ROCK ENGINEERING, PLLC

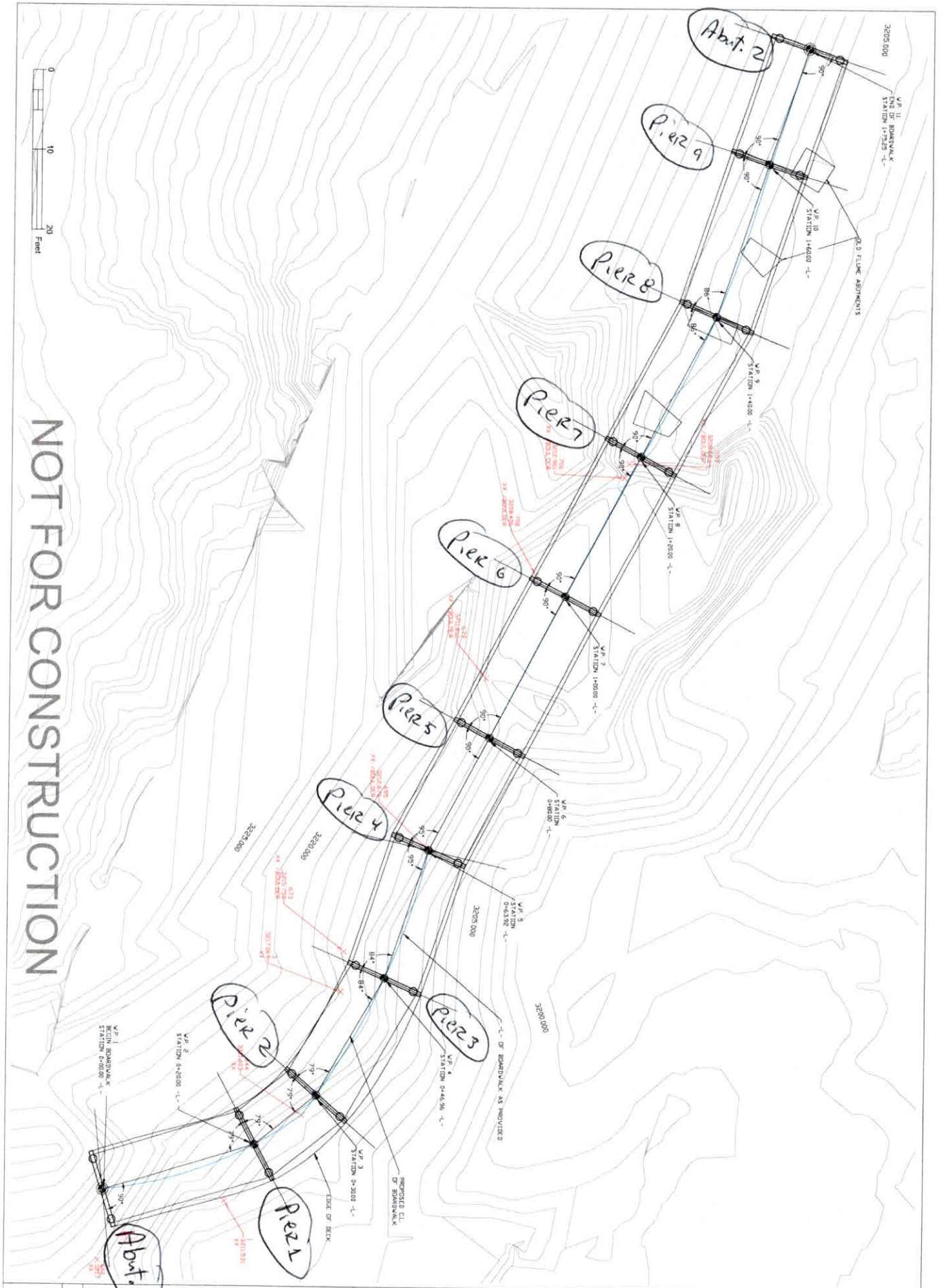
10-21-23

NORTH CAROLINA PROFESSIONAL SEAL 20450 ENGINEER JEFFREY D. HOLCHIN

Jeffrey D. Holchin, P.E., D.GE
Principal Geotechnical Engineer

Cc: Mr. Adam Felmlee (adam@areteengineers.com)
Ms. Carrie Caviness (carrie.caviness.1@gmail.com)

Attachments: Draft Boardwalk Plan and Section Drawing from Arete' Engineers
Slump and Stream Crossing Area Plan View from IEC
Figure SRE-1 Boulder Retaining Wall Detail for Slump Area
Figure SRE-2 Rock Pin Detail



NOT FOR CONSTRUCTION

S2

SHEET NUMBER

MIDDLE FORK GREENWAY
ELEVATED BOARDWALK PLANS
FOR
INTERFACE ENVIRONMENTAL CONSULTING, LLC
AT
MIDDLE FORK OF NEW RIVER,
DOWNSTREAM OF PAYNE BRANCH RD.
BLOWING ROCK, NC 28605

ELEVATED BOARDWALK PLAN

DATE:	8/12/2023
DRAWN BY:	LDM
REVIEWED BY:	AGF
APPROVED BY:	AGF
PROJECT No.	4026

No.	REVISIONS	DATE
1		
2		
3		

Areté ENGINEERS
ARETÉ ENGINEERS, PLLC
7668 Valley Blvd.
P.O. Box 745
Blowing Rock, NC 28605

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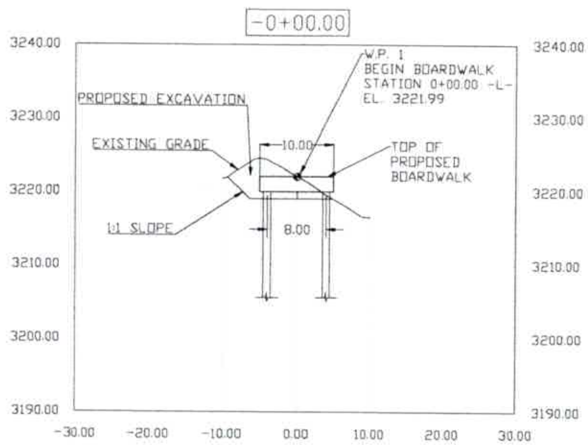

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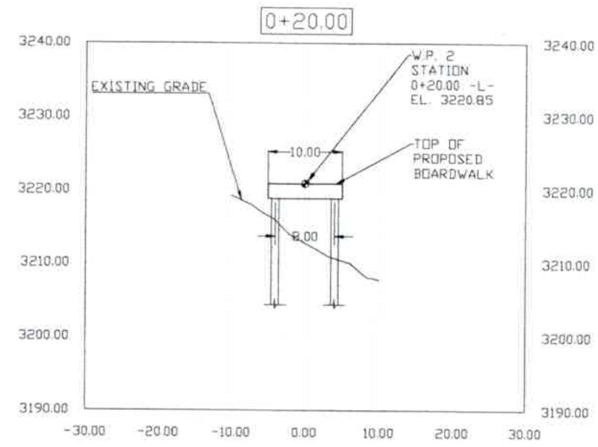

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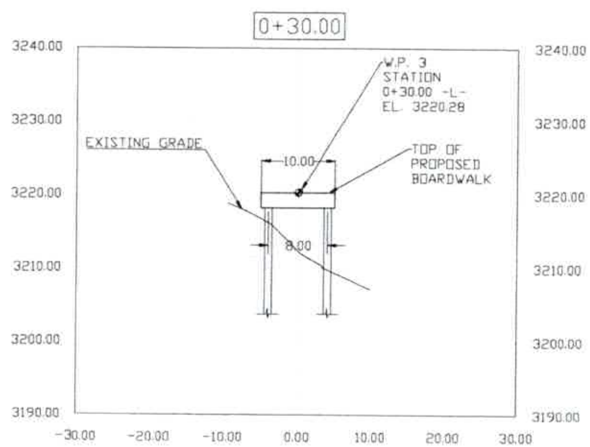

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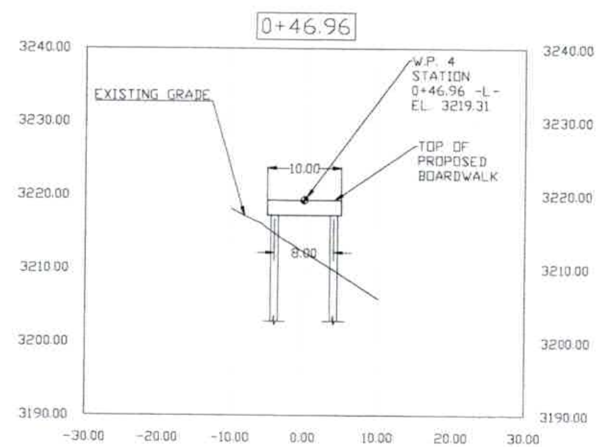

(4) SECTION AT STATION 0+46.96 - PIER 3
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MIDDLE FORK GREENWAY
ELEVATED BOARDWALK PLANS
FOR
INTERFACE ENVIRONMENTAL CONSULTING, LLC
AT
MIDDLE FORK OF NEW RIVER,
DOWNSTREAM OF PAYNE BRANCH RD.
BLOWING ROCK, NC 28605

SECTIONS AT ABUTMENT 1 THRU PIER 3

		No.	REVISIONS	DATE
DATE:	8/12/2023	1		
DRAWN BY: / REVIEWED BY:	LDM / AGF			
APPROVED BY:	AGF	2		
PROJECT No.:	4026			
SCALE:	AS NOTED	3		

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Blowing Rock, NC 28605
FIRM LICENSE No. P-1337

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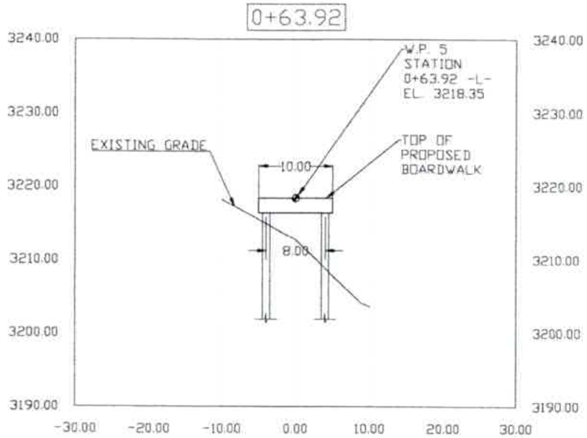
SHEET NUMBER
S3



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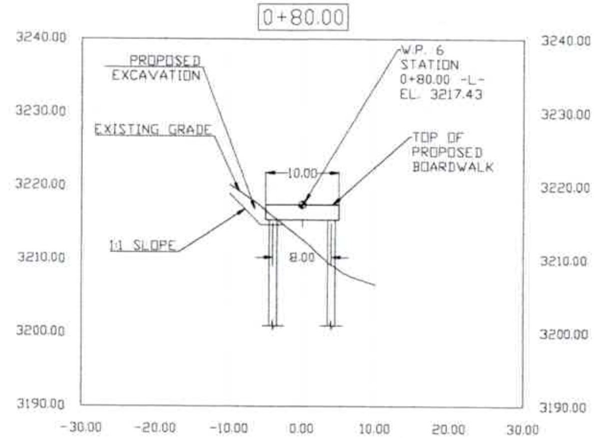

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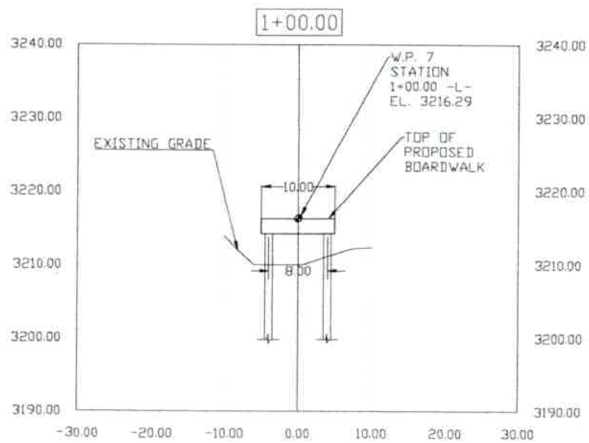

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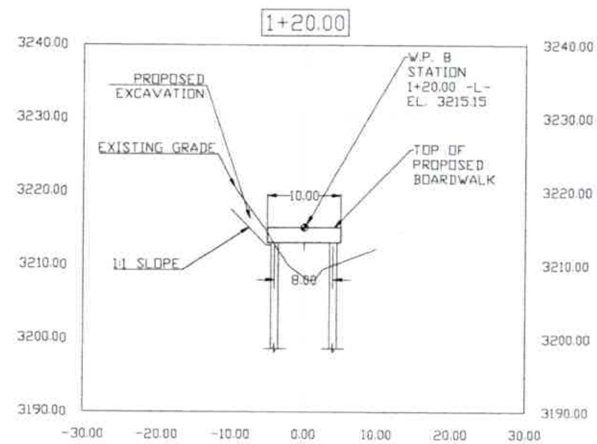

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Scale: 1 1/2" = 1'

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MIDDLE FORK GREENWAY
ELEVATED BOARDWALK PLANS
FOR
INTERFACE ENVIRONMENTAL CONSULTING, LLC
AT
MIDDLE FORK OF NEW RIVER,
DOWNSTREAM OF PAYNE BRANCH RD.
BLOWING ROCK, NC 28605

SHEET NUMBER

S4

SECTIONS AT PIER 4 THRU PIER 7

		No.	REVISIONS	DATE
DATE:	8/12/2023			
DRAWN BY:	LDM	1		
REVIEWED BY:	AGF			
APPROVED BY:	AGF	2		
PROJECT No.:	4026			
SCALE:	AS NOTED	3		

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Blowing Rock, NC 28605
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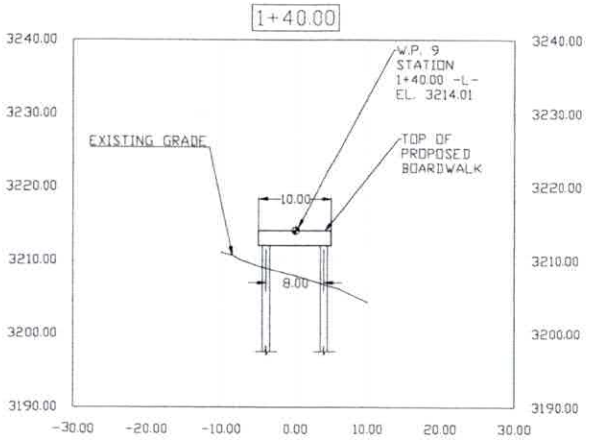

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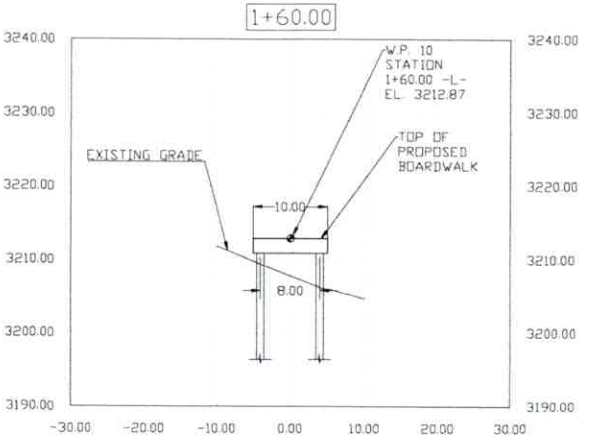

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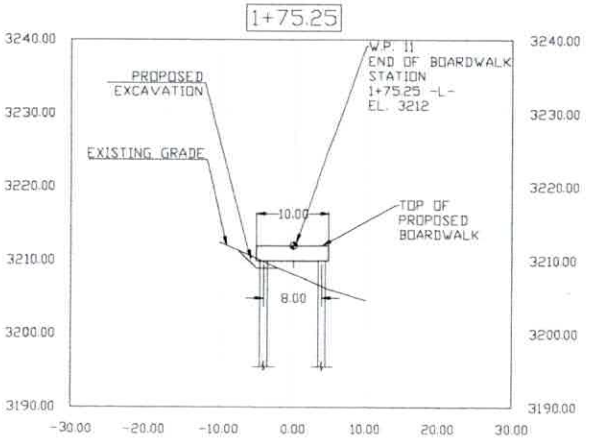

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Scale: 1 1/2" = 1'

NOT FOR CONSTRUCTION

FOR REVIEW
NOT FOR CONSTRUCTION

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ARETE ENGINEERS, PLLC
7668 Valley Blvd
P.O. Box 745
Blowing Rock, NC 28605
NRM LICENSE No. P-1617

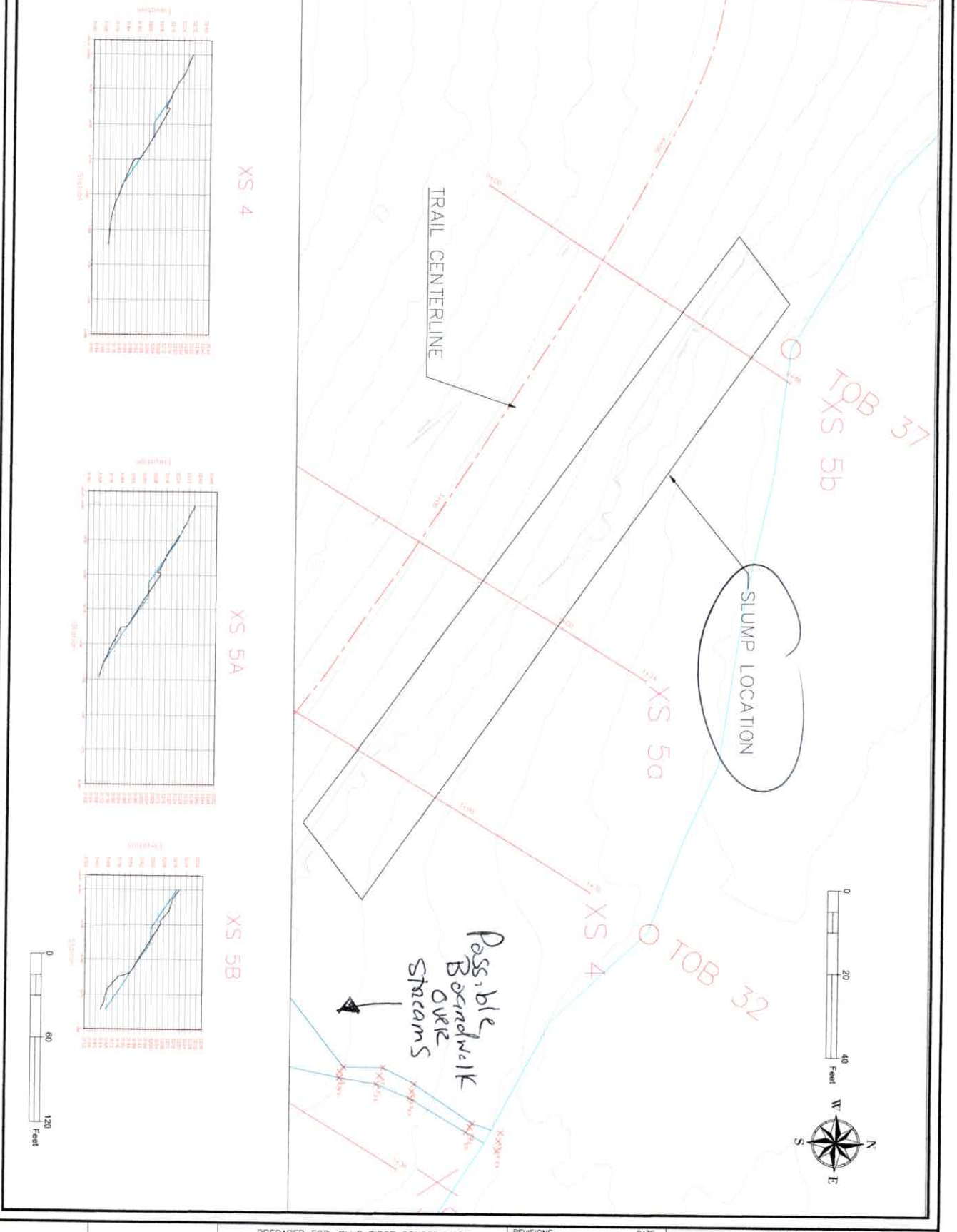
SECTIONS AT PIER 8
THRU ABUTMENT 2

No.	REVISIONS	DATE
1		
2		
3		

DATE: 8/10/2023
DRAWN BY: LDM
REVIEWED BY: AGF
APPROVED BY: AGF
PROJECT No.: 4026
SCALE: AS NOTED

MIDDLE FORK GREENWAY
ELEVATED BOARDWALK PLANS
FOR
INTERFACE ENVIRONMENTAL
CONSULTING, LLC
AT
MIDDLE FORK OF NEW RIVER,
DOWNSTREAM OF PAYNE BRANCH RD.
BLOWING ROCK, NC 28605

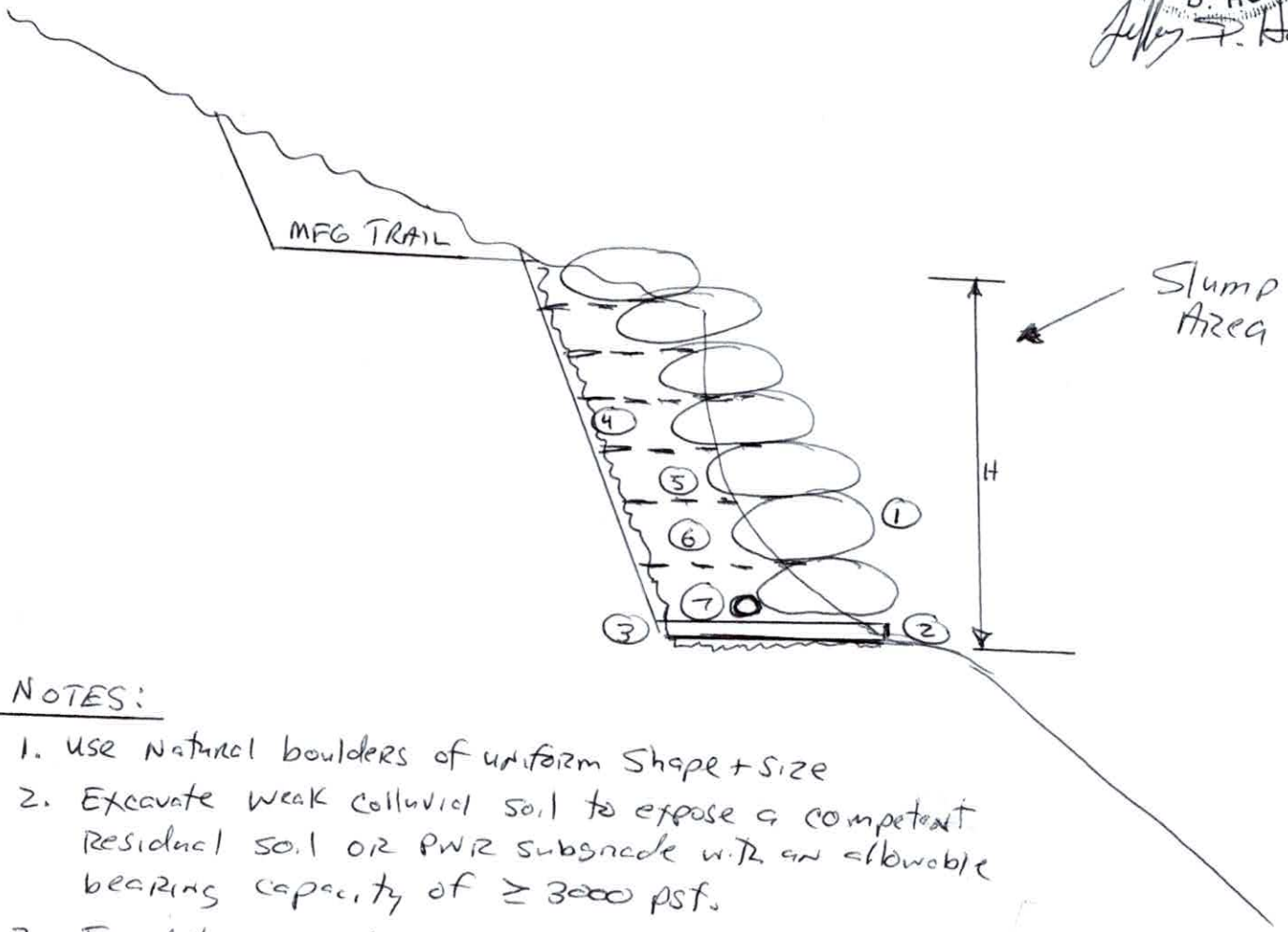
SHEET NUMBER
S5



SHEET X/X	(NORTH ARROW HERE) SCALE: 1"=1' (SCALE BAR HERE)	PREPARED FOR: BLUE RIDGE CONSERVANCY BOONE GORGE TRAIL ALIGNMENT MIDDLE FORK GREENWAY – BOONE GORGE WATAUGA COUNTY, NC	REVISIONS / DATE	PREPARED BY: INTERFACE ENVIRONMENTAL CONSULTING, LLC 476 HIDDEN POND ROAD BOONE, NC 28607 919-656-4543	IEC

10-21-23

NORTH CAROLINA PROFESSIONAL SEAL 20450 ENGINEER JEFFREY D. HOLCHIN



NOTES:

1. Use Natural boulders of uniform Shape + Size
2. Excavate weak colluvial soil to expose a competent Residual soil or PWR subgrade w.Th an allowable bearing capacity of ≥ 3000 psf.
3. Foundation = 6" compacted ABC gravel
4. Separate The Natural soil and gravel backfill w.Th 6 oz. geotextile separator fabric
5. Use TENSAR BX 1100 geogrid between every course of boulders; L ≥ 0.75 H.
6. Use compacted #57 gravel as backfill
7. Use a 4" diameter perforated sch. 40 PVC pipe as a drain, with gravity outlets

FIGURE SRE-1 N.T.S.

BOULDER RETAINING WALL DETAIL

SLUMP AREA IN MFG TRAIL - BOONE GORGE

BOONE, NC

10-21-23

NORTH CAROLINA PROFESSIONAL SEAL 20450 ENGINEER JEFFREY D. HOLCHIN

Jeffrey D. Holchin

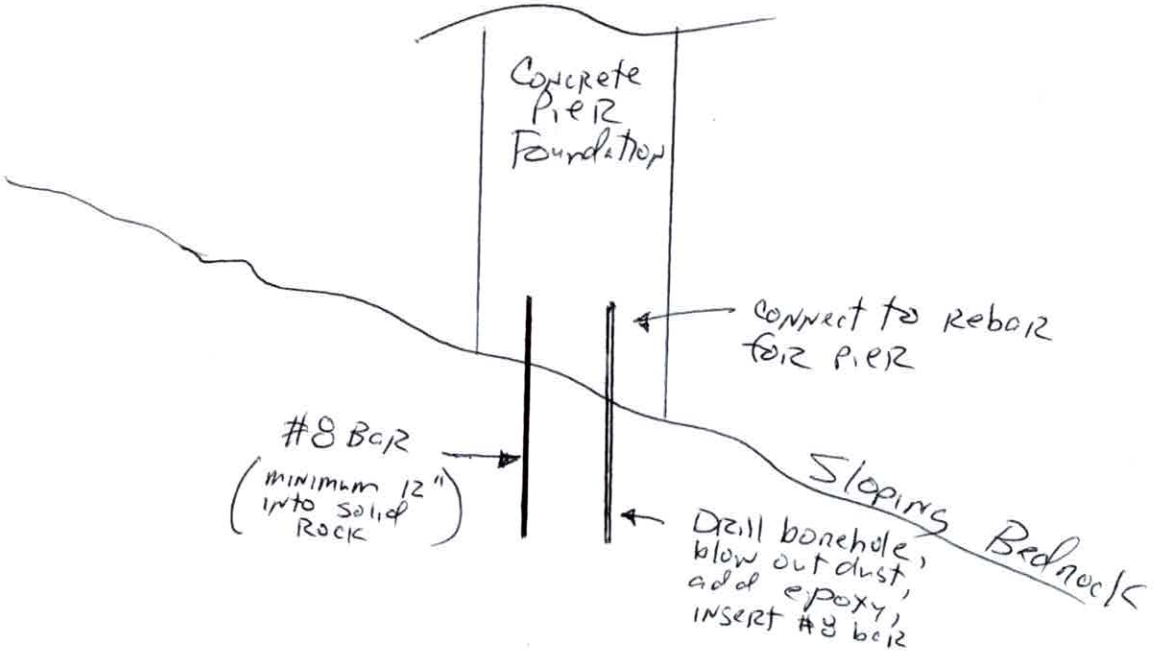


FIGURE SRE-2 N.T.S.

ROCK PIN DETAIL, FOR BOARDWALK FOUNDATIONS ON ROCK

MTG - BOONE GORGE BOONE NC

MEET NORTH CAROLINA ONE-CALL CENTER

North Carolina One-Call is a corporation formed and funded by participating utility companies and municipalities in the interest of community and job safety and improved service through damage reduction to the utilities.

A one call toll free number, 1-800-632-4949, provides an avenue to all of the participating members from any point within the State of North Carolina.

Anyone proposing to excavate, dig, bore, tunnel, blast or disturb the earth in any manner in which buried utilities may be damaged is requested to call the toll-free number between the hours of 7:00 a.m. and 5:00 p.m., Monday through Friday, forty-eight hours before starting the proposed work.

Within minutes of your telephone call, the participating members will be made aware of your plans and will be given pertinent information that has been provided by you about your planned work. You will be told the names of the participating members from whom you can expect a response. If there are buried facilities in the path of your activity, the route of the utilities will be staked and/or marked at no expense to you. If there are no facilities in the area of the planned work, you will be called or notified by a representative of the participating company accordingly.

Should a non-participating utility operator be serving your area, we recommend that you call them on an individual basis. All utility operators, whether company or municipality, will be provided an opportunity to become a member of North Carolina One-Call.

Naturally, knowing the route of the utilities, the excavator is expected to exercise caution and to avoid damage as the project progresses.

Damage prevention doesn't just happen - it is a planned and orderly process through which each of us can participate - Yes, we can and will dramatically reduce damages to the utilities in the State of North Carolina! Thanks for your help.

BEFORE YOU DIG IN THE INTEREST OF COMMUNITY AND JOB SAFETY

AND IMPROVED SERVICE

CALL NORTH CAROLINA ONE-CALL

1-800-632-4949

Contractor's Application for Payment

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

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

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:

(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;

(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and

(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____

Signature: _____ **Date:** _____

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

Progress Estimate - Lump Sum Work

Contractor's Application for Payment

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

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

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

Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			

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

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

Progress Estimate - Unit Price Work | **Contractor's Application for Payment**

Owner: ______________________ **Owner's Project No.:** __________
Engineer: ______________________ **Engineer's Project No.:** __________
Contractor: ______________________ **Contractor's Project No.:** __________
Project: ______________________
Contract: ______________________

Application No.: __________ **Application Period:** **From** __________ **to** __________ **Application Date:** __________

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

Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: ______________________ **Owner's Project No.:** ______________
Engineer: ______________________ **Engineer's Project No.:** ______________
Contractor: ______________________ **Contractor's Project No.:** ______________
Project: ______________________
Contract: ______________________

Application No.: __________ **Application Period:** **From** __________ **to** __________ **Application Date:** __________

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

Stored Materials Summary

Contractor's Application for Payment

Owner: ______________________________ Owner's Project No.: ____________

Engineer: ______________________________ Engineer's Project No.: ____________

Contractor: ______________________________ Contractor's Project No.: ____________

Project: ______________________________

Contract: ______________________________

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

A	B	C	D	E	F	G	H	I	J	K	L	M
						Materials Stored			Incorporated in Work			
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Previous Amount Stored ($)	Amount Stored this Period ($)	Amount Stored to Date (G+H) ($)	Amount Previously Incorporated in the Work ($)	Amount Incorporated in the Work this Period ($)	Total Amount Incorporated in the Work (J+K) ($)	Materials Remaining in Storage (I-L) ($)
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
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								-			-	-
								-			-	-
								-			-	-
					Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -

WORK CHANGE DIRECTIVE NO.: ___

Owner:	Owner's Project No.:
Engineer:	Engineer's Project No.:
Contractor:	Contractor's Project No.:
Project:	
Contract Name:	
Date Issued:	Effective Date of Work Change Directive:

Contractor is directed to proceed promptly with the following change(s):

Description:

Attachments:

Purpose for the Work Change Directive:

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

☐ Non-agreement on pricing of proposed change. ☐ Necessity to proceed for schedule or other reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price: $ _____

Contract Time: _____ days

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

	Recommended by Engineer	Authorized by Owner
By:	_____	_____
Title:	_____	_____
Date:	_____	_____

CHANGE ORDER NO.: 1

Owner: Owner's Project No.:
Engineer: Engineer's Project No.:
Contractor: Contractor's Project No.:
Project:
Contract Name:
Date Issued: Effective Date of Change Order:

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments:

Change in Contract Price	**Change in Contract Times**
Original Contract Price: $ _____	Original Contract Times: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] from previously approved Change Orders No. 1 to No. $ _____	**[Increase] [Decrease]** from previously approved Change Orders No.1 to No. Substantial Completion: _____ Ready for final payment: _____
Contract Price prior to this Change Order: $ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] this Change Order: $ _____	**[Increase] [Decrease]** this Change Order: Substantial Completion: _____ Ready for final payment: _____
Contract Price incorporating this Change Order: $ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for final payment: _____

Recommended by Engineer (if required)	Accepted by Contractor
By: _____	_____
Title: _____	_____
Date: _____	_____
Authorized by Owner	Approved by Funding Agency (if applicable)
By: _____	_____
Title: _____	_____
Date: _____	_____

FIELD ORDER NO.: [Number of Field Order]

Owner:	Owner's Project No.:
Engineer:	Engineer's Project No.:
Contractor:	Contractor's Project No.:
Project:	
Contract Name:	
Date Issued:	Effective Date of Field Order:

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s):

Drawing(s) / Details (s):

Description:

Attachments:

]

Issued by Engineer

By: _____

Title: _____

Date: _____

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:
Engineer:
Contractor:
Project:
Contract Name:

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

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

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

Date of Substantial Completion:

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

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

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

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

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

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

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

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

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

NC AFFIDAVIT OF COMPLAINCE E-VERIFY

STATE OF NORTH CAROLINA
COUNTY OF ROBESON

AFFIDAVIT of COMPLIANCE
with N.C. E-Verify Statutes

I, _____(hereinafter the "Affiant"), duly authorized by and on behalf of, _____ (hereinafter the "Employer"), after being first duly sworn deposes and says as follows:

1. I am the _____ (President, Manager, CEO, etc.) of the Employer and possess the full authority to speak for and on behalf of the Employer identified above.
2. Employer understands that "E-Verify" means the federal E-Verify program operated by the United States Department of Homeland Security and other federal agencies, or any successor or equivalent program used to verify the work authorization of newly hire employees pursuant to federal law.
3. _____Employer employs 25 or more employees in the State of North Carolina, and is in compliance with the provisions of N.C. Gen. Stat. 564-26. Employer has verified the work authorization of its employees through E-Verify and shall retain the records of verification for a period of at least one year.
4. _____Employer employs fewer than 25 Employees and is therefore not subject to the provisions of N.C. Gen. Stat. S64-26.
5. All subcontractors engaged by or to be engaged by Employer have or will have likewise complied with the provisions of N.C. Gen. Stat. 564-26.
6. Employer shall keep the Housing Authority of the City of Lumberton informed of any change in its status pursuant to Article 2 of Chapter 64 of the North Carolina General Statutes.

Further this affiant sayeth not.

This _____ day of _____ year of 20_____.

Affiant: _____

NON-COLLUSION, DEBARMENT AND GIFT BAN CERTIFICATION

CORPORATION

The prequalified bidder declares (or certifies, verifies, or states) under penalty of perjury under the laws of the United States that neither he, nor any official, agent or employee has entered into any agreement, participated in any collusion, or otherwise taken any action which is in restraint of free competitive bidding in connection with any bid or contract, that the prequalified bidder has not been convicted of violating *N.C.G.S. §133-24* within the last three years, and that the prequalified bidder intends to do the work with his own bonafide employees or subcontractors and will not bid for the benefit of another contractor.

By submitting this non-collusion, debarment and gift ban certification, the Contractor is attesting his status under penalty of perjury under the laws of the United States in accordance with the Debarment Certification attached, provided that the Debarment Certification also includes any required statements concerning exceptions that are applicable.

N.C.G.S. §133-32 and Executive Order 24 prohibit the offer to, or acceptance by, any State Employee of any gift from anyone with a contract with the State, or from any person seeking to do business with the State. By execution of any response in this procurement, you attest, for your entire organization and its employees or agents, that you are not aware that any such gift has been offered, accepted, or promised by any employees of your organization.

SIGNATURE OF PREQUALIFIED BIDDER

_____

Full name of Corporation

_____

Address as Prequalified

Attest _____ By _____

Secretary/Assistant Secretary
(Select appropriate title)

President/Vice President/Assistant Vice President
(Select appropriate title)

_____

Print or type Signer's name

Print or type Signer's name

Date _____

Must be within 60 days of application

CORPORATE SEAL

DEBARMENT CERTIFICATION OF PREQUALIFIED BIDDER

Conditions for certification:

1. The prequalified bidder shall provide immediate written notice to the Department if at any time the bidder learns that his certification was erroneous when he submitted his debarment certification or explanation that is file with the Department, or has become erroneous because of changed circumstances.

2. The terms *covered transaction*, *debarred*, *suspended*, *ineligible*, *lower tier covered transaction*, *participant*, *person*, *primary covered transaction*, *principal*, *proposal*, and *voluntarily excluded*, as used in this provision, have the meanings set out in the Definitions and Coverage sections of the rules implementing Executive Order 12549. A copy of the Federal Rules requiring this certification and detailing the definitions and coverages may be obtained from the Contract Officer of the Department.

3. The prequalified bidder agrees by submitting this form, that he will not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in NCDOT contracts, unless authorized by the Department.

4. For Federal Aid projects, the prequalified bidder further agrees that by submitting this form he will include the Federal-Aid Provision titled *Required Contract Provisions Federal-Aid Construction Contract (Form FHWA PR 1273*) provided by the Department, without subsequent modification, in all lower tier covered transactions.

5. The prequalified bidder may rely upon a certification of a participant in a lower tier covered transaction that he is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless he knows that the certification is erroneous. The bidder may decide the method and frequency by which he will determine the eligibility of his subcontractors.

6. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this provision. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

7. Except as authorized in paragraph 6 herein, the Department may terminate any contract if the bidder knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available by the Federal Government.

DEBARMENT CERTIFICATION

The prequalified bidder certifies to the best of his knowledge and belief, that he and his principals:

a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

b. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records; making false statements; or receiving stolen property;

c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph b. of this certification; and

d. Have not within a three-year period preceding this proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

e. Will submit a revised Debarment Certification immediately if his status changes and will show in his bid proposal an explanation for the change in status.

If the prequalified bidder cannot certify that he is not debarred, he shall provide an explanation with this submittal. An explanation will not necessarily result in denial of participation in a contract.

Failure to submit a non-collusion and debarment certification will result in the prequalified bidder's bid being considered non-responsive.

☐ Check here if an explanation is attached to this certification.

SECTION 011000

SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Work under separate contracts.
6. Future work.
7. Owner-furnished products.
9. Access to site.
10. Work restrictions.
13. Specifications and drawing conventions

1.3 PROJECT INFORMATION

A. Project Identification: Middle Fork Greenway Boone Gorge Park

B. Project Location: Old Blowing Rock Road Boone, NC 28607
BK 30 PG 349, BK 30 PG 350, BK 82 PG 487, BK 2272 PG 781

C. Owner: Watauga County

D. Engineer: J. Patrick Warren, PE

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. Work shall include, but it is not necessarily limited to the following:

Clearing/grubbing and removal of specified trees at the project site. Grading and construction of a paved parking area, sidewalk and recreational area, adjacent retaining walls and stormwater control measures, on-site utility installation, trail adjoining to existing trail system, and construction of three (3) structures (restroom, pavilion, kiosk).

B. Type of Contract: C-520 Construction Contract

1.5 PHASED CONSTRUCTION

A. The Work shall be conducted as one project in its entirety. There will not be phased construction.

1.6 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under the contract or work by the Owner. Coordinate the work of this contract with work performed by the Owner.

1.7 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this contract or other contracts. Coordinate the work of this contract with work performed under separate contracts.

1.8 FUTURE WORK

No future work is proposed.

1.09 OWNER FURNISHED PRODUCTS

A. General: The Owner shall furnish the following products:

Benches provided by Charleston Forge to be installed by Contractor.
One (1) kiosk structure to be installed by Contractor.

1.10 ACCESS TO SITES

A. General: Contractor shall have full use of Project sites for construction operations during construction period. Contractor's use of Project sites is limited only by Owner's right to perform work or retain other contractors on portions of project. Any damage to the areas outside the project areas by the Contractor must be restored to existing conditions at the full expense of the Contractor, to the satisfaction of and subject to the approval of the Owner and/or its designated representative.

B. General: Contractor shall have limited use of Project site for construction operations as indicated on drawings by the contractors limits and as indicated by requirements in this section

C. Use of Site: Limit use of Project site to areas withing the contract limits indicated. Do not disturb portions of Project site beyond areas in which the work is indicated.

1. Limits: Confine construction operations to areas within the limits of disturbance. Contractor is responsible for fencing off all active work areas from the general public.

2. Driveways, Walkways and Entrances: Keep driveways, loading areas and entrances serving premise clear and available to Owner, Owner's employees and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work on parking lots to normal business working hours, except as otherwise indicated or approved by the Owner.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Engineer not less than seven (7) business days in advance of proposed utility interruptions.

2. Obtain Engineer's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption with the Owner.

1. Notify Engineer not less than 3 business days in advance of proposed disruptive operations.

2. Obtain Engineer's written permission before proceeding with disruptive operations.

E. Controlled Substances: Use of tobacco products and other controlled substances within the property is prohibited.

F. Employee Identification: Provide identification tags for Contractor personnel working on the Project site. Require personnel to utilize identification tags at all times.

G. Employee Screening: Comply with Owner's requirements regarding drug and background screening of Contractor personnel working on the Project site. Maintain list of approved screened personnel with Owner's Representative.

1.15 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 33-division format and CSI/CSC's "Master Format" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence Is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.

2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be

SECTION 012100
ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.
1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:
1. Lump-sum allowances.
2. Unit-cost allowances.
3. Quantity allowances.
4. Contingency allowances.
5. Testing and inspecting allowances.

C. Related Sections:

1. Division 01 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

2.Divisions 02 through 33 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Engineer from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

D. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials to be selected by the Owner and purchased by the Contractor under allowance and shall include taxes, freight, and delivery to Project site.

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order Proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.

2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

3. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.

4. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or Return damaged or defective products to manufacturer for defects. replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

END OF SECTION 012100

performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

2. Abbreviations: Materials and products are identified by common industry abbreviations.

END OF SECTION 011000

SECTION 012500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Sections:

1. Division 01 Section "Alternates" for products selected under an alternate.

2. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

3. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

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

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

2.Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor and/or Owner.

1.4 A. SUBMITTALS

A Substitution Requests: Submit three (3) copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1.Substitution Request Form: Use form acceptable to Engineer. Documentation: Show compliance with substitution requirements contained in the Modified General

2.Conditions. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation of a request for substitution. Engineer will promptly notify Contractor of acceptance or rejection of proposed substitution. Construction Change

a. Forms of Acceptance: Change Order, Directive, or Engineer's Supplemental Instructions for minor changes in the Work.

b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time necessary to avoid delay.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change.

1. Conditions: Engineer will consider Contractor's request for substitution when the conditions described in the Modified General Conditions are satisfied. If those conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

B. Substitutions for Convenience: Engineer will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Engineer.

1. Conditions: Engineer will consider Contractor's request for substitution when the conditions described in the Modified General Conditions are satisfied. If those conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

END OF SECTION 012500

SECTION 012600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections:

1. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Engineer are not instructions either to stop work in progress or to execute the proposed change.

2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

c. Include costs of labor and supervision directly attributable to the change.

d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. Quotation Form: Use forms acceptable to Engineer.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Engineer.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2 Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4 Include costs of labor and supervision directly attributable to the change.

5 Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

7. Proposal Request Form: Use form acceptable to Engineer.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: Refer to Division 01 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Engineer will issue a Change Order for signatures of Owner and Contractor.

1.7 WORK CHANGE DIRECTIVE

A. Work Change Directive: Engineer may issue a Work Change Directive. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

END OF SECTION 012600

SECTION 012900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections:

1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule. Division 01 Section "Submittal Procedures" for administrative requirements governing the preparation and submittal of the submittal schedule.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule. A cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the Schedule of Values.

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

a. Application for Payment forms with continuation sheets. Submittal schedule. C. Items required to be indicated as separate activities in Contractor's Construction Schedule.

2. Submit the Schedule of Values to Engineer at earliest possible date but no later than 7 days prior to the date scheduled for submittal of the initial Applications for Payment.

3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values correlated with each element.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Engineer.
c. Engineer's project number.
d. Contractor's name and address.
e. Date of submittal.

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

a. Related Specification Section or Division.
b. Description of the Work. Name of subcontractor.
c. Name of manufacturer or fabricator. e. t. Name of supplier.
d. Dollar value as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
e. Name of supplier
f. Dollar value as a percentage of the Contract Sum to the nearest one-hundredth percent, adjusted total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide multiple line items for principal contract amounts as appropriate which include separate costs for items such as shop drawings, and project closeout items such as, but not limited to demobilization, project restoration and final cleanup, furnishing Operation and Maintenance manuals, punch list activities, equipment demonstration, operator training and Project Record Documents.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit

cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item. a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place shall be proportionately applied to other line items in the Schedule of Values.

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

1.4 APPLICATIONS FOR PAYMENT

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

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: Progress payments shall be submitted to Engineer by a specific day of the month to be established at the pre-construction conference. The period covered by each Application for Payment is one month, ending on the specific day of the month that is established at the pre-construction conference.

C. Application for Payment Forms: Use forms provided in Contract Documents.

D. Application Preparation: Complete every entry on form. Execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.

1 Entries shall match data on the schedule of values and Contractor's Construction Schedule. Use updated schedules if revisions were made.

2. Include amounts for all work completed since the previous Application for Payment by including amounts for all work completed on the project and subtracting those quantities included on previous Applications for Payment. Include only amounts for work completed through the cut-off date established at the pre-construction conference.

3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.

2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.

3. Provide summary documentation for stored materials indicating the following:

a. Materials previously stored and included in previous Applications for Payment.

b. Work completed for this Application utilizing previously stored materials.

c. Additional materials stored with this Application.

d. Total materials remaining stored, including materials with this Application.

4. Reimbursement for stored materials shall not exceed 50 percent of the unit price bid for the associated line item or as shown in the Schedule of Values for that portion of the work, unless otherwise agreed upon by the Engineer and Owner.

F. Retainage: The Owner may retain a portion of the amount otherwise due the Contractor. Except as provided elsewhere, the amount retained by the Owner shall be limited to the following:

1. Withholding of not more than 5 percent of the payment claimed until work is 50 percent complete.

2 When the contract is 50 percent complete no further retainage shall be withheld from periodic payments. However, the Owner may reinstate retainage (up to 5 percent) if they feel the work is unsatisfactory. The Owner may withhold additional retainage as necessary from periodic payments in a sum necessary to maintain total retainage of 2.5 percent of contract cost through the completion of the project.

3 When the work is substantially complete (operational or beneficial occupancy), the withheld amount shall be further reduced below 5 percent to only that amount necessary to assure completion.

4. The Owner may accept securities negotiable without recourse, conditions or restrictions, a release of retainage bond or an irrevocable letter of credit provided by the Contractor in lieu of all or part of the cash retainage.

G. For unit price projects, the Contractor may use the "Progress Estimate - Unit Price Work" form included with the Contract Documents, or a similar form that provides the required information.

H. Sales Tax Statement: When requested by the Owner, each request for progress payment submitted by the Contractor shall include a sales tax reimbursement statement. The Contractor shall utilize the form provided with the Contract Documents, or a similar form that provides the required information and certification.

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

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

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

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.

2. When an application shows completion of an item, submit conditional final or full waivers.

3. Owner reserves the right to designate which entities involved in the Work must submit waivers.

4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

K. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1： List of subcontractors.

2. Schedule of Values.

3. Contractor's construction schedule.

4. Sales tax statement (as necessary)

5. Combined Contractor's construction schedule incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.

6. Products list.

7. Schedule of unit prices.

8. Submittal schedule.

9. List of Contractor's staff assignments

10. List of Contractor's principal consultants.

11. Copies of building permits.

12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.

13. Any other requirements described in the Modified General Conditions of the Contract.

L. Progress Applications for Payment: Administrative actions and submittals that must precede or coincide with submittal of each Progress Application for Payment include the following:

1. Updated Schedule of Values.

2. Updated Contractor's construction schedule.

3. Sales tax statements (as necessary).

4. Certified payroll statements (as necessary).

5 Summary of stored materials.

6. Any other requirements described in the Modified General Conditions of the Contract.

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

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

3. Any other requirements described in the Modified General Conditions of the Contract.

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

1. Evidence of completion of Project closeout requirements.

2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.

3. Updated final statement, accounting for final changes to the Contract Sum (Final Adjusting Change Order issued by Engineer).

4. Contractor's Affidavit of Release of Liens.

5. Consent of Surety to Final Payment.

6. Evidence that claims have been settled.

7 Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took. possession of and assumed responsibility for corresponding elements of the Work.

8. Final liquidated damages settlement statement.

9. Record Documents.

10.General warranty letter.

11.Sales tax statements (as necessary).

12 Any other requirements described in the Modified General Conditions of the Contract.

END OF SECTION 012900

SECTION 013100 PROJECT

MANAGEMENT AND COORDINATION

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Coordination drawings.
4.Requests for Information (RFIs).
5.Project meetings.

B. Related Sections:

1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.

2.Division 01 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

3.Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

4.Division 01 Section "General Commissioning Requirements" for coordinating the Work with Owner's commissioning authority.

1.3 DEFINITIONS

A. RFI (Request for Information): Request from Contractor seeking information and clarification from the Engineer during construction.

1.4 COORDINATION

A. Coordination: The Contractor shall coordinate its construction operations with those of others to ensure efficient and orderly installation of each part of the Work. The Contractor shall be responsible for the coordination of each of their subcontractors' schedules. Contractor and each subcontractor shall coordinate its operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1.Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5.Progress meetings.
6. Preinstallation conferences.
7. Startup and adjustment of systems.
8. Project closeout activities.

1.5 KEY PERSONNEL

A. Key Personnel Names: Within 15 days after the Notice to Proceed date, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Make copies of list available on site at all times for Owner's and Engineer's use and keep list current at all times.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.

c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.

f. Indicate required installation sequences.

g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately upon discovery of the need for additional information, interpretation, or clarification of the Contract Documents, Contractor shall prepare and submit an RFI.

1. RFIs shall originate with Contractor. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name, including Owner.
2. Date.
3. Name of Contractor.
4. Name of Engineer.
5. RFI number, numbered sequentially.
6.RFI subject.
7. Specification Section number and title and related paragraphs, as appropriate.
8. Drawing number and detail references, as appropriate.
9.Field dimensions and conditions, as appropriate.
10. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
11.Contractor's signature Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form acceptable to Engineer.

D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow seven (7) working days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

a. Requests for approval of submittals.

b. Requests for approval of substitutions.

c. Requests for coordination information already indicated in the Contract Documents.

d. Requests for adjustments in the Contract Time or the Contract Sum.

f. Requests for interpretation of Engineer's actions on submittals.

g. Incomplete RFIs or inaccurately prepared RFIs.

2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.

3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within 10 days of receipt of the RFI response.

E. Upon receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within seven (7) days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Contractor shall be prepared to discuss the log and the status of pending FIs at all Progress or Coordination Meetings.

G. Improper or Frivolous RFI: Improper and/or Frivolous RFI's shall be defined as RFI's that request information that is clearly indicated on or reasonably inferable from Contract Documents.

1. Will be returned unanswered, will be removed from the Contractor's RFI log, and the number assigned will be assigned to subsequent RFI.

2. At the Contractor's request, after notification by Engineer that a RFI is improper or frivolous, the RFI will be processed with processing costs charged to Contractor as follows:

a. The Contractor shall reimburse the Owner for the Engineer's account for time spent in processing improper or frivolous RFI's at the rate of the Engineer's current standard hourly fee schedule for personnel and associated expenses.

1.8 PROJECT MEETINGS

A. General: Engineer will schedule and conduct meetings and conferences at project site unless otherwise indicated

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.

2.Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3.Minutes: Engineer will record significant discussions and agreements achieved and distribute the meeting minutes to everyone concerned, including Owner and Contractor.

B. Preconstruction Conference: Engineer will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.

2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the

conference shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect progress of the work.

4. Minutes: Engineer will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, Shall attend the meeting. Contractor shall advise Engineer of potential scheduled meeting dates. Engineering will coordinate with Owner and respond with acceptable meeting date and time.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Engineer will conduct progress meetings on a monthly basis or as necessary.

1. Coordinate dates of meetings with preparation of payment requests.

2. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity involved with current progress or planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Topics for discussion at these meetings will be determined as necessary based on the status of Project including, but limited to:

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule

revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present.

4. Minutes: Engineer will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Coordination Meetings: Engineer will conduct Project Coordination meetings as necessary. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.

2.Agenda: Review and correct or approve minutes of the previous Coordination Meeting. Review other items of significance that could affect progress. Topics for discussion at these meetings will be determined as necessary based on the status of Project.

3.Contractor's Construction Schedule: Review progress since the last Coordination Meeting. Determine whether contract is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

a. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3)Status of submittals.
4)Deliveries.

5) Off-site fabrication.
6) Access.
7)Site utilization.
8) Temporary facilities and controls.
9) Work hours
10) Hazards and risks.
11) Progress cleaning
12) Quality and work standards.
13) Change Orders.

4.Reporting: Engineer shall record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

F. Project Closeout Conference: Engineer shall schedule and conduct a Project Closeout Conference, at a time convenient to Owner and Contractor, prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.

2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its suppliers; and other concerned superintendent; major subcontractors; parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3.Agenda: Discuss items of significance that could affect or delay Project closeout.

4. Minutes: minutes. Entity conducting meeting will record and distribute meeting minutes

END OF SECTION 013100

SECTION 013200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Submittals schedule.
3. Field condition reports.
4. Start-up construction schedule.
5. Special reports.

B. Related Sections:

1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values. 2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
3. Division 1 Section "Submittal Procedures" for submitting schedules and reports. 4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.

2. Predecessor Activity: An activity that precedes another activity in the network.

3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Engineer.

C. CPM: Critical Path Method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships.

Network calculations determine when activities can be performed and the critical path of the Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date. No claims shall arise from the use of float by either party.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 SUBMITTALS

A. Format for Submittals: Submit indicated submittals in accordance with Section 013300.

B. Construction Schedule: Initial schedule, of size required to legibly display entire schedule for entire construction period.

C. Submittals Schedule: Arrange the following information in a tabular format:

1. Scheduled date for initial submittals.

2. Specification Section number and title.

3. Submittal category (action or informational).

4. Description of the Work covered.

5. Scheduled date for Engineer's final release or approval.

D. Field Condition Reports: Submit at time of discovery of differing conditions.

E. Start-up construction schedule.

1. Approval of cost-loaded start-up construction schedule will not constitute approval of schedule of values for cost-loaded activities.

F. Special Reports: Submit at time of unusual event.

1.5 COORDINATION

A. Contractor shall coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of subcontractors.

B. Contractor shall coordinate Construction Schedule with the Schedule of Values, subcontractors, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM METHOD)

A. CPM Schedule: Prepare Contractor's construction schedule using a cost- loaded, time-scaled CPM network analysis diagram for the Work.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each aspect of the work as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities such that no activity is longer than 20 days, unless specifically allowed by Engineer.

2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Construction Schedule with submittal schedule.

4. Startup and Testing Time: Within the Construction Schedule, include an appropriate number of days for startup and testing based on the scope of the project.

5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for administrative procedures necessary for certification of Substantial Completion.

6. Punch List and Final Completion: Include not more than 30 days for punch list and final completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1.Phasing: Arrange list of activities on schedule by phase

2.Work by Owner: Include a separate activity for each portion of the Work performed by Owner.

3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

5. Work Restrictions: Construction Schedule shall account for and show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial use/occupancy before Substantial Completion.
e. Use of premises restrictions.
f. Seasonal variation/restrictions.
g. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c Purchases.
d. Fabrication.
e. Sample testing
f. Deliveries.
g. Installation
h. Tests and inspections.
i. Adjusting
j. Curing.
k. Startup and placement into final use and operation.

7.Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area

must be sequenced or integrated with other construction activities to provide for items including, but not limited to the following:

a. Structural completion.

b. Permanent space enclosure.

c. Completion of mechanical installation.

d. Completion of electrical installation.

e. Substantial Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, Final Completion and other project-specific milestones.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1. Refer to Division 01 Section "Payment Procedures" for cost reporting and payment procedures.

G. Upcoming Work Summary: At monthly intervals, prepare a summary report indicating activities scheduled to occur or commence prior to submittal of the next schedule update. Summarize the following:

1. Unresolved issues.

2. Unanswered RFIs.

3. Rejected or unreturned submittals.

4. Notations on returned submittals.

H. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

I. Prepare schedules using a software program Computer Scheduling Software: that has been developed specifically to manage construction schedules.

2.2 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order Include time required for review, by dates required by Progress schedule. resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Progress Schedule.

2. Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.3 FIELD CONDITION REPORTS

A. Immediately upon discovery of a difference between field conditions and the Contract Documents, notify Engineer to discuss these differences. Based on those conversations, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, with recommendations for changing the Contract Documents.

2.4 START-UP CONSTRUCTION SCHEDULE

A. In conjunction with the initial submittal of a Construction Schedule, submit an equipment start-up schedule which includes information detailing the start-up of each piece of equipment on the Project.

2.5 SPECIAL REPORTS

A. General: Submit special reports to Engineer within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Engineer in advance when these events are known or predictable. April 2023 Project #22.01702 013200 - Page 6

PART 3 – EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue updated schedule one week prior to each regularly scheduled progress meeting or prior to submission of Application for Payment.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Engineer, Owner, subcontractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1.Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.
4. Preconstruction video recordings.
5.Periodic construction video recordings.

B. Related Sections:

1. Division 01 Section "Submittal Procedures" for submitting photographic documentation.

2. Division 01 Section "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.

3.Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

4. Division 02 Section "Demolition" for photographic documentation before building demolition operations commence.

5. Division 31 Section "Site Clearing" for photographic documentation before site clearing operations commence.

1.3 A. COSTS

AThe cost for photographic documentation services shall be considered incidental to the work and shall be included in the bid. No separate payment will be made for photographic documentation.

1.4 INFORMATIONAL SUBMITTALS

A. Construction Photographs: Submit two (2) copies of each photographic view within seven (7) days of taking photographs.

1. Format: Submit all photographs in a digital format acceptable to Engineer.

2. Identification: Each submittal shall be labeled with the following information:

a. Name of Project.

b. Name of Contractor.

c. Date(s) photographs were taken.

3. The digital file for each photograph shall include the following:

a. Date stamp by camera.

b. File names indicative of the description of the photographs.

c. Unique sequential identifier (as necessary).

1.5 USAGE RIGHTS

A. Contractor shall transfer copyright usage rights to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 1600 by 1200 pixels and 300 dpi.

PART 3 – EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted. 1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.

2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Engineer.

C. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Engineer.

1.Flag construction limits before taking construction photographs.

2.Take photographs necessary to show existing conditions adjacent to property before starting the Work.

3.Take photographs of existing buildings either on or adjoining property as necessary to accurately record physical conditions at start of construction.

4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take photographs monthly, coinciding with the cutoff date associated with each application of payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Engineer-Directed Construction Photographs: From time to time, Engineer will instruct Contractor about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

F. Final Completion Construction Photographs: Take photographs after date of Substantial Completion for submission as project record documents. Engineer will inform Contractor of desired vantage points.

G. Additional Photographs: Engineer may request photographs in addition to periodic photographs specified.

1. Three days' notice will be given, where feasible.

2. In emergency situations, take additional photographs within 24 hours of request.

3. Circumstances that could require additional photographs include, but are not limited to, the following:

a. Special events planned at Project site.

b. Immediate follow-up when on-site events result in construction damage or losses.

c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.

d. Substantial Completion of a major phase or component of the Work. Extra record photographs at time of final acceptance. Owner's request for special publicity photographs.

END OF SECTION 013233

SECTION 013300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 REQUIREMENTS

A. This section specifies the methods and requirements for the submissions applicable to Shop drawings, Working drawings, Product data, Samples, Request for substitutions, Test procedures, and Construction and Submittal schedules. Drawings and general provisions of the Contract, including Modified General and Supplementary Conditions and other Specification Sections, apply to this Section.

B. All submittals shall be clearly identified by reference to the Specification Section, Paragraph, Drawing number, or Detail as applicable.

C. All submittals shall be submitted by the Contractor and the Contractor shall be solely responsible for the coordination and management of all submittals. No submittals received directly from material/equipment suppliers or subcontractors will be accepted unless otherwise agreed upon by all parties. The Engineer's review comments and markup submittals will be returned to the Contractor who shall promptly coordinate and return the comments and markup submittals to the appropriate parties.

D. The Contractor shall submit to the Engineer a detailed submittal schedule in accordance with the Modified General Conditions.

E. The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment, and method of work shall be a described in the submittal. Submittal documents shall be edited to clearly show only those items to be included in the contract. All extraneous materials shall be crossed out or otherwise obliterated. The Contractor shall be solely responsible for the coordination of submittals so that work will not be delayed. Different categories of submittals shall be scheduled so that one will not be delayed for lack of coordination or approval of another. No extensions of time will be allowed because of failure to properly schedule or manage submittals.

1.2 SUMMARY

A. Related Sections:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.

2. Division 01 Section "Construction Progress Documentation" for submitting

3. schedules and reports, including Contractor's construction schedule. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.

4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

5. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals or those inferred by the work shown on the drawings or detailed in the project documents.

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

E. Time/Days: Where days are referenced as a measurement of time the unit shall be calendar days. SUBMITTALS SCHEDULE

1.4 SUBMITTAL SCHEDULES

A. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Engineer and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Format: Arrange the following information in a tabular format:
    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action, informational.
    d. Name of subcontractor, if applicable.
    e. Description of the Work covered.
    f. Scheduled date for Engineer's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled dates for installation.
    i. Activity or event number from Construction Schedule.

B. Submit revised submittal schedule as necessary to reflect changes in current status and timing for submittals.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Engineer's Digital Data Files: Electronic copies of the Contract Drawings and project specifications may be provided by Engineer for Contractor's use in preparing submittals only if detailed in other Sections of the Contract Documents. In cases where Engineer provides electronic copies of these documents, Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to the Contract Drawings. Please refer to the Modified General Conditions for more details regarding the use of the Engineer's digital data files.

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

1.Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

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

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Based on the complexity of the submittal, allow 7 to 21 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Based on the complexity of the submittal, allow 7 to 21 days for review of each resubmittal.

4. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

E. Each submittal shall be accompanied by the transmittal cover contained in this section. The cover sheet shall be printed in a bright unique color of paper (color selected per project) and affixed to paper copies of each submittal. The information required for each submittal is contained on the cover sheet and shall be furnished for each submittal.

F. Submittal Identification Number: A unique four (4) character number shall be assigned by the Contractor and shall be noted on the transmittal cover sheet accompanying each submittal. Submittal numbers shall have the following format:

1. The first character shall be a SD, W, S, or M, which represents Shop Drawing Data (SD), Working Drawing (W), Sample (S), or Operating/Maintenance Manual (M).

2. The next digits shall be the specification section number.

3. The next digits shall be a three digit number (001 - 999) assigned to sequentially number each submittal.

4. The last character is a letter, A-Z, indicating the submission, or resubmission of the same data, i.e., A - 1st submittal, B- 2d submittal, etc

5. A typical submittal number would be:
SD-15800-013-A where: G.
15800 = technical specification section 15800
013 contractor's submittal number 013
A = 1st submittal

G. Deviations: All deviations from the Contract Documents shall be identified on submittals.

H. Paper and Electronic Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

I. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Engineer will discard submittals received from sources other than Contractor.

J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.

2 Note date and content of revision and clearly indicate extent of revision.

3.Resubmit submittals until they are marked with approval notation from Engineer.

K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

L. Use for Construction: Use only final submittals that are marked with approval notation from Engineer.

PART 2 - PRODUCTS

2.1. SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submittals: Submit two (2) paper copies and one electronic copy in a PDF format of each submittal, unless otherwise indicated. Engineer will return one (1) copy.

2. All submittals shall include a copy of the specification section, with addendum updates included, and all referenced and applicable sections, and each paragraph shall be check-marked to indicate that the submitted material is in compliance with the specification or marked to indicate requested deviations from the specified requirements. If deviations are noted and/or requested each deviation shall be underlined and denoted by a number in the margin to the right with a detailed description of the deviation on a separate sheet.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. Mark each copy of each submittal to show which products and options are applicable.

2. Include the following information, as applicable:

a. Manufacturer's catalog cuts.

b. Manufacturer's product specifications.

c. Standard color charts.

d. Statement of compliance or variations with specified referenced standards

e. Testing by recognized testing agency.

f. Application of testing agency labels and seals.

g. Notation of coordination requirements.

h. Availability and delivery time information.

3. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.

b. Printed performance curves.

c. Operational range diagrams.

d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

4. Submit Product Data before or concurrent with Samples.

5. Submit Product Data in the following format:

a. Submit two (2) paper copies and one electronic copy in a PDF format of each submittal, unless otherwise indicated. Engineer will return one (1) copy.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. on Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.

b. Schedules.

c. Compliance and variation with specified standards.

d. Notation of coordination requirements.

e. Notation of dimensions established by field measurement.

f. Relationship and attachment to adjoining construction clearly indicated.

g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.

b. Product name and name of manufacturer.

c. Sample source.

d. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit 2 full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return one (1) submittal with options selected.

E. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

F. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

G. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

H. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.

2. Number and title of related Specification Sections) covered by subcontract.

3. Drawing number and detail references, as appropriate, covered by subcontract.

4. Submit subcontract list in the following format: a. Submit two (2) paper copies and one electronic copy in a PDF format, unless otherwise indicated.

I. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

J. Equipment Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that the manufacturer has reviewed the Contract drawings and specifications, including all addendums, and that the equipment and related accessories included in the shop drawing submittal are suitable for installation in the applications proposed for the project. Include evidence of manufacturing experience where required.

K. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

L. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. performance and design criteria and a summary of loads. Include list of assumptions and other diagrams if applicable. Include load calculations. Include page numbers. Provide name and version of software, if any, used for

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit two (2) paper copies and one electronic copy in a PDF format of design documents, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, design calculations and other factors used in performing these services.

PART 3 - EXECUTION 3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."

C. Submittal Transmittal: Contractor shall include with each submittal a transmittal form as contained at the end of this section. Include all information required by the form including Project name and location, submittal number, Specification Section title and

number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S ACTION

A. Engineer will not review submittals that do not bear required cover sheet and Contractor's approval and signature and will return them without action.

B. Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. The transmittal form included in this Section contains a copy of the review stamp to be completed by the Engineer. The Engineer will complete the stamp for each submittal and will mark stamp appropriately to indicate action.

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

D. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

F. Submittals will be returned to the Contractor under one of the following codes.

Code 1 - FURNISH AS SUBMITTED, No Exceptions - The review indicates that the material, equipment or work method complies with the project documents. In this event the contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.

Code 2 - FURNISH AS SUBMITTED, Make corrections noted - The review indicates that there are limited corrections required for the material, equipment or work method. In this event the contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal in accordance with the noted corrections.

Code 3 - NOT APPROVED (See Notes), Revise and resubmit - The review indicates that the submittal is insufficient or contains incorrect data, copies or other information. Except at his own risk, the Contractor shall not undertake work covered by this submittal until such time as it is revised and meets the requirements of code 1 or 2.

Code 4 - NOT APPROVED, Rejected - The review indicates that the submittal does not comply with the project documents and is unacceptable for incorporation into the project. Except at his own risk, the Contractor shall not undertake work covered by this submittal until such time as it is revised and meets the requirements of code 1 or 2.

Code 5 - Receipt Acknowledged - The review indicates that the material is for information purposes only and the Engineer has taken no action as none is required.

3.3 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

A. The Engineer's review of submittal information provided by the Contractor based upon his review of the drawings, specifications, other project documents and proposed methods of work or information regarding materials or equipment shall not relieve the Contractor of his responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the Owner or the Engineer, or by any officer or employee thereof, and the Contractor shall have no claim under the contract on the account of the failure, or partial failure, of the method of work, material, or equipment so reviewed. A mark of "No Exceptions" or "Make Corrections Noted" shall mean that the Owner has no objection to the Contractor, upon his own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

3.4 COSTS FOR REVIEW OF RESUBMITTALS

A. The Contractor shall be responsible for the completeness of each submittal and identifying deviations from the project requirements. Any submittal that may require more than two (2) reviews by the Engineer shall be assessed a review charge for time spent in processing shop drawings at the rate of the Engineer's current standard hourly fee schedule for personnel assigned to the shop drawing review and associated expenses. This charge, covering the cost of engineering and administration, shall be assessed against progress payments.

3.5 SUBMITTAL LOG

A. Prepare, maintain, and submit a tabular log of submittals organized by the submittal number. Contractor shall be prepared to discuss the log and the status of pending submittals at all Progress or Coordination Meetings.

END OF SECTION 013300

SECTION 014000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and control procedures that facilitate compliance with the Contract Document requirements.

3. Requirements for Contractor to provide quality-assurance and control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections:

1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.

2.Divisions 02 through 33 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the

Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.

C. Product Testing: Tests and inspections that are performed by a Nationally Recognized Testing Laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP), or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

D. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

E. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

G. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

H. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainty and requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.5 SUBMITTALS

A. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1.Specification Section number and title.

2.Entity responsible for performing tests and inspections.
3.Description of test and inspection.
4.Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8.Requirements for obtaining samples.
9.Unique characteristics of each quality-control service.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making
2. Statement of field condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance comply with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: information documenting manufacturer's Prepare written factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance comply with requirements.

4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

2. Payment for these services will be made either directly by the Owner or from testing and inspecting allowances, as authorized by the Contract documents, if such allowances are included in the Contractor's construction contract.

3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are the Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 96 hours in advance of time when Work that requires testing or inspecting will be performed.

4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control

5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility. 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, Contractor shall provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Engineer and Contractor promptly of irregularities or deficiencies

2. observed in the Work during performance of its services. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1.Access to the Work.

2.Incidental labor and facilities necessary to facilitate tests and inspections.

3.Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

4.Facilities for storage and field curing of test samples.

5. Preliminary design mix proposed for use for material mixes that require control by testing agency.

6. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following: Date test or inspection was conducted. Description of the Work tested or inspected.

1.Date test or inspection results were transmitted to Engineer.

2. Description of the work tested or inspected

3. Date test or inspection results were transmitted to Engineer.

4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.
3.2

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution Requirements."

B. Protect construction exposed by or for quality control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION 014000

SECTION 014200
REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General: Contract. Basic Contract definitions are included in the Conditions

B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Such standards are made a part of the

Documents to the extent referenced. Contract Documents by reference. In all cases, the standards referenced within these Contract Documents shall be construed to reference the most current version, amendment or applicable replacement pertaining to the work.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA Aluminum Association, Inc. (The) www.aluminum.org (703) 358-2960

AASHTO American Association of State Highway and Transportation Officials www.transportation.org (202) 624-5800

ACI American Concrete Institute www.concrete.org (248) 848-3700

ACPA American Concrete Pipe Association www.concrete-pipe.org (972) 506-7216 AGC Associated General Contractors of America (The) (703) 548-3118 www.agc.org

AI Asphalt Institute www.asphaltinstitute.org (859) 288-4960

AISC American Institute of Steel Construction www.aisc.org (800) 644-2400 (312) 670-2400

AISI American Iron and Steel Institute www.steel.org (202) 452-7100

AITC American Institute of Timber Construction www.aitc-glulam.org (303) 792-9559

ALCA Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network) (301) 972-1700

ALSC American Lumber Standard Committee, Incorporated www.alsc.org (301) 972-1700 ANSI American National Standards Institute www.ansi.org (202) 293-8020

APA - The Engineered Wood Association www.apawood.org (253) 565-6600

API American Petroleum Institute www.api.org (202) 682-8000

ARMA Asphalt Roofing Manufacturers Association www.asphaltroofing.org (202) 207-0917

ASCE American Society of Civil Engineers www.asce.org (800) 548-2723 (703) 295-6300

ASCE/SEI American Society of Civil Engineers/Structural Engineering Institute (See ASCE)

ASME/ ASME International (American Society of Mechanical Engineers International) www.asme.org (800) 843-2763 (973) 882-1170

ASTM/ ASTM International (American Society for Testing and Materials International) www.astm.org (610) 832-9500

AWS American Welding Society www.aws.org (800) 443-9353 (305) 443-9353

AWWA American Water Works Association www.awwa.org (800)926-7337 (303) 794-7711

BHMA Builders Hardware Manufacturers Association www.buildershardware.com (212) 297-2122

BIA Brick Industry Association (The) www.bia.org (703) 620-0010

CLFMI Chain Link Fence Manufacturers Institute www.chainlinkinfo.org (301) 596-2583

CPPA Corrugated Polyethylene Pipe Association www.plasticpipe.org (800) 510-2772 (202) 462-9607

CRSI Concrete Reinforcing Steel Institute www.crsi.org (847) 517-1200

CSA Canadian Standards Association (800) 463-6727 (416) 747-4000

CSA International (Formerly: IAS - International Approval Services) www.csa-international.org

(866) 797-4272 (416) 747-4000

CSI Construction Specifications Institute (The) www.csinet.org (800) 689-2900 (703) 684-0300

DHI Door and Hardware Institute www.dhi.org (703) 222-2010

EIA Electronic Industries Alliance www.eia.org (703) 907-7500

EJCDC Engineers Joint Contract Documents Committee (703) 295-5000 www.ejdc.org

FM Approvals FM Approvals LLC www.fmglobal.com (781) 762-4300

FM Global FM Global (Formerly: FMG - FM Global) www.fmglobal.com (401) 275-3000

FMRC Factory Mutual Research Corporation (Now FM Global) (202)289-5440

GA Gypsum Association www.gypsum.org (202) 289-5440

GSI Geosynthetic Institute www.geosynthetic-institute.org (610) 522-8440

HI Hydraulic Institute www.pumps.org (973) 267-9700

ICEA Insulated Cable Engineers Association, Inc. www.icea.net (770) 830-0369

ICRI International Concrete Repair Institute, Inc. www.icri.org (847) 827-0830

IEC International Electrotechnical Commission www.iec.ch (412) 919- 02 11

IEEE Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org (212) 419-7900

IES Illuminating Engineering Society www.ies.org (212) 248-5000

IESNA Illuminating Engineering Society of North America (Now IES)

IEST Institute of Environmental Sciences and Technology www.iest.org (847) 981-0100 41 22 749 01 11

ISO International Organization for Standardization www.iso.ch (202) 293-8020 Available from ANSI www.ansi.org (972) 238-5591

ITS Intertek Testing Service NA (Now ETL SEMCO) 41 22 730 51 11

ITU International Telecommunication Union www.itu.int/home (800) 488-6864

LPI Lightning Protection Institute www.lightning.org (216) 241-7333

MBMA Metal Building Manufacturers Association www.mbma.com (312) 644-6610

MFMA Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org

MH Material Handling (Now MHIA) (800) 345-1815

MHIA Material Handling Industry of America www.mhia.org (704) 676-1190 (888) 674-8937

MPI Master Painters Institute www.paintinfo.com (604) 298-7578

MSS Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com (703) 281-6613

NACE NACE International (National Association of Corrosion Engineers International) www.nace.org (800) 797-6623 (281) 228-6200

NCMA National Concrete Masonry Association www.ncma.org (703) 713-1900

NCTA National Cable & Telecommunications Association www.ncta.com (202) 775-2300

NECA National Electrical Contractors Association www.necanet.org (301) 657-3110

NeLMA Northeastern Lumber Manufacturers' Association (207) 829-6901 www.nelma.org

NEMA National Electrical Manufacturers Association www.nema.org (703) 841-3200

NESC National Electrical Safety Code (212) 419-7900

NETA InterNational Electrical Testing Association www.netaworld.org (888)300-6382

(303) 697-8441

NFPA National Fire Protection Association www.nfpa.org (800) 344-3555 (617) 770-3000

NLGA National Lumber Grades Authority www.nlga.org (604) 524-2393

NRCA National Roofing Contractors Association www.nrca.net (800) 323-9545 (847) 299-9070

NRMCA National Ready Mixed Concrete Association www.nrmca.org (888) 846-7622 (301) 587-1400

NSF NSF International (National Sanitation Foundation International) www.nsf.org (800) 673-6275 (734) 769-8010

NSSGA National Stone, Sand & Gravel Association www.nssga.org (800) 342-1415 (703) 525-8788

NWWDA National Wood Window and Door Association (Now WDMA)

PCI Precast/Prestressed Concrete Institute www.pci.org (312) 786-0300

PDI Plumbing & Drainage Institute www.pdionline.org (800) 589-8956 (978) 557-0720 PGI

PVC Geomembrane Institute http://pgi-tp.cee.uiuc.edu (217) 333-3929

PLANET Professional Landcare Network www.landcarenetwork.org (800) 395-2522 (703) 736-9666

PTI Post-Tensioning Institute www.post-tensioning.org (602) 870-7540 RCSC Research Council on Structural Connections www.boltcouncil.org

SDI Steel Deck Institute (847) 458-4647 014200 www.sdi.org (440) 899-0010

SDI Steel Door Institute www.steeldoor.org Structural Engineering Institute/American Society

SEI/ASCE SJI of Civil Engineers (See ASCE)

SJI Steel Joist Institute www.steeljoist.org (843) 626-1995 (877) 281-7772

SSPC SSPC: The Society for Protective Coatings www.sspc.org (412) 281-2331

STI Steel Tank Institute www.steeltank.com (847) 438-8265

SWI Steel Window Institute www.stee/windows.com (216) 241-7333

SWRI Sealant, Waterproofing, & Restoration Institute www.swrionline.org (816) 472-7974

TIA/EIA Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org (703) 907-7700

TMS The Masonry Society www.masonrysociety.org (303) 939-9700

UL Underwriters Laboratories Inc. www.ul.com (877) 854-3577 (847) 272-8800 UNI Uni-Bell

PVC Pipe Association www.uni-bell.org (972) 243-3902

WASTEC Waste Equipment Technology Association www.wastec.org (800) 424-2869

WDMA Window & Door Manufacturers Association www.wdma.com (202) 244-4700 (800) 223-2301

WWPA Western Wood Products Association www.wwpa.org (847) 299-5200 (503) 224-3930

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ICC International Code Council www.iccsafe.org 888) 422-7233

UBC Uniform Building Code (See ICC)

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE Army Corps of Engineers www.usace.army.mil (202) 761-0011

DOE Department of Energy (202) 586-9220 www.energy.gov

EPA Environmental Protection Agency (202) 272-0167 www.epa.gov

FCC Federal Communications Commission (888) 225-5322 www.fcc.gov

HUD Department of Housing and Urban Development (202) 708-1112 www.hud.gov

NIST National Institute of Standards and Technology (301) 975-6478 www.nist.gov

OSHA Occupational Safety & Health Administration (800) 321-6742 (202) 693-1999 www.osha.gov

RUS (202) 720-9540 Rural Utilities Service (See USDA) (202) 720-2791

USDA Department of Agriculture www.usda.gov

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG Americans with Disabilities Act (ADA) (800) 872-2253 (202) 272-0080 Engineerural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov

CFR Code of Federal Regulations (866) 512-1800 (202) 512-1800 Available from Government Printing Office www.gpoaccess.gov/cfr/index.html

DOD Department of Defense Military Specifications and Standards (215) 697-2664 Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil

FS Federal Specification (215) 697-2664 Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil Available from Defense Standardization Program www.dps.dla.mil Available from General Services Administration www.gsa.gov (202) 619-8925 Available from National Institute of Building Sciences www.wbdg.org/ccb (202) 289-7800

UFAS Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov (800) 872-2253 (202) 272-0080 PART 2 - PRODUCTS (Not Used) PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections:

1. Division 1 Section "Summary" for limitations on utility interruptions and other work restrictions.

2. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.

3. Division 1 Section "Execution Requirements" for progress cleaning requirements.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Price unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to Owner, Engineer, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

C. Construction Surveying: All work shall be constructed in accordance with the lines, grades and elevations shown on the plans or as given by the Engineer in the field. The Contractor shall be fully responsible for maintaining alignment and grade. All principal controlling points and base lines for locating the principal components of the work together with a suitable number of benchmarks adjacent to the work will be provided by the Engineer. From this information, the Contractor shall verify benchmarks and develop and make all detail surveys needed for construction. The Contractor shall protect and safeguard all points, stakes, grade marks, monuments, and benchmarks at the site of the work and shall reestablish, at his own expense, any marks which are removed or destroyed due to his construction operations.

1. It is imperative that the Contractor work within the shown rights of way or easements at all times, unless approved otherwise by the property owner and the Engineer.

2. The Contractor shall, at his expense, provide competent engineering survey services and shall provide and maintain accurate, detailed, survey work.

3. The plans and supplementary drawings shall not be scaled and the Contractor must verify all dimensions and elevations at the site prior to proceeding with the work. The Contractor shall also verify existing utility locations prior to purchasing materials affected by these locations.

1.5 PROJECT CONDITIONS

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

PART 2 – PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0. 148-inch thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts with 1-5/8-inch OD top rails with galvanized barbed-wire top strand.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch, thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide concrete or galvanized steel bases for supporting posts.

C. Wood Enclosure Fence: Plywood, 6 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Engineer, and construction personnel office activities and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

2.Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot square tack and marker boards.

3. Drinking water and private toilet.

4. Coffee machine and supplies.

5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 degrees

6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section "Closeout Procedures".

C. Air Filtration Units: HEPA primary and secondary filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."

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

3.2 TEMPORARY UTILITY INSTALLATION

A. Water Service: If available at the site and if authorized by the Owner, connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use or as required for project completion. Otherwise, Contractor shall provide non-potable water form sources acceptable to authorities having jurisdiction by installing water service and distribution piping in sizes and pressures adequate for construction. If temporary utilities require connection to municipal systems, Contractor shall provide these connections as directed by authorities having jurisdiction and install metering devices as required.

B. Sanitary Facilities: Contractor shall provide temporary toilets, wash facilities, drinking water and associated piping and appurtenances for use of Owner, Engineer, and construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. If temporary utilities require connection to municipal systems, Contractor shall provide these connections as directed by authorities having jurisdiction.

C. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

D. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.

b. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.

3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

E. Ventilation and Humidity Control: If necessary, provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

F. Electric Power Service: Contractor shall provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Comply with all requirements of authorities having jurisdiction.

G. Lighting: Provide temporary lighting with local switching that provides, adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area. All work shall comply with NFPA 241.

2. Maintain support facilities until Substantial Completion inspection is scheduled. Remove before Final Completion.

B. Temporary Roads and Paved Areas: As necessary, construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Permanent Roads and Paved Areas: As necessary, locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

2 Prepare subgrade and install subbase and base for temporary roads and

3. paved areas according to other specification sections. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.

4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to other specification sections.

D. Traffic Maintenance:

1. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient warning lights, danger signals, and signs, shall provide a sufficient number of flagmen to direct the traffic and shall take all necessary precautions for the protection of the work and the safety of the public.

2. All barricades and obstructions or hazardous conditions shall be illuminated as necessary to provide for safe traffic conditions.

3. Warning and caution signs shall be posted throughout the length of any

4. portion of the project where traffic flow is restricted. Protect existing site improvements to remain including curbs, pavement, and utilities.

5. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Special Provisions: North Carolina Department of Transportation (NCDOT):

1. All Contractors doing work within the NCDOT right of way are to have a copy of the approved encroachment agreement plans, and special provisions on the job site.

2. The travelling public shall be warned of the construction with signing that is in accordance with the latest Manual on Uniform Traffic Control Devices.

3 Contact the appropriate utility companies) involved and make satisfactory arrangements to adjust utilities in conflict with the proposed work prior to construction.

4. Materials and workmanship shall conform to the NCDOT's Standards and Specifications Manual.

5. Strict compliance with the Policies and Procedures for Accommodating Utilities on Highway Rights of Way Manual shall be required.

6. All earth areas disturbed shall be regraded and seeded in accordance with the NCDOT standards and specifications.

7. Complete restoration including reestablishing ditch line, fertilizing, seeding, mulching, tacking of straw and all areas disturbed during construction will follow within a maximum of thirty (30) working days of the initial disturbing activity.

8. All open cuts shall conform to the NCDOT Policies and Procedures for Accommodating Utilities on Highway Rights of Way Manual.

9. All roadway signs which are removed due to installation will be reinstalled on the same day or as soon as possible.

10. The Contractor shall notify the local NCDOT office at least 24 hours prior to construction.

F. Parking: Provide temporary parking areas for construction personnel.

G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.

2. Remove show and ice as required to minimize accumulations.

H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated within the Contract Documents.

2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. As necessary, provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are easily legible at all times.

I. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management."

J. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution Requirements" for progress cleaning requirements.

K. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel. 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

L. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

M. Existing Stair Usage: Where and when approved by the Owner, use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

N. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 01 Section "Summary."

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties, according to requirements of authorities having jurisdiction.

1. Install erosion control measures as shown on the Drawings and as specified in the Contract Documents as necessary to prevent erosion and prevent soil-bearing water runoff from reaching nearby waterways, and storm water conveyance systems.

2. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

3. Clean, repair, and restore adjoining properties, roads, storm water systems and other areas affected by erosion and sedimentation from the project site during the course of the project.

4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

F. Security Enclosure and Lockup: As necessary, install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

I. Covered Walkway: As necessary, erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing.

2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and sate passage.

3. Paint and maintain appearance of walkway for duration of the Work.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

K. Temporary Partitions: When necessary, provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.

2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant treated plywood.

a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.

3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.

4. Insulate partitions to control noise transmission to occupied areas

5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors 6. and security locks where openings are required.

6. Protect air-handling equipment.

7. Provide walk-off mats at each entrance through temporary partition.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.

2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.

2. Protect stored and installed material from flowing or standing water.

3. Keep porous and organic materials from coming into prolonged contact with concrete.

4. Remove standing water from all surfaces.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of appropriate construction area, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed areas.

2. Keep interior spaces reasonably clean and protected from water damage.

3. Periodically collect and remove waste containing cellulose or other organic

4. Discard or replace water-damaged material.

5. Do not install material that is wet.

6. Discard, replace or clean stored or installed material that begins to grow mold.

7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the construction areas but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside area by maintaining effective dry-in conditions.

2. Use permanent HVAC system to control humidity.

3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.

b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Engineer.

c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor.

2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 015639

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for temporary site fencing.

2. Division 31 Section "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches above the ground for trees up to, and including, 4-inch size; and 12 inches above the ground for trees larger than 4-inch size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, as indicated on Drawings or as defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 SUBMITTALS

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

B. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree

2. Location on site plan. Include unique identifier for each.

3. Reason for pruning.

4. Description of pruning to be performed.

5. Description of maintenance following pruning.

C. Certification (when requested): From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and beat protected promptly and properly treated and repaired when damaged.

D. Maintenance Recommendations (when requested): From arborist, for care and protection of trees affected by construction during and after completing the Work.

E. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or videotape.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE

A. Arborist Qualifications: located. Licensed arborist in jurisdiction where Project is

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

1.6 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.

3.Foot traffic.

4.Erection of sheds or structures.

5. Impoundment of water.

6.Excavation or other digging unless otherwise indicated

7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other non-soil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of the following:

1. Type: Shredded hardwood.

2. Size Range: 3 inches maximum, 1/2 inch minimum.

3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements. Previously used materials may be used when approved by Engineer. 1.

1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch- diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch OD line posts, and 2-7/8-inch- OD corner and pull posts with 1-5/8-inch- OD top rails and 0.177-inch-diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

a. Height: 4 feet.

2. Plywood Protection-Zone Fencing: Plywood framed with four 2-by-4-inch rails, with 4-by-4-inch preservative-treated wood posts spaced not more than 8 feet apart.

a. Height: 4 feet.

b. Plywood and Lumber: Comply with requirements in Division 06 Section "Rough Carpentry."

3. Wood Protection-Zone Fencing: Constructed of two 2-by-4-inch horizontal rails, with 4-by-4-inch preservative-treated wood posts spaced not more than 8 feet apart, and lower rail set halfway between top rail and ground.

a. Height: 4 feet.

b. Lumber: Comply with requirements in Division 06 Section "Rough Carpentry."

4. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft. remaining flexible from minus 60 to plus 200 degree F inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet apart. a. Height:

A.4 feet.

b. Color: High-visibility orange, nonfading.

5. Gates: Swinging access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width as indicated.

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows

1. Size and Text: As shown on Drawings.

2. Lettering: 3-inch-high minimum, white characters on red background.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Tie a 1-inch blue-vinyl tape around each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.

1. Apply 4-inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

3.3 TREE- AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.

2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Engineer.

3.Access Gates: Install where indicated; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Engineer. Install one sign spaced approximately every 35 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction. C. Maintain protection zones free of weeds and trash

D. Repair or replace trees, shrubs and other vegetation indicated to remain or be relocated that are damaged by construction, operations, in a manner approved by Engineer.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Engineer and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone:

2. Temporary access is permitted subject to reapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 31 Section "Earth Moving."

B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.

2. Cut Ends: Do not paint cut root ends.

3.Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.

4.Cover exposed roots with burlap and water regularly.

5. Backfill as soon as possible according to requirements in Division 31 Section "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune roots flush with the edge of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:

1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.

2. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

3.Cut branches with sharp pruning instruments; do not break or chop.

4. Do not apply pruning paint to wounds.

B. Chip removed branches and spread over areas identified by Engineer or dispose of off-site.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone except as noted below.

C. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Engineer.

1. Submit details of proposed root cutting and tree and shrub repairs.

2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.

3.Treat damaged trunks, limbs, and roots according to arborist's written instructions.

4. Perform repairs within 24 hours

5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Engineer.

B. Trees: Remove and replace trees indicated to remain that are more than 50 percent dead or in an unhealthy condition or are damaged during construction operations that Engineer determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.

2. Provide two new trees of 6-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.

a. Species: Species selected by Engineer.

3. Plant and maintain new trees as specified in Division 32 Section "Plants."

C. Soil Aeration: Where directed by Engineer, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch diameter holes a minimum of 12 inches deep at 24 inches on center. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 016000 PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in project; product delivery, storage, and handling; manufacturers' standard warranties on product; special warranties; and comparable products.

B. Related Sections:

1. Division 01 Section "Allowances" for products selected under an allowance.

2. Division 01 Section "Alternates" for products selected under an alternate.

3. Division 01 Section "Substitution Procedures" for requests for substitutions.

4. Division 01 Section "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.

2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.

3. Comparable Product: Product that is demonstrated and approved through submittal process, or where approved as a product substitution, to have the indicated qualities related to type, function, dimension, in-service. Performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

C. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics force poses of evaluating comparable products of additional manufacturers named in the specification.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include manufacturer's name and generic names of products required. proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.

2. Form: Tabulate information for each product under the following column headings:
   a. Specification Section number and title.
   b. Generic name used in the Contract Documents.
   c. Proprietary name, model number, and similar designations.
   d. Manufacturer's name and address.
   e. Supplier's name and address.
   f. Installer's name and address.
   g. Projected delivery date or time span of delivery period.
   h. Identification of items that require early submittal approval for scheduled delivery date.

3. Completed List: Within 30 days after date of commencement of the Work, submit copies of completed product list in accordance with Section 013300. Include a written explanation for omissions of data and for variations from Contract requirements.

4. Engineer's Action: Engineer will respond in writing to Contractor as Engineer indicated in Section 013300. Engineer's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Engineer’s response, or lack of response does not constitute a waiver of requirements to comply with the Contract Documents.

B. Substitution Requests: Submit copies of each request for consideration in accordance with Section 013300. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

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

   a. Statement indicating why specified material or product cannot be provided.

   b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by

Owner and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners.

g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery

. j. Cost information, including a proposal of change, if any, in the Contract Sum.

k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.

l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation and notify Contractor of acceptance or rejection of proposed substitution in accordance with Section 013300.

C. Comparable Product Requests: Submit copies of each request for consideration in accordance with Section 013300. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation and notify Contractor of acceptance or rejection of proposed comparable product in accordance with Section 013300.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

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

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, protecting, and installing. complete with labels and instructions for handling, storing, unpacking,

4. Inspect products upon delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.

2. Store materials in a manner that will not endanger Project structure.

3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

4.Comply with product manufacturer's written instructions for temperature, humidity, ventilation, exposure to sunlight, and weather-protection requirements for storage.

5.. Protect stored products from damage and liquids from freezing

6.Provide a secure location and enclosure at Project site for storage of materials and equipment. Coordinate location with Owner.

7. Provide periodic rotation or movement of equipment as required by manufacturer.

1.7 PRODUCT WARRANTIES

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

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by, or incorporated into, the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.

3. Refer to Divisions 02 through 33. Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and

2. effect. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

5. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article below to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.

Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.

3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

4. Manufacturers: Where Specifications include a list of manufacturers with requirements. names, provide a product by one of the manufacturers listed that complies

5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with unnamed product. provisions in Part 2 "Comparable Products" Article for consideration of an

6.Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.

7.Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.

8.Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article below for consideration of an unnamed product by the other named manufacturers.

2.2 PRODUCT SUBSTITUTIONS

A. All product substitutions shall be made in accordance with Division 01 Section "Substitution Procedures"

2.3 COMPARABLE PRODUCTS

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

1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents, and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

3. Evidence that proposed product provides specified warranty. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners, if requested. Samples, if requested.

END OF SECTION 016000

SECTION 017000

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Sections:

1. Division 01 Section "Submittal Procedures".

2. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.

3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 SUBMITTALS

A. Qualification Data: For professional land surveyor.

B. Certificates: Submit certificate signed by professional land surveyor certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit two copies signed by professional land surveyor.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from the Engineer before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety. Operational elements include, but are not limited to the following:

a. Primary operational systems and equipment.
b. Fire-suppression systems.
c. Mechanical systems piping and ducts.
d. Control systems.
e. Communication systems.
f. Conveying systems.
g. Electrical wiring systems.
h. Operating systems of special construction.

3.Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

a Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Equipment supports.
d. Piping, ductwork, vessels, and equipment.
e. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the structure's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS 2.1 MATERIALS

A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION 3.1

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of all structures, underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and/or Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately upon discovery of the need for clarification of the Contract Documents caused by differing field conditions

outside the control of the Contractor, submit a request for information to Engineer according to requirements in Division 01 Section "Project Management and Coordination." Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.

B. General: Engage a professional land surveyor to lay out the Work using accepted surveying practices.

1.Establish benchmarks and control points to set lines as needed to locate each element of Project. to obtain required dimensions.

2. Establish dimensions within tolerances indicated. Do not scale Drawings.

3. Inform installers of lines and levels to which they must comply.

4. Check the location, level and plumb, of every major element as the Work progresses.

5. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.

6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

3.4 FIELD ENGINEERING

A. Identification: Contractor shall identify existing or establish benchmarks, control points, and property corners as necessary.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.

2.Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.

3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: of foundation walls, major site Upon completion improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Attachment: Provide blocking, attachment plates, anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and conditions. type of attachments are not indicated, verify size and type required for load

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.

2. Allow for structure movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Division 01 Section "Summary."

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption of services.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations

1. In general, use hand or small power tools designed for sawing and Cut holes and slots neatly to grinding, not hammering and chopping. minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over

the patch, and apply final paint coat over entire unbroken blends with adjacent surfaces. surface containing the patch. Provide additional coats until patch

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: When required, coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 degrees F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

a. Utilize containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

2. Where e liquid spill proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Construction Waste Management".

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion

. I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply Requirements." qualification requirements in Division 1 Section "Quality Requirements”

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017000

SECTION 017419

CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.

2. Recycling nonhazardous demolition and construction waste.

3. Disposing of nonhazardous demolition and construction waste

B. Related Sections:

1.Division 01 Section "Temporary Facilities and Controls" for environmental-protection measures during construction, and location of waste containers at Project site.

2.Division 02 Section "Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.

3. Division 02 Section "Selective Structure Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.

4. Division 04 Section "Unit Masonry" for disposal requirements for masonry waste.

5.Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS (Not Used)

1.5 SUBMITTALS (Not Used)

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Waste Management Conference: Conduct conference at Project site. Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of Contractor's waste management coordinator.

2. Review requirements for documenting each type of waste and its disposition.

3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.

4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.

5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A:General: Develop a waste management plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by management plan. weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.

2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.

3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers

4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.

2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.

3. Total cost of disposal (with no waste management).

4. Revenue from salvaged materials.

5.Revenue from recycled materials.

6. Savings in hauling and tipping fees by donating materials.

7 Savings in hauling and tipping fees that are avoided.

8. Handling and transportation costs. Include cost of collection containers for each type of waste.

9. Net additional cost or net savings from waste management plan.

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.

2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1.Clean salvaged items.

2.Pack or crate items after cleaning. Identify contents of containers.

3.Store items in a secure area until installation.

4.Protect items from damage during transport and storage.

5.Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers.

3.Store items in a secure area until delivery to Owner.

4. Transport items to Owner's storage area as designated by Owner.

5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.Stockpile materials away from construction area. Do not store within drip line of remaining trees.

4.Store components off the ground and protect from the weather.

5.Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphaltic Concrete Paving: Grind asphalt to maximum 1-1/2-inch size. Crush asphaltic concrete paving and screen to comply with requirements in Division 31 Section "Earth Moving" for use as general fill.

B. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.

2. Crush concrete and screen to comply with requirements in Division 31 Section "Earth Moving" for use as satisfactory soil for fill or subbase.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 1-1/2-inch size.

a. Crush masonry and screen to comply with requirements in Division 31 Section "Earth Moving" for use as satisfactory soil for fill or subbase.

2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. materials. Separate lumber, engineered wood products, panel products, and treated wood

F. Metals: Separate metals by type.

1. Structural Steel; Stack members according to size, type of member, and length.

2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets or in containers and dispose of fasteners. store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

K. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

L. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

M. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.

2.Polystyrene Packaging: Separate and bag materials.

3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees on-site, if permitted by Owner, or at landfill facility.

1. Comply with requirements in other specification sections for use of chipped organic waste as organic mulch.

C. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.

2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

a. Comply with requirements in other specification sections for use of clean sawdust as organic mulch.

D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

a. Comply with requirements in other specification sections for use of clean ground gypsum board as inorganic soil amendment.

3.6 A DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700

CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Substantial Completion procedures.

2.Final completion procedures.

3. Warranties.

4. Final cleaning.

B. Related Sections

1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.

2. Division 1 Section "Execution Requirements" for progress cleaning of Project site.

3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

4. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

5. Division 1 Section "Demonstration and Training" for requirements for instructing Owner's personnel.

6. Divisions 2 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

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

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.

2. Advise Owner of pending insurance changeover requirements.

Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

5. Prepare and submit Project Record Documents, operation and maintenance manuals, property surveys, and similar final record information.

6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

7.Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.

8. Complete startup testing of systems.

9.Submit test/adjust/balance records.

10. Terminate and remove temporary facilities from Project site, along with construction tools, and similar elements.

11. Advise Owner of changeover in heat and other utilities.

12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

13. Complete final cleaning requirements, including touchup painting.

14.Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

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

1. Reinspection: Request reinspection when the Work identified in previous

2. inspections as incomplete is completed or corrected. Results of completed inspection will form the basis of requirements for final completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section

2. "Payment Procedures." insurance requirements. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

3. As necessary, submit pest-control final inspection report and warranty.

4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

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

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

1.5 WARRANTIES

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

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

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

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of installer.

3.Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

4. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

1. Complete the following cleaning operations before requesting inspection for certification of substantial completion for entire project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

d. Remove tools, construction equipment, machinery, and surplus material from Project site.

e. As necessary, remove snow and ice to provide safe access to the work area.

f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

h. Sweep floors broom clean.

i. Vacuum any carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

k. Remove labels that are not permanent.

l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

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

m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity:

o. Clean any and all plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

p. Replace any and all disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

q. Clean any and all ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning.

r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

s. Leave Project clean and ready for operation.

B. Construction Waste Disposal: Comply with waste disposal requirements in the Modified General Conditions of this contract.

END OF SECTION 017700 (Standard Form Attached)

CONTRACTORS FINAL AFFIDAVIT AND WAIVER OF LIEN

PROJECT: _____
OWNER_____

_____
_____

_____
_____

CONTRACTOR_____

_____

_____

CONTRACT AMMOUNT:_____ CONTRACT DATE:_____

STATE OF:_____
DATE:_____

COUNTY OF:_____

This is to certify that all claims for labor, material, services and any other just claims arising out of the performance of this Contract have been satisfied, except for payment to subcontractors to be made out of retainage presently being held by the Owner, and that no claims or liens exist against this Contractor in connection with this contract; that to the best of our knowledge no claims or liens exist, and if any such claims or liens appear after payment of the retained amount due on the Contract, this Contractor shall save the Owner harmless on account thereof. After payment of the retained amount the undersigned does hereby waive, release and relinquish any and all claims or rights of lien presently held or hereafter accruing upon the above project.

CONTRACTOR:_____
_____

BY:_____
_____

TITLE:_____
_____

SWORN TO AND SUBSCRIBED BEFORE ME THIS _____DAY OF

_____202____

NOTARY PUBLIC:

_____

MY COMISSION
EXPIRES:_____

SECTION 017823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1.Operation and maintenance documentation directory.

2. Operational components of manuals for systems, subsystems, and equipment.

3. Product maintenance components of manuals.

4. Systems and equipment maintenance manuals.

B. Related Sections:

1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.

3. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.

4. Divisions 2 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file of initial submittal and final submittal. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Engineer.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.

b. Enable inserted reviewer comments on draft submittals.

2.Paper copies (for final submittal only): Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Manual Submittal: Submit two (2) digital copies and three (3) paper copies of each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Engineer will return copy with comments.

1. Correct or modify each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals,

PART 2 – PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1.List of documents.

2.List of systems.

3. List of equipment.

4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically: Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each operation and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents.

2.2 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.

2.Table of contents.

3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1.Subject matter included in manual.

2. Name and address of Project.

3. Name and address of Owner.

4. Date of submittal.

5. Name and contact information for Contractor.

6.Name and contact information for Engineer.

7. Name and contact information for Equipment Manufacturer's Representative.

8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where scanning of paper documents is required, configure scanned file for minimum readable file size.

2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel upon opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, vinyl-covered, binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

b. Identity each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose software storage media for computerized electronic equipment.

4.Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.

5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 OPERATIONAL COMPONENTS OF MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2.Use designations for systems and equipment indicated on Contract Documents.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams. Control diagrams.
7. Piped system diagrams.
8. Precautions against improper use.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2.Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5 Normal shutdown instructions.
6. Seasonal and weekend operating instructions.
7. Required sequences for electric or electronic systems.
8. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

F. Emergency Instructions: Describe and explain warnings, trouble indications, Include responsibilities of error messages, and similar codes and signals. Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

G. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.

2.4 PRODUCT MAINTENANCE COMPONENTS OF MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1.Product name and model number. Manufacturer's name. Material and chemical composition. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Schedule for routine maintenance.
3. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE COMPONENTS OF MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and

maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.

2.Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

3. Identification and nomenclature of parts and components.

4.List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2, Troubleshooting guide.
3. Precautions against improper maintenance.
4.Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available. Include service and lubrication

E. Maintenance and Service Schedules: requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.

2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to operation, and maintenance manuals.

B. Product Maintenance Components of Manuals: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operational Components of Manuals: Assemble a complete set of operational not part of a system. data indicating operation of each system, subsystem, and piece of equipment.

1.Engage a factory-authorized service representative to assemble and not part of a system.

2. Prepare information for each system, subsystem, and piece of equipment Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals. 2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following: Record Drawings. Miscellaneous record submittals. Related Sections:

1. Division 01 Section "Closeout Procedures" for general closeout procedures.
2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 2 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints and one digital copy as described below.

B. Miscellaneous Record Submittals: Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and one digital copy of each submittal as described below.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.

1. Preparation: Mark record prints to show the actual installation where installation edges cord, whether individual or entity is installer, installation varies from that shown originally. Require individual or entity subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Accurately record information in an understandable drawing technique.

c. Record data as soon as possible after obtaining it.

d. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below grade.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Changes made by Change Order or Work Change Directive.
i. Changes made following Engineer's written orders.
j. Details not on the original Contract Drawings.
k. Field records for variable and concealed conditions.
l. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location. or omitted from original Drawings.

5.Mark important additional information that was either shown schematically

6.Note Change Order or Work Change Directive numbers, alternate numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer. When authorized, prepare a digital copy of those Contract Drawings.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Provide information in the following formats:

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Record Digital Data Files on a disk: Organize digital data information into separate PDF electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

3. Identification: As follows:
    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Contractor.

2.2 MISCELLANEOUS RECORD SUBMITTALS

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

B. Format: Submit three (3) paper copies and two (2) digital copies of all miscellaneous records.

1. Include a miscellaneous record submittals directory organized by specification section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 – EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's reference during normal working hours.

END OF SECTION 017839

SECTION 031000 –

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Division 01 Sections

B. Section 032000 - Concrete Reinforcing.

C. Section 033000 - Cast-in-Place Concrete.

1.2 REFERENCES

ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.

ACI 301 – Standard Specifications for Structural Concrete.

ACI 318 – Building Code Requirements for Structural Concrete.

ACI 347 – Guide to Formwork for Concrete.

ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials

. ASTM E154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover. A

STM E1643 – Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

ASTM E1745 – Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

ASTM E1993 – Standard Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

ASTM F1249 – Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.3 SUBMITTALS

A. Submit manufacturer’s data for:

1. Vapor Retarder

2. Expansion/Isolation Joint Filler.

1.4 DESIGN OF FORMWORK

A. Design of formwork, shoring, and reshoring and its removal is the Contractor's responsibility.

B. Design of formwork, shoring, and reshoring shall conform to ACI 117, ACI 301, ACI 318, and ACI 347.

C. Design formwork in a manner such that existing or new construction is not overloaded.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Form Material: Wood, plywood, metal, fiberglass or a combination of these, with sufficient strength to prevent distortion.

B. Form Definitions 1. Standard Forms: No form-facing material required. Standard forms are acceptable everywhere.

2.2 FORMWORK ACCESSORIES

A. Formwork Accessories: Commercially manufactured products, including ties and hangers. Do not use nonfabricated wire form ties.

2.3 FORM RELEASE AGENT

A. Form release agent shall not bond with, stain, nor adversely affect concrete surfaces.
2.4 VAPOR RETARDER

A. Vapor Retarder

1. Polyethylene sheet, not less than 10 mils thick, complying with ASTM E1745, Class A, B, and C.

2. Maximum Permeance: ASTM E96: 0.04 perms (US).

3. Seam Tape: High Density Polyethylene Tape with pressure sensitive adhesive; minimum width of 4 inches.

4. Pipe Boots: Construct pipe boots from vapor barrier material and seam tape in accordance with manufacturer's instructions.

2.5 EXPANSION / ISOLATION JOINT FILLER

A. Expansion / Isolation Joint Filler: ASTM D1751, asphalt impregnated premolded fiberboard, 3/8- inch thick by full thickness of slab or joint, unless indicated otherwise in the Structural Drawings.

2.6 CONSTRUCTION JOINTS

A. Slabs On Grade: Steel plate dowel (1/4" thick) such as manufactured by PNA Construction Technologies, Inc., Greenstreak Group, Inc., or approved equal.

1. Plate Thickness: 1/4-inch thick for slabs up to 6 inches in thickness; 3/8-inch for slabs over 6 inches and up to 8 inches in thickness; 3/4-inch thick for slabs over 8 inches in thickness and up to 12 inches in thickness.

PART 3 - EXECUTION

3.1 GENERAL

A. Erect formwork in accordance with ACI 301 and ACI 347

B. Finished work shall comply with tolerances of ACI 117.

C. Provide 3/4-inch chamfer at all formed corners.

3.2 FOUNDATION ELEMENTS

A. Form foundation elements if soil or other conditions are such that earth trench forms are unsuitable.

B. Sides of turned-down slabs shall be formed.

C. Maintain minimum coverage of reinforcing steel as indicated in Structural Drawings.

3.3 VAPOR RETARDER

A. Where indicated on Structural Drawings, place vapor retarder over granular subbase and behind expansion / isolation joints at walls. Place electrical conduits and ducts in granular subbase.

B. Install vapor retarder in accordance with manufacturer's instructions and ASTM E1643.

1. Lap vapor retarder six inches minimum at splices and seal with seam tape.

2. Lap vapor retarder over footings and seal to walls.

3. Seal all pipe penetrations with pipe boot.

4. No penetration of vapor retarder is permitted except for reinforcing steel and permanent utilities.

5. Do not puncture vapor retarder; repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches and taping all four sides.

C. Install waterproof and vaporproof membrane in accordance with manufacturer's recommendations.

3.4 FORM PREPARATION

A. Seal form joints to prevent leakage.

B. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed.

C. Before reinforcement is placed, coat contact surfaces of form with form release agent in accordance with manufacturer's recommendations. Do not allow excess form release agent to accumulate in forms or come in contact with concrete surfaces against which fresh concrete will be placed.

3.5 INSERTS AND EMBEDMENT ITEMS

A. Install and secure in position required inserts, embeds, hangers, sleeves, anchors, and nailers.

B. Locate anchor bolts/rods in position in accordance with approved setting drawings and secure to prevent displacement during concrete placement.

3.6 PROVISIONS FOR OTHER TRADES

A. Install openings in concrete formwork to accommodate work of other trades. Determine size and location of openings and recesses from trades requiring such items. Obtain approval from Structural Engineer for openings not shown in Structural Drawings

B. Accurately place and securely support items built into forms.

3.7 CONSTRUCTION JOINTS

A. Slabs On Grade: Install steel plate dowels in accordance with manufacturer's recommendations. Place plate dowels at mid-depth of slab (+/-1/4-inch), unless noted otherwise in the Structural Drawings.

3.8 FORMWORK REMOVAL

A. Remove formwork carefully in such manner and at such time as to ensure complete safety of structure. Do not remove formwork, shoring, or reshoring until members have acquired sufficient strength to support their weight and the load thereon safely.

3.9 FINISHES OF FORMED SURFACES

A. Standard Form Finish: Patch tie holes and defects. Chip or rub off fins exceeding ¼ inch in height. Leave surface with the texture imparted by the forms.

END OF SECTION 031000

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Vapor retarder.

B. Related Sections:

1. Section 31 2000 "Earth Moving" for drainage fill under slabs-on-grade.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blastfurnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. 1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules,

stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.

2. Admixtures.

3. Form materials and form-release agents.

4. Steel reinforcement and accessories.

5. Waterstops.

6. Curing compounds.

7. Floor and slab treatments.

8. Bonding agents.

9. Adhesives.

10. Underslab waterproofings.

11. Joint-filler strips.

12. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

F. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.

b. Independent testing agency responsible for concrete design mixtures.

c. Ready-mix concrete manufacturer.

d. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab

flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Metal or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.

b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

c. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforcedplastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

a. Fly Ash: ASTM C 618, Class F.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: As indicated in design mixes.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.

2. Retarding Admixture: ASTM C 494, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.

6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Euclid Chemical Company (The), an RPM company; EUCON CIA.

b. Grace Construction Products, W. R. Grace & Co.; DCI.

c. Sika Corporation; Sika CNI.

2.6 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BoMetals, Inc.

b. Greenstreak.

c. Vinylex Corp.

2. Profile: Ribbed with center bulb.

3. Dimensions: As applicable to location; nontapered.

B. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Concrete Sealants Inc.; Conseal CS-231.

b. Greenstreak; Swellstop.

c. Henry Company, Sealants Division; Hydro-Flex.

d. JP Specialties, Inc.; Earth Shield Type 20.

C. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Adeka Ultra Seal/OCM, Inc.; Adeka Ultra Seal.

b. Greenstreak; Hydrotite.

c. Vinylex Corp.; Swellseal.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with a perm rating of less than 0.01 Perms grains/(ft2 · hr · inHg) as tested in accordance with ASTM E 1745 Section 7. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.

b. Fortifiber Building Systems Group; Moistop Ultra 15.

c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.

d. Insulation Solutions, Inc.; Viper VaporCheck 16.

e. Meadows, W. R., Inc.; Perminator 15 mil.

f. Raven Industries Inc.; Vapor Block 15.

g. Reef Industries, Inc.; Griffolyn 15 mil Green.

h. Stego Industries, LLC; Stego Wrap 15 mil Class A.

2.8 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ChemMasters; Chemisil Plus.

b. ChemTec Int'l; ChemTec One.

c. Conspec by Dayton Superior; Intraseal.

d. Edoco by Dayton Superior; Titan Hard.

e. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.

f. Meadows, W. R., Inc.; LIQUI-HARD.

g. Symons by Dayton Superior; Buff Hard.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ChemMasters; SprayFilm.

b. Conspec by Dayton Superior; Aquafilm.

c. Edoco by Dayton Superior; BurkeFilm.

d. Euclid Chemical Company (The), an RPM company; Eucobar.

e. L&M Construction Chemicals, Inc.; E-CON.

f. Meadows, W. R., Inc.; EVAPRE.

g. Sika Corporation; SikaFilm.

h. Symons by Dayton Superior; Finishing Aid.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Kure-N-Seal W.

b. ChemMasters; Safe-Cure Clear.

c. Conspec by Dayton Superior; High Seal.

d. Euclid Chemical Company (The), an RPM company; Diamond Clear VOX; Clearseal WB STD.

e. L&M Construction Chemicals, Inc.; Dress & Seal WB.

f. Meadows, W. R., Inc.; Vocomp-20.

g. Symons by Dayton Superior; Cure & Seal 18 Percent E.

F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Kure-N-Seal 25 LV.

b. ChemMasters; Spray-Cure & Seal Plus.

c. Conspec by Dayton Superior; Sealcure 1315.

d. Edoco by Dayton Superior; Cureseal 1315.

e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear; LusterSeal 300.

f. L&M Construction Chemicals, Inc.; Lumiseal Plus.

g. Meadows, W. R., Inc.;

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Non-Retaining Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio by Weight: 0.50.
3. Minimum Cementitious Materials Content: 475 lb/cu. yd.
4. Maximum Nominal Aggregate Size: 1 inch.
5. Maximum Slump Limit: 3-1/2 inches, plus 1 inch.
6. Air Content: 4 to 6 percent.

B. Slabs-on-Grade (Interior): Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio by Weight: 0.45.
3. Minimum Cementitious Materials Content: 540 lb/cu. yd.
4. Maximum Nominal Aggregate Size: 1 inch.
5. Maximum Slump Limit: 3-1/2 inches, plus 1 inch.

C. Foundation and Retaining Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio by Weight: 0.45.
3. Minimum Cementitious Materials Content: 590 lb./cu.yd.
4. Maximum Nominal Aggregate Size: 1-1/2 inches.
5. Maximum Slump Limit: 3-1/2 inches, plus 1 inch.
6. Air Content: 4 to 6 percent.

D. Concrete Toppings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio by Weight: 0.45.

3. Minimum Cementitious Materials Content: 590 lb./cu.yd.

4. Maximum Nominal Aggregate Size: 3/8 inch.

5. Maximum Slump Limit: 3-1/2 inches, plus 1 inch.

6. Air Content: 4 to 6 percent.

E. Suspended Slabs: Proportion structural lightweight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.

2. Minimum Cementitious Materials Content: 660 lb./cu.yd.

3. Maximum Nominal Aggregate Size: 3/4 inch.

4. Maximum Slump Limit: 2-1/2 inches, plus 1 inch.

5. Air Content: 4 to 8 percent.

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.

2. Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.

2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture underslab waterproofing. Repair damage and reseal underslab waterproofing before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one fourth Insert depth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 9200 "Joint Sealants," are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items and underslab waterproofing is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until

producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and onehalf parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bullfloated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish or to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-filmfinish coating system.

2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with inplace construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hotweather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.

b. Continuous water-fog spray.

c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.

2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify

mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.

2. Steel reinforcement welding.

3. Headed bolts and studs.

4. Verification of use of required design mixture.

5. Concrete placement, including conveying and depositing.

6. Curing procedures and maintenance of curing temperature.

7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete;one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days. a. Test one set of

two field-cured specimens at 7 days and one set of two specimens at 28 days. b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

6. When strength of field-cured cylinders is less than 85 percent of companion laboratorycured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi

8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents. D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 061000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

D. RALL MATERIAL SHALL BE EXTERIOR GRADE, TREATED LUMBER.

E. Any interior floor must not exceed a 1% slope. If an excessive slope is encountered, the Developer must take the necessary steps to correct, including but not limited to engaging a structural engineer.

ART 2 - PRODUCTS

2.1 WOOD PRODUCTS,

GENERAL

A. Lumber: Provide dressed lumber, S4S, marked with grade stamp of inspection agency.

B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

2.2 TREATED MATERIALS

A. Preservative-Treated Materials: AWPA C2, except that lumber not in ground contact and not exposed to the weather may be treated according to AWPA C31 with inorganic boron (SBX).

1. Use treatment containing no arsenic or chromium.
2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

B. Provide preservative-treated materials for all rough carpentry unless otherwise indicated.

1. Wood members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Concealed members in contact with masonry or concrete.
3. Wood framing members that are less than 18 inches above the ground.
4. Wood floor plates that are installed over concrete slabs-on-grade.

C. Fire-Retardant-Treated Materials: Comply with performance requirements in AWPA C20.

1. Use Exterior type for exterior locations.
2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
3. Use Interior Type A unless otherwise indicated.
4. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.

D. Provide fire-retardant treated materials for all rough carpentry.

2.3 LUMBER

A. Dimension Lumber:

1. Maximum Moisture Content: 19 percent for 2-inch nominal thickness or less, no limit for more than 2-inch nominal thickness.
2. Non-Load-Bearing Interior Partitions: Standard, Stud, or No. 3
3. Framing Other Than Non-Load-Bearing Interior Partitions: Construction or No. 2
4. Retain subparagraph below for better appearance for exposed work.
5. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
    a. Species: As specified for framing other than non-load-bearing interior partitions.
    b. Grade: Select Structural or No. 1

B. Timbers 5-Inch Nominal Size and Thicker: Select Structural, No. 1 or Douglas fir Maximum Moisture Content: 23 percent.

C. Exposed Boards: Mixed southern pine, No. 1 with 19 percent maximum moisture content.

D. Concealed Boards: Eastern softwoods, No. 3 Common: NELMA or Mixed southern pine, No. 2: SPIB; with 19 percent maximum moisture content. E. Miscellaneous Lumber: Standard, Stud, or No. 3 grade with 19 percent maximum moisture content of any species. Provide for nailers, blocking, and similar members.

2.4 ENGINEERED WOOD PRODUCTS

A. Engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.

B. Laminated-Veneer Lumber: Manufactured with exterior-type adhesive complying with ASTM D 2559. Allowable design values determined according to ASTM D 5456.

1. Extreme Fiber Stress in Bending, Edgewise: Minimum of 2600 psi for 12-inch nominal depth members.

2. Modulus of Elasticity, Edgewise: Minimum of 1,800,000 psi

C. Wood I-Joists: Prefabricated units, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Provide units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.

1. Web Material: Either oriented strand board or plywood, Exposure 1.
2. Structural Properties: Provide units with depths and design values not less than those indicated.
3. Provide units complying with APA PRI-400, factory marked with nominal joist depth, joist class, span ratings, mill identification, and compliance with APA standard.

D. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.

1. Material: glued-laminated wood or product made from any combination solid lumber, wood strands, and veneers.
2. Thickness: Minimum of 1-1/8 inches.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: Plywood, Exterior, AC, Exterior or C-C Plugged, fire-retardant treated, not less than 1/2-inch nominal thickness.

2.6 MISCELLANEOUS PRODUCTS

A. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.

1. Power-Driven Fasteners: CABO NER-272.
2. Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers.

B. Metal Framing Anchors: Structural capacity, type, and size indicated.

1. Use anchors made from hot-dip galvanized steel complying with ASTM A 653/A 653M, G60 coating designation for interior locations where stainless steel is not indicated.
2. Use anchors made from stainless steel complying with ASTM A 666, Type 304 for exterior locations and where indicated.

C. Sill Sealer: Glass-fiber insulation, 1 inch thick, compressible to 1/32 inch.

PART 3 - EXECUTION 3.1 INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Securely attach rough carpentry to substrates, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.

END OF SECTION 061000

06 1100 FRAMING AND SHEATHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor, roof and wall framing.

2. Floor decking.

3. Roof and wall sheathing.

4. Wood blocking and furring.

5. Preservative and fire retardant treatment of wood.

B. Related Sections:

1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

A. American Wood Protection Association (AWPA) U1 - Use Category System - User Specification for Treated Wood.

B. ASTM International (ASTM):

1. A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

2. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

3. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

4. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs. 5. F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55 and 105 KSI Yield Strength.

C. Engineered Wood Association (APA) PRP-108 - Performance Standards and Qualification Policy for Structural-Use Panels.

D. Forest Stewardship Council (FSC) STD-40-004 - Chain of Custody Standard.

E. National Institute of Standards and Technology (NIST) - Product Standard PS 20 - American Softwood Lumber Standard.

F. Northeastern Lumber Manufacturers Association (NELMA) - Standard Grading Rules for Northeastern Lumber.

G. National Lumber Grades Authority (NLGA) - Standard Grading Rules for Canadian Lumber.

H. Redwood Inspection Service (RIS) - Standard Specifications for Grades of California Redwood Lumber.

I. Southern Pine Inspection Bureau (SPIB) - Standard Grading Rules for Southern Pine Lumber.

J. West Coast Lumber Inspection Bureau (WCLIB) - Standard Grading Rules for West Coast Lumber.

K. Western Red Cedar Lumber Association (WRCLA) - Grading Rules.

L. Western Wood Products Association (WWPA) G-5 - Western Lumber Grading Rules.

1.3 SUBMITTALS

A. Sustainable Design Submittals:

1. Materials Reuse.

2. Recycled Content.

3. Regional Materials. 4. Rapidly Renewable Materials.

5. Low-Emitting Materials.

6. Certified Wood.

1.4 QUALITY ASSURANCE

A. Lumber Grading Agency: Certified to NIST PS 20.

B. Identify lumber and panel products by official grade mark.

C. Fire Retardant Treated Products: Bear label of recognized independent testing laboratory indicating flame spread rating of 25 or less, tested to ASTM E84.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials minimum 6 inches above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation.

B. Do not store seasoned or treated materials in damp location. C. Protect edges and corners of sheet materials from damage.

1.6 WARRANTIES

A. Provide manufacturer’s 10 year warranty against rot and termite damage for composite wood.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Laminated Veneer Lumber:

1. Boise Cascade Corporation. (www.bc.com)

2. Georgia-Pacific Corporation. (www.gp.com) 3. LP Corp. (www.lpcorp.com)

B. OR EQUIVANET.

2.2 MATERIALS

A. Dimension Lumber:

1. Grading rules: NELMA, NLGA, SPIB, WWPA.

2. Species: Southern Pine, Douglas Fir

3. Grade: Select Structural

4. Surfacing: Surfaced four sides (S4S) unless otherwise indicated.

5. Maximum moisture content: 19 percent.

6. Finger jointed, manufactured using low-emitting, urea formaldehyde-free binders.

7. Certified to FSC STD-04-004.

B. Laminated Veneer Lumber:

1. Fabricated by laminating wood veneers under pressure using exterior type adhesive with grain of veneers parallel with length.

2. Veneer: Douglas Fir or Southern Pine.

3. Manufactured using low-emitting, urea formaldehyde-free binders.

4. Certified to FSC STD-04-004.

C. Composite Joists and Headers:

1. Fabricated by laminating wood veneers to narrow oriented strand board to produce rectangular members with veneers making up not less than 32 percent of total cross section.

2. Manufactured using low-emitting, urea formaldehyde-free adhesives.

D. Panel Products:

1. Type: APA Plywood, Oriented Strand Board.

2. Panel grade:

a. Floor, wall and roof sheathing: APA Rated Sheathing.

b. Combination subfloor/underlayment: APA Sturd-I-Floor.

c. Underlayment: APA Underlayment.

3. Exposure:

a. Exterior applications: Exterior.

b. Interior applications: Exposure 1. Sturd-I-Floor subfloor for all applications.

4. Rapidly renewable product made from chopped straw, manufactured using low-emitting, urea formaldehyde-free binders.

5. Certified to FSC STD-04-004.

2.3 ACCESSORIES

A. Anchor Bolts: ASTM F1554.

B. Fasteners:

1. Type and size: As required by conditions of use.

2. Exterior locations and treated products: Stainless steel, ASTM F593, Type 304 or 316.

3. Other interior locations: Plain steel.

C. Metal Connectors: Joist Hangers:

1. Galvanized steel, ASTM A653/A653M, G185 coating class.

2. Size and shape: To suit framing conditions.

D. Subflooring Adhesive:

1. Waterproof, water based, air cure type, in cartridge dispensers.

2. Maximum volatile organic compound (VOC) content: 30 grams per liter.

E. Sill Gasket: ¼ inch thick, plate width, closed cell polyethylene or urethane foam from continuous rolls.

F. Termite Shield: Galvanized sheet steel, minimum 26 gage.

2.4 FABRICATION

A. Preservative Treatment:

1. Treat lumber and panel products in accordance with AWPA U1:

a. Interior locations protected from moisture sources: Category UC1 - Interior/Dry.

b. Interior locations subject to sources of moisture: Category UC2 - Interior/Damp.

c. Exterior locations above ground: Category UC3A - Above Ground/Protected UC3B - Above Ground/Exposed.

d. Exterior locations in contact with ground: Category UC4A - Ground Contact/General Use. UC4B - Ground Contact/Heavy Duty. UC4C - Ground Contact/Extreme Duty.

2. Treatment process: Type ACQ - Ammoniacal Copper Quaternary (ACQ); free from arsenic, chromium, and other EPA classified hazardous preservatives.

B. Fire Retardant Treatment; treat lumber and panel products in accordance with AWPA U1:

1. Interior locations: Category UCFA - Fire Retardant/Interior.

2. Exterior locations: Category UCFB - Fire Retardant/Exterior.

PART 3 EXECUTION 3.1 INSTALLATION

A. Set members level, plumb, and rigid.

B. Make provisions for erection loads, and for temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Place beams, joists, and rafters with crown edge up.

D. Construct load bearing framing members full length without splices. E. Sills:

1. Place full width continuous sill flashings under framed walls on cementitious foundations. Lap flashing joint 4 inches.

2. Place sill gasket directly on cementitious foundation. Fit tight to protruding foundation anchor bolts.

3. Anchor sills to foundation with anchor bolts, expansion fasteners, or power driven fasteners.

F. Joist Framing:

1. Provide minimum 1-1/2 inches of bearing.

2. Lap members framing from opposite sides minimum 4 inches.

3. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists. Frame rigidly into joists. 4. Bridge joists at mid span for spans in excess of 8 feet.

G. Stud Framing:

1. Provide single bottom plate and double top plates for load bearing partitions.

2. Provide single bottom and top plates for non-load bearing partitions.

3. Anchor bottom plates to concrete structure with anchor bolts, expansion fasteners, or power driven fasteners.

4. Triple studs at corners and partition intersections.

5. Anchor studs abutting masonry or concrete with toggle or expansion bolts.

6. Frame openings with double studs and headers. Space short studs over and under opening to stud spacing.

H. Rafter Framing:

1. Notch to fit exterior wall plates.

2. Double rafters at roof openings; support with metal hangers.

3. At ridge, place rafters directly opposite each other and secure to ridge member.

4. At hips and valleys, bevel ends for bearing against hip or valley rafter.

5. Locate collar ties at every pair of rafters where indicated on drawings, one third of the distance to ceiling joists; cut ends to fit slope and secure to rafters.

I. Beams:

1. Provide minimum end bearing of 4 inches.

2. Nail built-up members with two rows of nails spaced 6 inches on center maximum.

J. Roof Sheathing:

1. Place panels perpendicular to framing members with ends staggered and sheet ends over firm bearing.

2. If tongue-and-groove panels are not used, install sheathing clips between adjacent sheets between roof framing members.

3. Leave 1/8-inch expansion space at panel ends and edges.

4. Secure to supports with screws spaced maximum 6 inches on center along edges and maximum 12 inches on center in field of panels.

K. Wall Sheathing:

1. Place panels parallel to framing members, with ends over firm bearing and staggered.

2. At corners, place sheathing for a horizontal distance of 48 inches.

3. Leave 1/8 inch expansion space at panel ends and edges.

4. Secure to supports with screws spaced maximum 6 inches on center along edges and maximum 12 inches on center in field of panels.

L. Floor Decking/subfloor:

1. Place T&G panels perpendicular to framing members, with ends over firm bearing and staggered.

2. Leave 1/8-inch expansion space at panel ends and edges.

3. Secure to supports with screws spaced maximum 12 inches on center along edges and in field of panels.

M. Subflooring/underlayment: For tile floor installations. Refer to Section 09-2900 Gypsum Board for specifications

N. Provide blocking, nailers, grounds, furring, and other similar items required to receive and support work.

O. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

P. Install telephone and electrical panel backboards where indicated: Oversize panel by 12 inches on all sides.

3.2 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/4 inch in 10 feet maximum.

END OF SECTION 061100

SECTION 061300 HEAVY TIMBER CONSTRUCTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Round timber frame structural assemblies.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete for concrete foundations.

B. Section 05400 - Cold Formed Metal Framing.

C. Section 06100 - Rough Carpentry for related framing systems.

D. Section 06170 - Prefabricated Structural Wood.

E. Section 06175 - Wood Trusses.

1.3 REFERENCES

A. International Log Builders Association (ILBA): Log Span Tables for Floor Joists, Beams and Roof Support Systems.

B. US Green Building Council (USGBC): LEED v4.

C. US Dept of Agriculture Forest Service: Wood Handbook - Wood as an Engineering Material.

D. Timber Construction Manual, Herzog, Natterer, Schweitzer, Bolz, Winter.

E. American Institute of Timber Construction: AITC 108 - Standard for Heavy Timber Construction.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide engineered round timber structural assemblies meeting or exceeding code required design loads:

1. For 1-2 unit housing, comply with ILBA Span Table Guidelines, and with design values database derived from destructive testing at the United States Department of Agriculture Forest Products Lab in Madison, WI.

2. For commercial and institutional construction, comply with manufacturer's structural engineering data.

3. Deflection limits shall not exceed 1/360 for floor/ceiling systems with wallboard finishes and 1/240 for roof systems with wood ceiling finishes. 061300-2

B. Delegated Design: Provide structural engineering shop drawings for timber construction, prepared by a professional engineer licensed in the jurisdiction of the Project site and engaged by the supplier of timbers.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used.

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

C. Shop Drawings: Provide detailed shop drawings including materials, connections and relationship with adjacent construction. Include small diameter timber beams, columns, branched columns and trusses with engineered connection points using wood and steel connectors and fasteners. Shop drawings shall be stamped by a professional engineer licensed in the jurisdiction of the Project.

D. Sustainable Design Submittals: Submit manufacturer's documentation of materials which contribute to USGBC LEED Credits for the following categories. Document compliance in accordance with the LEED v4 requirements.

1. MR114 - Wood certification by the Forest Stewardship Council (FSC) and chain of custody documentation.

2. MR115 - Declare Label for WholeTrees Structural Components.

3. MR115 - Health Product Declaration for WholeTrees Structural Components

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 8 years experience in timber frame construction.

B. Installer Qualifications: Minimum 2 years experience installing similar products and acceptable to the manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in accordance with manufacturer's recommendations. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings. Handle materials to avoid 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 recommended limits.

1.9 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this Section. Agenda shall include sequence of construction, work of related trades, protection of materials and similar items.

PART 2 PRODUCTS

2.1 MATERIALS

A. Columns: Factory fabricated with engineered connection points using either wood and steel connectors or fasteners.

1. Column diameters per sealed structural designs.

2. Column lengths per sealed structural designs.

3. Columns peeled and seasoned or kiln dried to 19 percent or lower moisture level to a 3” depth.

4. Treated with one coating of Timbor or another approved insecticide/fungicide.

5. Finish: Unfinished.

6. Finish: One coat of Heritage clear finish or approved alternative.

7. Species as selected by Architect and acceptable to manufacturer.

8. Columns milled flat on one or two sides to accept wall assemblies.

9. Source columns from Forest Stewardship Council certified forests.

B. Branched Columns: Factory fabricated with engineered connection points using wood or steel connectors or fasteners.

1. Column diameters per sealed structural plans.

2. Column lengths per sealed structural plans.

3. Columns peeled and seasoned or kiln dried to 19 percent or lower moisture level.

4. Treated with one coating of Timbor or another approved insecticide/fungicide..

5. Finish: Unfinished.

6. Finish: One coat of HempShield clear finish or approved alternative.

7. Species as selected by Architect and acceptable to manufacturer.

8. Columns milled flat on one or two sides to accept wall assemblies.

9. Source columns from Forest Stewardship Council certified forests.

C. Beams: Factory fabricated with engineered connection points using wood or steel connectors or fasteners.

1. Beam diameters within manufacturer's standard limits, typically 4 inches (101 mm) to 24 inches (610 mm)

2. Beam lengths within manufacturer's standard limits, typically 3 feet (1 m) to 50 feet (15 m).

3. Beams peeled and seasoned or kiln dried to 19 percent or lower moisture level.

4. Treated with one coating of Timbor or another approved insecticide/fungicide.

5. Finished with one coating of HempShield clear finish or alternative.

6. Species as selected by Architect and acceptable to manufacturer.

7. Beams milled flat on one or two sides to accept floor deck or roof deck.

8. Columns can be sourced from Forest Stewardship Council certified forests.

D. Trusses: Factory fabricated with engineered connection points using wood or steel connectors or fasteners. 061300-4

1. Design of truss as indicated on the drawings, including but not limited to parallel chord trusses, king post trusses, queen post trusses, and bowstring trusses.

2. Wood truss member diameters within manufacturer's standard limits, typically 4 inches (101 mm) to 24 inches (610 mm).

3. Wood truss lengths within manufacturer's standard limits, typically 7 feet (2 m) to 42 feet (12 m).

4. Wood truss members peeled and seasoned or kiln dried to 19 percent or lower moisture level.

5. Treated with one coating of Timbor or another approved insecticide/fungicide..

6. Finished with one coating of HempShield clear finish or alternative.

7. Species as selected by Architect and acceptable to manufacturer.

8. Wood truss members milled flat on one side to accept floor deck or roof deck.

9. Source wood truss members from Forest Stewardship Council certified forests.

10. Steel truss members for parallel chord truss with length and diameter to meet engineering specifications. Depth to meet approved shop drawings.

E. Connectors and Fasteners: Interior grade or exterior grade finishes and steel per service and engineering requirements.

2.3 FABRICATION

A. Inspect columns, beams and truss members with regard to ability to select stand, visual, and digital timber grading as applicable, and post peeling inspection process.

B. Mill structural system wood members flat on one side to accept wall, roof, ceiling or deck assemblies in accordance with approved shop drawings.

C. Factory fabricate timbers to the greatest extent practical, including pre-drilling.

D. Fabricate, disassemble, stage and ship structural system connections to job site.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared. If substrate preparation is improper, notify Architect before proceeding.

3.2 INSTALLATION

A. Install materials in accordance with manufacturer's recommendations and with approved shop drawings. Installation shall be performed by the manufacturer or an installer acceptable to the manufacturer.

1. Schedule delivery and installation of timbers to avoid extended on-site storage and to avoid delaying work of other trades that follow.

2. Prepare surfaces using methods recommended by the manufacturer.

3. Erect framing true and plumb and in proper relationship with adjacent construction.

4. Do not cut members without first receiving approval from the manufacturer. Where field fitting is required, consult and comply with manufacturer's recommendations.

3.3 PROTECTION

A. Protect installed products from construction activities until completion of project to ensure no damage occurs in construction. 061300-5

B. Touch-up, repair minor nicks, dings and gouges to timber members before Substantial Completion. Replace damaged members as directed where damage is beyond satisfactory repair.

END OF SECTION

SECTION 061323

HEAVY TIMBER CONSTRUCTION

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Rough Carpentry: Section 061000.

B. Glued Laminated Construction: Section 061800

C. Finish Carpentry: Section 062000.

1.02 DEFINITIONS

A. Heavy timber construction is hereby defined to include wood members with thicknesses of 5 inches (nominal) or more.

1.03 REFERENCES

A. Standards: Except as otherwise indicated, comply with "Timber Construction Standards" AITC 100 and "Recommended Practice for the Erection of Structural Timber Framing" AITC 105 by the American Institute of Timber Construction, as applicable to the Work required.

B. Grading: Provide timber graded by a recognized agency, with rules and service complying with requirements and recommendations of the American Lumber Standards Committee and PS 20.

1. Use only pieces which bear the inspection service's grade mark, except do not apply inspection service grade mark on timber shown as exposed in the Work and without painted finish. For exposed unpainted material, submit certificate of grade compliance, obtained from the mill for each shipment, directly to the Director's Representative at the site.

C. Preservative Treatment: Comply with applicable U1 Standards of the American Wood-Preservers' Association (AWPA).

1. Each piece of timber shall be stamped with the AWPA Quality Mark certifying compliance with the treatment standards specified, except do not apply AWPA Quality Mark on timber shown as exposed in the Work and without painted finish.

1.04 SUBMITTALS

A. Shop Drawings: Show erection drawings. Also show joint and connection details.

B. Samples:

1. Timber: 24 inches long x full width and depth, showing range of variation to be expected in appearance of timber Work, including specified treatment, if any. Samples will be reviewed for color, grain and texture only. Compliance with other requirements is the responsibility of the Contractor.

2. Sealer: One pint, each type specified.

3. Metal Connectors, Anchors and Accessories: One of each type required, with specified finish.

C. Quality Control Submittals:

1. Preservative Treatment Certification: Submit "Certificate of Treatment" by treating plant, for each shipment, indicating the species of lumber, tally, charge number, date treated, type of preservative used, and final net retention.

2. Preservative Treatment Certification: For each shipment, submit certification by an independent Quality Control Agency recognized by the AWPA, stating that treatment complies with specified standards.

3. Fire-Retardant Treatment Certification: Submit certification by treating plant, for each shipment, stating that treatment complies with specified standards.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Keep timbers dry during fabrication, delivery, storage, handling and erection, until the building enclosure is completed to the extent necessary for protection from the weather. Do not store in areas of either excessively high or excessively low relative humidity.

B. Time the delivery and installation of timber Work to avoid extended on-site storage, and to avoid delaying the Work of other trades whose Work must follow the erection of timber Work.

1.06 PROJECT CONDITIONS

A. Installer shall examine supporting foundations or substructures to receive timber Work, and the conditions under which the Work is to be erected, and notify the Director's Representative in writing of conditions detrimental to the proper completion of the Work. Do not proceed with the installation until detrimental conditions have been corrected.

B. Obtain necessary information from fabricator concerning heating, ventilating and air conditioning limitations in the building after erection, in order to avoid damage or deterioration of the timber Work.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Comply with grading rules published by recognized grading agency for the species of timber used, as follows:

1. RIS - Redwood Inspection Service.

2. SPIB - Southern Pine Inspection Bureau.

3. WCLIB - West Coast Lumber Inspection Bureau.

4. WWPA - Western Wood Products Association.

B. Timber Species:

1. Douglas Fir, Western Larch or Southern Pine, at fabricator's option.

2. Hem-Fir (Hemlock or True Fir).

3. California Redwood.

4. Western Red Cedar.

5. Substitutions approved at Engineers discretion.

C. Timber Grade: For the species indicated, comply with the following grade (or grades if more than one species specified at fabricator's option):

1. WWPA Grade:

2. WCLIB Grade:

3. SPIB Grade:

4. RIS Grade:

D. Moisture Content:

1. Except as otherwise indicated, provide timber dried to a maximum moisture content of 19 percent, and include "S-DRY" or similar indication in grade marking or certification of grade.

1. Except as otherwise indicated, provide timber which is unseasoned (moisture content may exceed 19 percent) and include "S-GRN" or similar indication in grade marking or certification of grade.

E. Dressing:

1. Provide timber which has been dressed on 4 sides (S4S) at the mill, prior to grading. Comply with grade sizes.

1. Except as otherwise indicated, provide timber which is rough sawn (RGH-Tmb) (undressed) at the mill and at time of grading. Comply with grade sizes.

F. Sealers:

1. End Sealer: Transparent colorless wood sealer, which is effective in retarding the transmission of moisture (both in and out) at cross-grain cuts in timber Work.

2. Penetrating Sealer: Translucent penetrating wood sealer, which will not interfere with application of wood stain and transparent finish, or paint finish, as indicated for the Work. Refer to Section 099101 for required finishes.

G. Metal Connectors, Anchors and Accessories: Provide fabricated structural steel (ASTM A 36) shapes, plates and bars, welded into assemblies of the types and sizes indicated or, if not indicated, manufacturer's standard units for the timber sizes indicated, with steel bolts (ASTM A 307), lag bolts (FS FF-B-561) and other standard fasteners as required.

1. Finish: Except as otherwise indicated, finish each assembly and fastener prior to use by hand-tool cleaning (SSPC-SP 2), solvent cleaning (SSPC-SP 1), phosphate pretreatment (SSPC-PT 4), and painting with rust-inhibitive primer (FS TT-P-1757, Type II), 2.0 mils dry film thickness.

2. Finish each assembly and fastener unit with hot-dip zinc coating (ASTM A153).

3. Finish each assembly and fastener unit exposed to treated wood with hot-dip zinc coating; ASTM A653, Class G-185. All metal hangers and framing anchors to be epoxy coated in addition to Class G-185 galvanizing.

2.02 FABRICATION

A. Camber:

1. Fabricate horizontal and angular members (units of less than 12 to 12 slope) with the natural convex bow (crown) up, so as to provide camber in the Work.

2. Where members are shown to be "Cambered", trim top surfaces from center to ends to provide either circular or parabolic camber, amounting to 1/180 of the span for the unloaded member, working each member with its natural convex bow (crown) up. Trim bottom surface of each "Cambered" member to be parallel with top surface.

B. Fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Pre-drill for fasteners and the assembly of units wherever feasible. Machine sand exposed surfaces to remove planing or surfacing marks, finishing with No. 120 grit sand paper.

C. Shop Fabrication: Where treatment of timber Work is indicated, fabricate members (cut, drill, surface and sand) prior to treatment, to the greatest extent possible. After cutting, restore exposed surfaces to match specified surfacing and finish all exposed surfaces by machine sanding with No. 120 grit sandpaper.

2.03 PRESERVATIVE TREATMENT

A. Pressure treat fabricated timber members with oil-borne preservative in accordance with AWPA Standard P.

1. Provide water repellent additive in preservative solution, complying with the standard.

2. Provide preservative treatment solution which is free of water repellents and other substances which might interfere with application of finishes indicated for the timber Work.

A. Pressure treat fabricated timber members with water-borne preservative in accordance with AWPA Standard P.

B. The scope of timber Work to receive preservative treatment (Trt-Wd) is shown on the Drawings.

2.04 FIRE-RETARDANT TREATMENT (FR-S)

A. Pressure impregnate each fabricated timber member with fire-retardant chemicals in accordance with AWPA recommended practice C-20, to achieve a flame spread rating not higher than 25 for a 30-minute test complying with UL Test 723, NFPA Test 255 or ASTM E 84.

1. Provide type of chemicals which will not bleed through finish or adversely affect bond of finish indicated for timber Work.

2. After treatment, kiln dry timbers to an average moisture content of 19%. Inspect each member and discard units which have been twisted, bowed, excessively checked, or otherwise adversely affected by treatment.

3. Provide UL label on each unit treated, including "FR-S" rating.

2.05 END-CUT SEALING

A. Immediately after end-cutting each member to final length, and after wood treatment (if any), apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces "flood-coated" for not less than 10 minutes.

2.06 SEAL COAT

A. After complete fabrication and surfacing of each unit, wood treatment (if any), and end-cut sealing, apply a heavy saturation coat of penetrating sealer on all surfaces of each unit, except for treated wood where the treatment has included a water repellent.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Comply with AITC 105.

B. Cutting: Avoid cutting (after fabrication) to the greatest extent possible.

1. Coat erection cross cuts with end sealer.

2. Where treated members must be cut during erection, apply a heavy brush coat of the same treatment solution to the cut surfaces in accordance with AWPA Standard M4.

C. Handle and temporarily support members with protective blocking and slings to prevent surface damage which will be visible after completion of the Work.

D. Maintain expansion spaces as shown, and as required by applicable AITC standards.

E. Repair damaged surfaces and finishes after completion of erection, or replace damaged members as directed where damage is beyond satisfactory repair.

END OF SECTION

SECTION 061326 HEAVY TIMBER TRUSS CONSTRUCTION

GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Trusses using timbers.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for dimension lumber items associated with heavy timber framing.

1.03 DEFINITIONS

A. Timbers: Lumber of 5 inches nominal or greater in least dimension.

B. Inspection agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.

2. NHLA: National Hardwood Lumber Association.

3. NLGA: National Lumber Grades Authority.

4. SPIB: Southern Pine Inspection Bureau (The).

5. WCLIB: West Coast Lumber Inspection Bureau.

6. WWPA: Western Wood Products Association.

1.04 ACTION SUBMITTALS

A. Product Data: For preservative-treated wood products and timber connectors.

1. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

2. For timber connectors. Include installation instructions.

B. Shop Drawings: For heavy timber trusses. Show layout, dimensions of each member, and details of connections.

C. Delegated-Design Submittal: For heavy timber trusses, including connections, indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For timbers specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.

2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Certificates of Inspection: Issued by lumber-grading agency for exposed timber not\ marked with grade stamp.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery of materials to avoid extended on-site storage and to avoid delaying the Work.

B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 PRODUCTS

2.01 TIMBER

A. Comply with DOC PS 20 and with grading rules of lumber-grading agencies certified by ALSC's Board of Review as applicable.

1. Factory mark each item of timber with grade stamp of grading agency.

2. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that are not exposed to view, or omit grade stamps and provide certificates of grade compliance issued by grading agency.

B. Timber Species and Grade: As indicated on drawings.

C. Moisture Content: Provide timber with 19 percent maximum moisture content at time of dressing.

D.Dressing: Provide dressed timber (S4S) unless otherwise indicated.

2.02 PRESERVATIVE TREATMENT

A. Pressure treat materials with waterborne preservative according to AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground.

B. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

1. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not contain colorants, bleed through, or otherwise adversely affect finishes.

C. Use process that includes water-repellent treatment.

D.Use process that does not include water repellents or other substances that might interfere with application of indicated finishes.

E. Retain first paragraph below if kiln-dried wood is required.

F. After treatment, redry materials to 19 percent maximum moisture content.

G.Mark treated materials with treatment quality mark of an inspection agency approved by ALSC's Board of Review.

1. For exposed items indicated to receive a stained or natural finish, mark each piece on surface that is not exposed or omit marking and provide certificates of treatment compliance issued by inspection agency.

H. Application: Treat all heavy timber framing unless otherwise indicated.

2.03 TIMBER CONNECTORS

A. Materials: Unless otherwise indicated, fabricate from the following materials:

1. Structural-steel shapes, plates, and flat bars complying with ASTM A36/A36M.

2. Round steel bars complying with ASTM A575, Grade M 1020.

3. Hot-rolled steel sheet complying with ASTM A1011/A1011M, Structural Steel, Type SS, Grade 33.

B. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A123/A123M or ASTM A153/A153M.

2.04 MISCELLANEOUS MATERIALS

A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.

B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.05 FABRICATION

A. Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.

B. Predrill for fasteners and assembly of units.

C. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWPA M4.

1. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

2. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

D. Coat crosscuts with end sealer.

E. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Erect heavy timber trusses true and plumb. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

1. Handle and temporarily support heavy timber framing to prevent surface damage, compression, and other effects that might interfere with indicated finish.

B. Framing Built into Masonry: Provide 1/2-inch clearance at tops, sides, and ends of members built into masonry, and bevel cut ends 3 inches; do not embed more than 4 inches unless otherwise indicated.

C. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

D. Fitting: Fit members by cutting and restoring exposed surfaces to match specified surfacing.

1. Predrill for fasteners using timber connectors as templates.

2. Finish exposed surfaces to remove planing or surfacing marks, and to provide a

finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.

3. Coat crosscuts with end sealer.

4. Where preservative-treated members must be cut during erection, apply a field treatment preservative to comply with AWPA M4.

a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

E. Install timber connectors as indicated.

1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.

2. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

3.02 ADJUSTING

A. Repair damaged surfaces and finishes after completing erection. Replace damaged heavy timber framing if repairs are not approved by Architect.

END OF SECTION 061300

SECTION 061333 – TIMBER PIER FRAMING

PART 1 : GENERAL

1.1 SCOPE

A. The work shall consist of the installation of timber pier framing andassociated hardware.

PART 2 : PRODUCTS

2.1 MATERIALS

A. Timber

1. Timber shall be Select Structural Grade Southern Pine unless otherwise indicated in the Contract Documents.

2. Timber shall be graded in accordance with ASTM D1990 and/or ASTM D245.

B. Treatment

2. Where treated timber is required by the Contract Documents, the timber shall be treated in accordance with this section.

3. Timber shall be pressure treated in accordance with AWPA C3, C18, M4 and UC4C.

4. Timber shall be treated with either Chromated Copper Arsenate (CCA) or Ammoniacal Copper Zinc Arsenate (ACZA).

5. Timber shall have a preservative retention in accordance with AWPA.

6. Piles shall not be treated with Creosote or other carcinogenic materials.

C. Hardware

1. Hardware shall include bolts with necessary nuts and washers, connectors, drift pins, dowels, nails, screws, spikes, and other metal fastenings.

2. Provide bolts with washers under nut and head.

3. All hardware shall be in accordance with ASTM A490 or A449 unless otherwise indicated in the Contract Documents.

4. All hardware shall be galvanized in accordance with ASTM A123 and/or A153 unless otherwise indicated in the Contract Documents.

PART 3 : SUBMITTALS

3.1 GENERAL

A. The Contractor shall submit the items contained in this section for review and acceptance, in accordance with the Contract.

3.2 SUBMITTAL ITEMS

A. The Contractor shall submit material certificates for all timber that include grade, dimension and treatment, if applicable.

B. The Contractor shall submit as-built drawings showing the installed timber locations to the Owner and Engineer upon completion of the work.

PART 4 : QUALITY ASSURANCE

4.1 REFERENCES

A. The International Building Code (IBC).

B. ASTM D245 - Method for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber.

C. ASTM D4945 – Standard Test Method for High-Strain Dynamic Testing of Deep Foundations.

D. AWPA American Wood Preserver’s Association.

PART 5 : CONTRACTOR’S QUALITY CONTROL REQUIREMENTS

5.1 HANDLING

A. Inspect timber upon delivery prior to installation. Defective and/or damaged materials will be rejected.

B. Handle materials in a manner to avoid damage. Handle treated lumber with nylon or other non-damaging rope slings.

5.2 FIELD TREATMENT

A. Where treated timber is specified, field treat all abrasions, holes, cuts and other penetrations in accordance with AWPA M4.

5.3 INSTALLATION

A. Cut all timber accurately and frame to a close fit to provide for even bearing of joints over the entire contact surface. Make joints without shimming. Field drill only as indicated or allowed.

B. Bore holes for bolts or rods with a bit diameter 1/16 inch larger than the bolt diameter. Counterbore for counter-sinking wherever smooth faces are specified or required.

C. Bolt the ends of bracing through the pile, post or cap.

D. Furnish bracing of sufficient length to provide a minimum distance of 8 inches between bolts and the end of the brace.

E. Provide washers under all bolt heads and nuts. After final tightening lock the nuts of all bolts.

5.4 TOLERANCES

A. The maximum deviation from the required framing locations shall be two inches (2 in).

- END OF SECTION -

SECTION 061500 WOOD DECKING AND LUMBER

PART 1 - GENERAL

1.1 SUMMARY

A. Provide labor, materials and equipment necessary to complete the work of this Section, including the following:

1. Wood decking, lumber and timbers for the following applications:

a. Decks

b. Boardwalk

c. Cladding

d. Walkways

e. Conservatories

f. Site furnishings

g. Pavilions

h. Pergolas

i. Dividers

j. Porte cochere

k. Lattice structures

l. Arbors

m. Greenhouses

n. Paneling

o. Ceilings

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections.

1. Section 061000 – ROUGH CARPENTRY for other rough carpentry work.

2. Section 062000 – FINISH CARPENTRY for other finish carpentry work.

C. Reference Standards: Comply with applicable requirements of the following:

1. ASTM D143-14 – Standard Test Methods for Small Clear Specimens of Timber.

2. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

3. ASTM D 4761-13, Section 8.5.3.1 – Standard Test Methods for Mechanical Properties of Lumber and Wood-Based Structural Materials

4. U.S. Lacey Act – Full Compliance as product is from FSC Managed Forest

5. FSC

6. ASTM E648-17 "Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source". The foregoing test procedure is comparable to NFPA No. 253

7. International Code Council (ICC) Evaluation Service Report (ESR) issued and active, meeting the criteria of Acceptance Criteria AC47: ESR-3756.

8. ENVIRONMENTAL PRODUCT DECLARATION (EPD) in accordance with ISO 14025, ISO 21930 and EN 15804. Kebony Clear Radiata Step-Clip DECKING AND LUMBER Kebony USA, 1-888-932-9663 Guide Specifications in CSI Format mhodjera@kebony.us WOOD DECKING, LUMBER AND TIMBERS 061500 - 2

1.2 SUBMITTALS

A. Submittals: Submit under provisions of Division 01.

B. Product Literature: Manufacturer’s product literature describing all components. Include installation recommendations and instructions.

C. Verification Samples: For each type of decking and lumber.

D. Certificate of Compliance, Forest Stewardship Council: FSC Controlled Wood, Chain of Custody.

E. USGBC LEED Submittals Only, Certified Wood: Submit chain-of-custody certificates signed by manufacturer certifying that wood products comply with LEED forest certification and chain-ofcustody requirements. Include evidence that mill and fabricator is certified for chain-of-custody or that outsourcing agreements are in place approved by an FSC-accredited certification body. Include statement indicating costs for each certified wood product.

F. Certificates of Compliance: Submit documentation of the following.

1. MSDS (Material Safety Data Sheet) – Submit a Material Safety and Data Sheet for the wood products supplied on the project.

2. ENVIRONMENTAL PRODUCT DECLARATION (EPD) in accordance with ISO 14025, ISO 21930 and EN 15804.

3. ICC ESR-3756.

1.3 QUALITY ASSURANCE

A. Manufacturer/Vendor Qualifications: Products covered under this Section shall be supplied by a single manufacturer/vendor unless otherwise specified with a minimum of ten years proven production or supply experience.

B. Installer Qualifications: Installer shall have a minimum of three years proven construction experience and be capable of estimating and building from drawings and details, determining elevations, in addition to proper material handling.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect materials during shipment, storage and construction against damage.

B. All units shall be individually strapped to wood pallets or blocking of a minimum thickness to allow the egress of lift forks using high strength strapping.

C. Store a minimum of 4 inches off the ground in a dry location and cover with polyethylene to protect from contact with materials which would cause staining or discoloration. Kebony Clear Radiata Step-Clip DECKING AND LUMBER Kebony USA, 1-888-932-9663 Guide Specifications in CSI Format mhodjera@kebony.us WOOD DECKING, LUMBER AND TIMBERS 061500 - 3 PART 2 - PRODUCTS 2.1 MANUFACTURER A. Basis-of-Design: Kebony™ Clear Radiata #2637 and #2638, nominal 5/4x6, (22x142mm) by Kebony AS, Tel 855.230.5656, info@kebony.us, www.kebony.us

1. Moisture Content: a. Moisture content of 4 to 8 %; all dimensions when net thickness is over 1 inch.

2. Surface:

a. S4S (surfaced four sides), E2E (eased two edges). Edges shall be eased to a radius of 3.5mm.

b. Rough Sawn. Edges shall be square.

c. Custom profiled. Profiles shall be as per plans and specifications.

d. Knots/Pitch pockets: May be visible and are a natural occurrence in wood.

e. Cupping: Max 1 % of width. 3. Dimensions on Drawings: Nominal and Actual Size shall be listed.

4. Length:

a. Lumber shall be supplied at or over specified length for final fit in the field.

b. Lumber shall be supplied precision trimmed to specified lengths only when specified in writing.

5. End Coating: No end coating or sealing is required.

B. Mechanical Properties: Meet or exceed the following when tested in accordance with ASTM D143:

1. Bending Strength (MOR): 5,235 psi, 36.1 MPa

2. Modulus of Elasticity (MOE): 1,798,468 psi, 12.4 GPa

3. Compression Parallel to Grain: 13,200 psi. 1553 psi (Note: Average)

4. Compression Perpendicular to Grain: (Note: Average) a. @ 0.02”: 325.5 psi. b. @ 0.04”: 1581.5 psi. c. @ 0.10”: 2638.5 psi.

5. Average Air-Dry Density: Approximately 42 lb/ft2 , 670 Kg/m3

6. Basic Specific Gravity: Ranges from 0.80-0.91.

7. Max. Swelling: 4% (dry to wet, tangential) Above values are typical, but not engineering design values.

C. Fire Rating, Acute Inhalation, Combustion Toxicity Requirements: Meet or exceed the following. Lumber supplied shall be fire resistant without the use of any fire-resistant treatments to meet ASTM E84-15a,"Standard Method of Test for Surface Burning Characteristics of Building Materials". The foregoing test procedure is comparable to UL 723, ANSI/NFPA No. 255, and UBC No. 8-1. Kebony Clear Radiata Step-Clip DECKING AND LUMBER Kebony USA, 1-888-932-9663 Guide Specifications in CSI Format mhodjera@kebony.us WOOD DECKING, LUMBER AND TIMBERS 061500 - 4

D. Environmental Compliance:

1. The natural service life of Kebony woods exceed their natural growth cycle, trap and store carbon and are able to be reclaimed, reused or recycled. Kebony woods do not require for service any petroleum based or inorganic chemical treatments adhesives or coatings. Kebony woods do not require for service any specialized handling storage or disposal procedures and generate zero post-industrial or post- consumer nonbiodegradable waste. Kebony woods are also safe for human and animal contact, meet Low VOC emission standards and meet International Building Code and International Residential Code requirements for naturally durable wood.

2. USGBC LEED Compliance Only: Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

3. ENVIRONMENTAL PRODUCT DECLARATION (EPD) in accordance with ISO 14025, ISO 21930 and EN 15804.

E. Fastening Systems:

1. Kebony wood products #2637 and #2638 uniquely offer four methods of fastening, three of which are patented.

a. Step-Clip for Kebony. Patented and licensed exclusively by Kebony from Barrette Outdoor Living. The system consists of: • custom profiled wood deck boards (#2637 and #2638) • custom extruded polypropylene (PP) strips with predefined clip locations and clip shapes designed to mate with the custom profile of the above boards. • 15-degree coiled stainless steel ring-shank nails

b. Fastenator Hidden Fastening System. Patented by Duralife Decking and Railing Systems. The system consists of • custom profiled wood deck boards (#2637 and #2638) • custom extruded clips with predefined screw locations and clip shapes designed to mate with the custom profile of the above boards. • clips include pre-tapped #7 x 2-1/4”

c. Pro Plug System for Wood • custom profiled wood deck boards (#2637 and #2638) • Patented Pro Plug Tool for Wood for counterboring and pre-drilling • Pre-Cut matching Kebony plugs

d. Face Fastening

PART 3 - EXECUTION 3.1 EXAMINATION

A. Prior to starting work inspect the substrate to ensure that it has been properly prepared to accept materials specified in this Section. Commencement of work shall imply acceptance of surfaces and deck conditions.

1. Review drawings for heavy static items such as planters, hot tubs, sculptures or equipment that will be installed on top of wood decking, lumber and timbers.

3.2 INSTALLATION Kebony Clear Radiata Step-Clip DECKING AND LUMBER Kebony USA, 1-888-932-9663 Guide Specifications in CSI Format mhodjera@kebony.us WOOD DECKING, LUMBER AND TIMBERS 061500 - 5

A. Install in accordance with manufacturer's instructions and approved submittals including the following:

1. Install materials plumb, true to line, cut and fitted.

2. Scribe and cope as required for accurate fit to adjacent construction.

3. Use manufacturer’s recommended fasteners.

4. Fasten tight to supports. Provide shims if there are variations in framing.

3.3 CLEANING AND PROTECTION

1. Protect from damage during construction operations. Promptly repair any damaged surfaces. Remove and replace work which cannot be satisfactorily repaired.

END OF SECTION

SECTION 061519 - WOOD DECKING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Softwood lumber structural wood decking.

1.2 RELATED SECTIONS

A. Section 013330 - Structural Submittals.

B. Section 014525 - Structural Testing/Inspection Agency Services.

C. Section 09900 - Paints and Coatings: Field finishing.

1.3 REFERENCES

A. PS20-American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 1999.

B. SPIB (GR) – Grading Rules; Southern Pine Inspection Bureau, Inc.; 2002.

1.4 SYSTEM DESCRIPTION

A. Design roof live and dead load: As indicated on structural drawings with deflection limited to 1/240 of span.

1.5 SUBMITTALS

A. Shop Drawings: Indicate deck framing system, loads and cambers, bearing details, and framed openings.

B. Samples of Wood Deck Exposed to View: Submit samples, 12 inch long in size.

1.6 QUALITY ASSURANCE

A. Comply with the following:

1. Lumber: PS 20 and approved grading rules and inspection agencies.

PART 2 - PRODUCTS

2.1 SOLID WOOD DECKING

A.Lumber Decking.

1. Species: Southern Pine.

2. Grade: Select Decking.

3. Moisture Content: 15 percent maximum moisture content.

4. Pattern and Dressing: beveled edges, single tongue, surfaced 2 sides.

5. Size: nominal 2 x 8, actual 1 ½ inches x 7 ½ inches.

2.2 ACCESSORIES

A. Fasteners and Anchors:

1. Fasteners: Hot dipped galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that support framing is ready to receive decking.

3.2 PREPARATION

A. Coordinate placement of bearing items.

3.3 INSTALLATION – LUMBER DECKING

A. Install decking at 90 degrees to framing members, with ends staggered over firm bearing. On sloped surfaces, lay decking with tongue upward. Install decking in a controlled random layout as required by applicable building code.

B. Fit butt end deck joints occurring between support members with metal splines to maintain tight, aligned joints.

C. Engage decking tongue and groove edges.

D. Secure with fasteners.

E. Maintain decking joint space of 1/16 inch maximum.

3.4 TOLERANCES

A. Surface Flatness of Decking Without Load: ¼ inch in 1 feet maximum, and ½ inch in 30 feet maximum.

END OF SECTION 061519

B. Clean finish carpentry on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.5 PROTECTION

A. Provide final protection and maintain conditions that ensure finish carpentry is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 06 2013

EXTERIOR FINISH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes the following exterior woodwork as fabricated from modified wood:

1. Wall cladding.

2. Exterior trim.

3. Exterior door facing.

4. Exterior soffits.

B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:

1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.

2. Section 06 1000 - ROUGH CARPENTRY.

3. Section 06 2023 - INTERIOR FINISH CARPENTRY

4. Section 06 4000 - ARCHITECTURAL WOODWORK

5. Section 07 6000 - FLASHING AND SHEET METAL.

6. Section 07 9200 - JOINT SEALANTS.

7. Section 09 9100 - PAINTING.

1.2 SUBMITTALS

A. Product Data: For each type of product, process and factory fabricated product.

1. Include data for wood preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

2. For water-borne-treated products include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.

B. Samples:

1. Submit two 12 inch long product samples of each wood specie and cut of wood to receive transparent finish.

2. Submit two 12 by 12 inch product samples of exposed plywood panels.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Experienced Installer who has completed finish carpentry similar in material, design, and extent to that indicated for this Project and with a record of successful inservice performance.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:

1. Protect materials against weather and contact with damp or wet surfaces.

2. Stack lumber, plywood, and other panels.

3. Provide for air circulation within and around stacks and under temporary coverings.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installing exterior finish carpentry only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

1.6 COORDINATION

A. Coordinate sizes and locations of framing, blocking, reinforcements, and other related items of work specified in other Sections to ensure that exterior woodwork can be supported and installed as indicated.

PART 2 PRODUCTS

2.2 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails of the following materials, in sufficient length to penetrate minimum of 1-1/2 inches into substrate, unless otherwise recommended by manufacturer.

1. Stainless steel.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide nonferrous metal or hot-dip galvanized anchors and inserts, unless otherwise indicated.

2. Provide toothed steel or lead expansion sleeves for drilled-in-place anchors.

C. Flashing: Comply with requirements of Section 07 6000 - FLASHING AND SHEET METAL for flashing materials installed in finish carpentry.

D. Sealant: Comply with requirements of Section 07 9200 - JOINT SEALANTS for materials required for sealing exterior woodwork.

2.3 FINISHES

A. General: Finish as specified in Section 09 9100 - PAINTING for exterior wood.

B. Apply one coat of sealer to concealed surfaces of exterior finish carpentry. Apply two coats to endgrain surfaces.

1. Apply sealer or primer in shop or in the field.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting installation and performance of finish carpentry.

1. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before installation, condition finish carpentry to average prevailing humidity conditions in installation areas.

B. Prime and backprime lumber for painted finish exposed on the exterior. Comply with requirements for surface preparation and application in Section 09 9100, “Painting.”

C. Lumber for Transparent Finish:

3.3 INSTALLATION, GENERAL

A. Do not use finish carpentry materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install finish carpentry plumb, level, true, and aligned with adjacent materials. Use concealed shims where required for alignment.

1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.

2. Countersink nails, fill surface flush, and sand where face nailing is unavoidable.

3. Provide flat steel washers at nuts and bolt heads bearing on wood.

4. Install to tolerance of 1/8 inch in 96 inches for plumb and level. Install adjoining finish carpentry with 1/32 inch maximum offset for flush installation and 1/16 inch maximum offset for reveal installation.

5. Coordinate finish carpentry with materials and systems in or adjacent to standing and running trim. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of finish carpentry components.

6. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of finishcarpentry components.

C. Preservative Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk concealed fasteners and blind nailing. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork.

E. Finish: Finish according to specified requirements.

3.4 ADJUSTING AND CLEANING

A. Repair damaged or defective finish carpentry where possible to eliminate functional or visual defects. Where not possible to repair, replace finish carpentry. Adjust joinery for uniform appearance.

B. Clean finish carpentry on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.5 PROTECTION

A. Provide final protection and maintain conditions that ensure finish carpentry is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior trim.

2. Interior plywood mounting boards.

3. Interior backer firring for raceway mounting.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical treatment manufacturer's written instructions for finishing treated material.

2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

4. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.

B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

C. Samples for Verification:

1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For fire-retardant-treated wood, from ICC-ES.

B. Sample Warranty: For manufacturer's warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.7 WARRANTY

A. Manufacturer's Warranty for Columns: Manufacturer agrees to repair or replace columns that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Columns: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Regional Materials: The following wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

1. Interior trim (includes raceway backer material).

2. Interior plywood (equipment mounting boards).

B. Low-Emitting Materials: Composite wood products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Softwood Plywood: DOC PS 1.

D. Hardboard: AHA A135.4.

E. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.

F. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

1. Color: As selected by engineer from manufacturer's full range.

2.2 FIRE-RETARDANT-TREATED MATERIALS (PLYWOOD EQUIPMENT BACKER BOARDS)

A. General: For applications indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction, and comply with testing requirements; testing by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flamespread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 9 and 15 percent respectively.

C. For exposed items indicated to receive a stained or natural finish, use organic resin chemical formulations that do not contain colorants, and provide materials that do not have marks from spacer sticks on exposed face.

D. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

E. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

2. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

2.3 INTERIOR TRIM (INCLUDING RACEWAY BACKER)

A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: Red oak; Clear; NHLA.

2. Maximum Moisture Content: 10 percent.

3. Finger Jointing: Not allowed.

4. Gluing for Width: Not allowed.

5. Veneered Material: Not allowed.

6. Face Surface: Surfaced (smooth).

7. Matching: Selected for compatible grain and color.

B. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade: Eastern white pine, D Select; NeLMA or NLGA.

2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.

3. Finger Jointing: Allowed.

4. Face Surface: Surfaced (smooth).

5. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Low-Emitting Materials: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

1. Wood glue shall have a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Paneling Adhesive: Comply with paneling manufacturer's written recommendations for adhesives.

1. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

1. Adhesive shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.

2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.5 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

3.6 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 07 4113

METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural roofing system of preformed aluminum panels.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Roof sheathing.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Storage and handling requirements and recommendations.

2. Installation methods.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.

1. Show work to be field-fabricated or field-assembled.

D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.

1. Aluminum Panels:

    a. Alloy and Temper: Aluminum complying with ASTM B209 (ASTM B209M); temper as required for forming.

    b. Thickness: Minimum 20 gage (0.032 inch).

2. Profile: Standing seam, with minimum 1.0 inch seam height; concealed fastener system for field seaming with special tool.

3. Texture: Smooth.

4. Length: As indicated on drawings.

5. Width: Maximum panel coverage of 24 inches.

2.03 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.04 FABRICATION

A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

2.05 FINISHES

A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected from manufacturer’s standards.

2.06 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:

1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

D. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.

1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.

2. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.

3. Fasteners: As specified by manufacturer and building code qualification report or approval.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Broom clean wood sheathing prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

D. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.

1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.

2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Install roofing felt and building paper slip sheet on roof deck before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 3 inches. Offset seams in building paper and seams in roofing felt.

D. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.

1. Provide sealant tape or other approved joint sealer at lapped panel joints.

2. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

3.04 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION 07 4113

SECTION 099300

STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and application of wood finishes[.] 1. Exterior Substrates: a. Exposed wood panel products.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. 1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily

1.5 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply finishes when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following :

1. Sherwin Williams Super Deck “Leeward”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.

2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Exterior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.

2. Prime edges, ends, faces, undersides, and backsides of wood.

a. For solid hide stained wood, stain edges and ends after priming.

b. For varnish coated stained wood, stain edges and ends and prime with varnish. Prime undersides and backsides with varnish.

3. Countersink steel nails, if used, and fill with putty or plastic wood filler tinted to final color. Sand smooth when dried.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for finish and substrate indicated.

2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.

3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

1.Drying Time, @ 50% RH: @ 77°F To Touch: 1 hour To Recoat: 2-4 hours To use: 24-48 hours Drying and recoat times are temperature, humidity, and film thickness dependent. Do not apply at air or surface temperatures below 50°F or when air or surface temperatures may drop below 50°F within 24 hours. Do not apply product if rain is likely to occur within 24 hours.

2. When rolling use 3/8 inch nap synthetic roller cover for smooth finishes, 1/2-3/4 inch nap for medium texture finish, and 1-1/4 inch nap for heavy texture finishes.

a. Back rolling is suggested when spraying, working the product smoothly and evenly into the surface to ensure a uniform appearance.

b. Always maintain a wet edge to avoid lapping.

c. Thoroughly coat cut ends and joints.

d. While the material is still wet, back brush-roll to force the material into the wood fibers and cracks to achieve a uniform appearance. 2 coats are required for damaged sound wood.

e. The first coat will help fill in cracks while the second coat will build to proper mil thickness of the coating.

f. Unsound, damaged or rotten wood should be replaced.

g. For best results apply in shade with surface temperatures between 50°F and 90°F. Do not apply if temperatures will fall below 50°F or if rain or snow is expected within 24 hours after application. Cooler temperatures require longer drying times.

h. Do not apply over wet or damp surfaces or when rain is imminent.

g. Do not reduce.

h. Brush: Use a nylon-polyester brush

i. Roller: Use 3/8-11/4 inch nap cover. For specific brushes and rollers, please refer to our Brush and Roller Guide on sherwinwilliams.com

j. Spray—Airless Pressure 2200-2400 p.s.i. Tip .017-.019 inch

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

END OF SECTION 09 9300

SECTION 09 9113 EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and as noted on drawings .

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Non-metallic roofing and flashing.
6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
7. Marble, granite, slate, and other natural stones.
8. Floors, unless specifically indicated.
9. Ceramic and other types of tiles.
10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
11. Glass.
12. Concealed pipes, ducts, and conduits.

1.02 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

4. Manufacturer's installation instructions.

C. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 8 1/2 x 11 inch in size.

D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.

3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. Benjamin Moore & Co.: www.benjaminmoore.com.
2. PPG Paints: www.ppgpaints.com.
3. Sherwin-Williams Company: www.sherwin-williams.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.

2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

5. Supply each paint material in quantity required to complete entire project's work from a single production run.

6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:

1) Opaque, Flat: 50 g/L, maximum.

2) Opaque, Nonflat: 150 g/L, maximum.

3) Opaque, High Gloss: 250 g/L, maximum.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings.

1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete masonry units, primed metal, and bare steel.

1. Two top coats and one coat primer.
2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
3. Top Coat Sheen:
    a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
4. Primer: As recommended by top coat manufacturer for specific substrate.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Masonry:

G. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

3.02 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.03 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.04 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 9113

SECTION 311000

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes the following:

1. Protecting existing trees, shrubs, groundcovers, plants, and grass to remain.

2. Removing existing trees, shrubs, groundcovers, plants, and grass.

3. Clearing and grubbing.

4. Stripping and stockpiling topsoil.

5. Removing above- and below-grade site improvements.

6. Disconnecting, capping or sealing, and abandoning site utilities in place, or removing site utilities as per plan.

7. Temporary erosion and sedimentation control measures.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preconstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction

2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect or Engineer.

C. Salvagable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 – EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated. C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

D. The boundaries of the clearing limits shown on this plan are within the curbed parking lot area. During the construction period, no disturbance beyond the curbed area shall be permitted.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the requirements of Ashe County and the sediment and erosion control plans.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION –

A. Protect trees as directed in the construction plans.

3.4 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect or Engineer not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect or Engineer's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

E. Removal of underground utilities is included in Division 22, Division 26, Division 33 sections covering site utilities.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, stumps, roots, buried logs, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.

4. Use only hand methods for grubbing within tree protection zone.

5. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. See Geotechnical report for recommended strippings depth, conditions and details.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 4 feet, or approved by Owner.

2. Do not stockpile topsoil within tree protection zones.

3. Dispose of excess topsoil as specified for waste material disposal.

4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000

SECTION 31 2000 EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Excavation, filling, compacting and grading in the areas shown on the drawings to obtain the required finished ground surface properly prepared to receive pavements, walks, building floor slabs, utilities, and drainage structures.

2. Ditching in soil areas of high moisture content to allow the soil to drain prior to making excavations.

3. Adjustment of moisture content up or down by discing of soils placed in fills if soil tests show drying to be necessary to meet compaction requirements.

4. Spreading topsoil in sufficient quantities to backfill islands, medians, and roadway shoulders and open graded areas.

5.Undercutting unsuitable soil materials and replacing with compacted approved soils.

6. Stockpiling approved soil material in convenient location and in sufficient quantity for use in backfill of walls.

7.Removal from the job of unsuitable, excess materials.

8.Importing material, if required, from offsite.

9.Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.

10.Excavating and backfilling.

11.Drainage course for concrete slabs-on-grade.

12. Subbase course for concrete walks and pavements.

13. Subbase and base courses for asphalt paving.

14. Subsurface drainage backfill for walls and trenches.

1.03 UNIT PRICES

A.Work of this Section may be affected by unit prices for earth moving.

B. Rock Excavation Volume:

1.Volume of rock actually removed, measured in original position, but not to exceed the following measurements. Unit prices for rock excavation include replacement with approved materials.

Measure Rock Excavation volume as follows:

a.Mass Rock:

1.Quantity of rock excavation will be established from cross sections taken by a representative chosen by the Owner. Prior to any rock excavation, expose the rock to be removed which has not been cross sectioned by the Owner’s representative or no payment will be made. Prior to payment for rock excavation, the Owner's representative will prepare final cross sections and verify that the rock has been removed to the proper elevation.

2. Rock removed before measurement will not receive compensation.

3. Calculate the quantity of rock using the following limits:

a. Top of rock;

b. To 6" below bottom of base course and 12” beyond edge of paving for uncurbed paved areas;

c. To vertical line one foot behind back of curb;

d. To 6" below foundations and footings;

e. To vertical faces located 12" horizontal distance from each footing or foundation face;

f. To 6" below bottom of slabs on grade;

g. To finish grade in cut where rock is removed to finish grade. Where it is not so removed, to the finish rock surface.

h. To 12” outside forms for concrete work requiring forms.

i. To neat outside dimensions for concrete work with no forms.

2. Trench Rock:

1. Measure trench rock by taking level reading at reasonable intervals but not more than ten feet along the exposed trench length before removal of rock.

2.Rock removed before measurement will not receive compensation.

3.Calculate the quantity of rock using the following limits:

a. Top of rock:

b. To vertical faces 12" beyond the outside of pipe barrel, each side;

c. To 6" below the pipe barrel for the full trench width;

d. To vertical faces 12" horizontal distance beyond structures and manholes;

e. To 6" below bottom of slab for structures.

C.Include in the bid submittal unit costs to purchase and place or perform as specified on the jobsite the following items:

1. Surge stone, Type 1 and Type 3 rip-rap (per ton placed)

2.#57 stone (per ton placed)

3.Graded Aggregate Base, GAB (per ton placed)

4.Geotextile fabric, Mirafi 500 X or equivalent (stabilization) (per sq.ft. installed)

5.Rock excavation and backfill complete (mass) (per cu.yd.)

6.Rock excavation and backfill complete (trench) (per cu.yd.)

1.04 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1.Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2.Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subgrade and hot-mix asphalt paving, concrete paving or walks.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Suitable soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Owner. Authorized additional excavation

and replacement material will be paid for according to Contract provisions for changes in the Work.

2.Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation.

G. Fill:

1. Structural Fill is defined as fill supporting retaining wall footings or any structure whatsoever and extending for a distance of ten feet (10') on each side of said structure measured at the finished grade, thereafter tapering away at a 45-degree angle.

2. Paving Area Fill is defined as fill supporting any asphalt, concrete paving, or special paving for parking of cars, or trucks, or concrete walks and extending for a distance of five feet (5') on each side of said area measured at the finished grade, thereafter tapering away at a 45- degree angle.

3.General Area Fill is defined as fill in the general grading area covering banks, lawns, hollows, drainage ditches.

H. "General earth excavation" is defined as follows:

1.Materials regardless of its nature or composition that can be removed by scrapers, loaders, pans, dozers, backhoes, or graders up to and including that material which requires the use of a single tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated not less than 80,000 pounds. Boulders & Partially Weathered Rock as defined in the geotechnical report are included.

I. “Mass rock” as used herein is defined as follows:

1.Material which cannot be excavated except by drilling or blasting;

2.Material which is hard enough to ring when struck with a hammer, and the amount is greater than one (1) cubic yard of solid stone in volume; and

3.Any material that cannot be excavated with a single-tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated no less than 80,000 pounds (Caterpillar D-8 or equivalent) and having an original volume of at least one (1) cubic yard.

J."Trench rock" is defined as follows:

1.Material which occurs in a utility trench;

2.Material which is greater than 2 cubic yards in volume; and

3. Any material that cannot be excavated with a large backhoe having a curling force of no less than 40,000 pounds (John Deer or equivalent) and having an original volume of at least one-half (1/2) cubic yard.

K. "Muck" is defined as highly organic or plastic material which cannot support fill, footings, slabs, and pavements and requires removal by power shovels or draglines. Excessively wet or dry materials are not considered unsuitable.

L. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

M. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below base course, drainage fill, drainage course, or topsoil materials.

N. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

O. Protection zones: Areas that include undisturbed buffers, tree protection zones, rights of way, wetlands, state waters, utility easements, adjacent properties and any other environmental sensitive areas.

1.05 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. At minimum, Owner, General Contractor, Site Contractor, Testing Agency and Local Inspector should be in attendance.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required, if requested:

1. Geotextiles.

2. Controlled low-strength material, including design mixture.

3. Warning tapes.

B. Samples for Verification: For the following, in sizes indicated below, if requested provide to Geotechnical Engineer:

1. Geotextile: 12 by 12 inches.

2. Warning Tape: 12 inches long; of each color.

3. Fifty pound sample of each class fill material encountered as directed by the Geotechnical Engineer using care that samples are representative.

4. Fifty pound sample of proposed offsite source fill material.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill.

C. Blasting plan approved by authorities having jurisdiction.

D. Seismic survey report from seismic survey agency.

E. Classification according to ASTM D 2487.

F. Laboratory compaction curve according to ASTM D 698.

G. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction property site improvements and downstream bodies of water including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

H. Submit certification by a Geotechnical Engineer to the Owner that materials imported to the site meet the definition of suitable soils and contain no hazardous substances.

1.06 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, “Explosive Material Code, “and prepare a blasting plan reporting the following:

1.Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.

2.Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services.

1.Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.

2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

D. Soils Report:

1.Obtain a copy of available reports and become familiar with their contents. The Owner makes no assurances as to the contents of the reports. Any claims based on the contents of the reports are disallowed.

E. Adjacent to buildings and in parking lots and roads, grade to within five hundredths (5/100) of a foot of the elevations and contours shown on the Drawings. In open areas, grade to within

one-tenth (1/10) of a foot of those shown on the Drawings. Hand dress grades under buildings, slabs, walks, and steps to obtain the required elevation as shown on the Drawings.

F. Perform no unauthorized or unnecessary grading. This consists of removal of materials beyond the plan limits of grading and removal of materials beyond indicated subgrade elevation or dimensions without specific direction of the Owner's representative. Provide necessary remedial work at no cost to the Owner.

1.07 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and Local Authority Having Jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or Authority Having Jurisdiction.

B. Improvements on Adjoining Property: Confirm Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Owner.

C. Utility Locator Service: Notify utility locator service for area where Project is located no less than 10 days before beginning earth moving operations. Notify Engineer of Record and cease work if any utilities located in the field differ from locations provided in project survey.

D . Do not commence earth moving operations until initial erosion and sedimentation control measures and plant protection measures are in place and 7 day letter has been issued.

E. The following practices are prohibited within protection zones:

1 Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.

3. Foot traffic.

4. Erection of sheds or structures.

5. Impoundment of water.

6. Excavation or other digging.

7. Attachment of signs to or wrapping materials around trees or plants.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient suitable soil materials are not available from excavations.

B. Suitable Soils: Soil Classification Groups GW, GP, GM, SW, SP, ML, CL, SC and SM according to ASTM D 2487, or a combination of these groups approved by the Geotechnical Engineering testing agency; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, organics, and other deleterious matter.

1.Use soils for structural backfill having a minimum dry density of 97 pounds per cubic foot unless otherwise approved by the Geotechnical Engineer.

C. Unsuitable Soils: Soil Classification Groups GC, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups, unless approved for use by the Geotechnical Engineer.

1. Existing undisturbed soils which are determined by the Geotechnical Engineer or Design Professional to be unsuitable for use as fill, in a particular application, for reasons other than moisture or water content.

a. Water saturated soils, regardless of the source of water (rainfall, storm runoff, ground water or other sources) shall not be considered unsuitable.

b. Unsuitable soil quantities will be determined by the Geotechnical Engineer by measuring in-place quantities.

D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1- 1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1- inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size #57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size #67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

H. Sand: ASTM C 33; fine aggregate.

2.02 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater

than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf ; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf ; ASTM D 4632.
4. Tear Strength: 56 lbf ; ASTM D 4533.
5. Puncture Strength: 56 lbf ; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf ; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf ; ASTM D 4632.
4. Tear Strength: 90 lbf ; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Cement: ASTM C 150, Type I.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 lb/cu. ft. minimum at point of placement, when tested according to ASTM C 138.

2. Compressive Strength: 80 psi, when tested according to ASTM C 495.

C. Produce conventional-weight, controlled low-strength material with 80-psi compressive strength when tested according to ASTM C 495.

2.04 MODULAR UNIT RETAINING WALLS

A. Use units of standard quality, free of chips and cracks, and consistent in color and tone chosen by Owner.

B. Remove defective units from the site.

2.05 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.

2. Yellow: Gas, oil, steam, and dangerous materials.

3. Orange: Telephone and other communications.

4. Blue: Water systems.

5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

D. Protection of Existing Trees Remaining:

1. Protect tops, trunks, and roots of trees to remain; box, fence or otherwise protect trees which are subject to site work or construction damage. See the Section SITE CLEARING for tree protection and removal of any interfering branches. Immediately and

properly trim and paint with a protective tree wound and sealing compound any cuts, or accidental injury to the bark or trunk. Remove protection only when danger from operations no longer exists.

E. Protection of Adjacent Property:

1. For the duration of the construction and until release, protect adjoining property from any excessive drainage and debris. Do not enter upon adjoining property without the permission of the property owner.

3.02 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.03 EXPLOSIVES

A. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to project site or using explosives on Project site.

1.Perform blasting without damaging adjacent structures, property, or site improvements.

2.Perform blasting without weakening the bearing capacity of rock subgrade and with the minimal disturbance of rock to remain.

3.04 PROCEDURES

A. After clearing and disposal is complete, strip from the top of the existing ground topsoil in all areas to be graded. Stockpile in approved locations where it will not interfere with building or utility operations. Use topsoil free from subsoil, debris and stones larger than 2" in diameter. Locate stockpiles as designated by the Owner. At the completion of the work, distribute topsoil over the grounds to form a minimum cover of 4 inches loose measure on graded areas to receive vegetation and other areas indicated by the Owner. Scarify subgrade prior to spreading topsoil. Form berms as directed to dispose of excess topsoil and haul off topsoil remaining. Import topsoil to meet the minimum coverage if onsite topsoil is insufficient.

B. Perform exterior grading in accordance with the drawings to ensure minimum 2% slope away from building in all directions.

C. Graded Areas: Repair and reestablish grades to the required elevations and slopes if any settlement or washing occurs prior to the acceptance of the work. Fill to required subgrade levels any areas where settlement occurs.

D. Temporary Grading and Drainage: Provide additional temporary drainage measures to prevent ponding and maintain effective drainage for the entire site through all phases of construction.

E. Excavating: Make no footing excavations to the full depth indicated when freezing temperatures or rain is expected. When full depths are reached, protect bottoms from frost or rain if placing of concrete is delayed.

1. Excavate material of every description and whatever substance encountered, to dimensions and levels shown on the Drawings. Excavate work to be clean-cut and true with bottoms level and sound.

2. Lab Testing: The Geotechnical Engineer will make necessary tests for required soil bearing values, and soil compaction.

3. Existing Site Conditions: Excavate any existing depressions or trenches that are encountered and are entirely within the new building walls, or within 5 feet of walls, to solid sub-grade and fill with compacted gravel or concrete to underside of new foundation or floor slab.

4. Unsuitable Bearing Material: Place the bottom of trenches, foundations and footings and base for paving on compacted suitable material. Remove loose materials, surface vegetation, debris and existing fill before any fill is placed. Proof roll the subgrade in the presence of the Geotechnical Engineer. Fill operations can then take place. Do not place footings until the Geotechnical Engineer and the Owner have examined and approved the soil upon which they will rest. If the bearing capacity at the levels indicated are found by the Testing Laboratory to be insufficient, the Owner may order the excavations carried to proper bearing capacity. Provide a minimum of twelve (12) inches compacted graded aggregate base stone between bottom of footings and any rock encountered. Compact fill in accordance with requirements for backfill.

5. Extend excavation to the depths and dimensions required by the drawings, including removal of rock.

3.05 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials include rock, trash, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for conditions encountered.

1. If excavated materials intended for fill and backfill include unsuitable soil materials and rock, replace with suitable soil materials.

2. Remove rock to lines and grades to permit installation of permanent construction to dimensions required for rock excavation measurement and payment is a minimum.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and measured.

The Contract Sum will be adjusted for rock excavation according to the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation will be considered earth excavation.

2. Rock excavation includes removal and disposal of rock. Measure rock excavation for payment to lines and subgrade elevations indicated to permit installation of permanent construction.

3.06 ROCK EXCAVATION

A. When rock is encountered, clear away earth and notify the Owner. Owner will inspect material and issue written instructions. Do not excavate rock without written instructions.

B. Blast in accordance with local ordinances, and obtain permits where required by law. Complete blasting before any building footing is poured.

C. Remove excavated rock from the site or bury as directed by the Geotechnical Engineer, if allowed.

D. Excavated or blast rock is not allowed to be used for rip-rap or erosion control BMPs. Meet the specifications for rip-rap.

E. Excavate rock to below bottom of building slabs and footing, pavement, and piping to dimensions specified for measurement as a minimum.

3.07 EXCAVATION FOR MUCK

A. When muck is encountered, notify Owner immediately. The Owner or Geotechnical Engineer will inspect the material and issue written instructions.

B. Quantity of muck will be established from taking level reading by a representative chosen by the Owner or Geotechnical Engineer. Take the readings at reasonable intervals to identify the contours of the area, including the existing condition and the final excavated condition.

C. Muck removed before measurement will not receive compensation.

D. Calculate the quantity of muck by making surveys before and after removal. Base payment on the quantity of muck removed as calculated using the surveys.

E. Stockpile muck on site and reuse as allowed by the Geotechnical Engineer. Remove material which is not reused from the site. Provide settling ponds, dikes, piping, and appurtenances to prevent stockpile runoff from discoloring nearby streams.

3.08 EXCAVATION EMBANKMENT AND BRACING

A. Accept full responsibility for excavations. Protect excavation embankments against collapse. Where possible, make embankments over 5'-0" high at a slope not greater than 2:1 unless a steeper slope is recommended by a Registered Geotechnical Engineer.

B. Where it is not possible to provide a safe environment for slopes, temporarily support banks and maintain securely until permanent support has been provided.

C. Provide cross bracing and shoring to prevent collapse, where ditches or trenches are over 5'-0" deep.

D. Provide bracing system drawings designed and sealed by a Registered Engineer experienced in such designs. Use these design drawings to show the work and sequence in its entirety and submit to the Owner prior to commencing the work.

E. To prevent caving or settlement of earth adjacent to excavations, and for the protection of persons as well as property, provide shoring, bracing, and other similar material to meet the conditions in each particular case encountered. Leave in place until construction has reached a point where backfills behind walls or in ditches have been made and the need for shoring and bracing has been eliminated.

3.09 FOUNDATION BEARING TEST

A. The Geotechnical Testing Lab shall inspect the bearing surface prior to the contractor placing reinforcing steel/concrete.

3.10 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placement and removal of concrete formwork for inspections, and for installation and other construction.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots. Protect any exposed roots.

3.11 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.12 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. All utility trenches must have clearances provided of 12 inches each side of pipe or conduit.

2. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide 12 inches on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. All utility trenches must have bedding provided that meets the requirements of the local jurisdiction and the geotechnical engineer’s recommendations.

2. Excavate trenches to an elevation required in rock or other unyielding bearing material to allow for bedding course as directed by geotechnical engineer.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

3. Protect any exposed roots.

3.13 EXCAVATION FOR ELEVATOR CYLINDER

A. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in Division 14.

B. Provide well casing as necessary to retain walls of well hole.

3.14 SUBGRADE INSPECTION

A. Notify Owner when excavations have reached required subgrade.

B. If Geotechnical Testing Agency determines that unsuitable soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proofrolling

1. Contact the Owner's representative and the Geotechnical Engineer at least 48 hours in advance of proofrolling.

2. Clear and strip as herein specified areas to receive controlled structural and paving area fill. After removal of existing structures and topsoil, and before placement of any structural and paving area fill, proofroll that portion of the footing area and paved areas to receive fill to a distance of ten feet (10') beyond the limits. Accomplish proofrolling with a loaded twenty (20) ton minimum dump truck with two (2) complete coverages in each of two (2) perpendicular directions unless otherwise allowed. Accomplish proofrolling under the observation of the Geotechnical Engineer.

3. For any areas that “pump” under the wheels of the loaded truck, follow remediation measures as directed by the Geotechnical Engineer.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Testing Agency, without additional compensation.

3.15 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Concrete fill to be used if approved by Geotechnical Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner and the Geotechnical Engineer.

3.16 ADDED EXCAVATIONS

A. Should the bearings at the levels indicated be found by the Geotechnical Engineer to be insufficient, the Owner may order the excavations carried to proper bearing or implementation of additional remedial work as recommended by the Geotechnical Engineer.

3.17 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated suitable soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.18 FILLING AND BACKFILL

A. Provide grading required for subgrade, under floor slabs, paved walks, drives, parking areas and against walls. Construct fills as herein specified.

B. Clear and grub vegetation from areas to be filled. Scarify the ground to insure bond between the fill and the original surface. For fill to be placed on hillsides, plow deeply or, where existing ground is steeper than 3:1 or as directed by Geotechnical Report, bench the existing ground surface before beginning the filling operations.

C. Place fill material in uniform, horizontal layers as indicated in Geotechnical Report. Moisten each layer as necessary to insure a proper bond and maximum compaction. Use suitable equipment to mix the material and insure uniform moisture content. Fully and uniformly compact each layer with a sheep's foot roller or vibratory roller of the proper size and weight to achieve specification.

D. Fill slopes in excess of 20' of vertical height should include a minimum 5' slope bench for every 15'-20' of vertical on the slope, and the slope should not be steeper than 2:1 or a global stabilization analysis must be provided by a licensed structural engineer.

3.19 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for Record Documents.

3. Testing and inspecting underground utilities.

4. Removing concrete formwork.

5. Removing trash and debris.

6. Removing temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.20 BACKFILL AGAINST FOUNDATION WALLS, IN TRENCHES AND EXCAVATIONS, AND OTHER NECESSARY LOCATIONS

A. Do not place backfill against foundation walls until foundation walls are braced and have cured sufficiently to develop the strength necessary to withstand, without damage, the pressures that will result from backfilling and compacting operations. Secure approval of the Geotechnical Engineer before commencing backfilling.

B. Placing Backfill: Place backfill material in uniform, approximately horizontal layers, not exceeding recommendation from Geotechnical Engineer. Compact each layer with pneumatic tampers or sheepsfoot roller to optimum moisture to produce a minimum of 95% of the standard proctor maximum dry density (ASTM D-698), with the upper 12" compacted to 98%. Coordinate with the Geotechnical Engineer to perform tests of fill density in place for every lift. Submit reports of tests to the Owner.

C. Surplus Materials: Dispose of excess or unsuitable materials.

3.21 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings as directed by Geotechnical Engineer; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03.

D. Shallow Trenches under Roadways: Unless indicated by Local Jurisdiction, provide 4- inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03.

E. Backfill voids with suitable soil while removing shoring and bracing.

F. Place and compact initial backfill of subbase material or suitable soil, free of particles larger than 2 inches in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Place final backfill of controlled low- strength material to final subgrade elevation. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of suitable soil to final subgrade elevation.

I. Install warning tape directly above utilities, 18 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.22 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use suitable soil material.

2. Under walks and pavements, use suitable soil.

3. Under steps and ramps, use suitable soil.

4. Under building slabs, use suitable soil.

5. Under footings and foundations, use suitable soil.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.23 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry, otherwise suitable soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.24 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers, or as directed by Geotechnical Engineer.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and re-compact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent, with the upper 12 inches compacted to 98 percent.

2. Under walkways, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent, with the upper 12 inches compacted to 98%.

3. Under turf or unpaved areas, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material to 90 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.25 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within 1/10th of a foot of design elevation.

C. Grading:

1. Place fill as specified for backfill except as noted herein. Accomplish compaction by traversing with a sheepsfoot roller or other approved heavy grading machinery. Compact fill to a minimum of 95% of the standard proctor maximum dry density (ASTM specifications D- 698) to 12 inches below subgrade for structural fill areas for a minimum distance of ten feet outside of structure perimeter and for locations for future buildings. Compact parking area fill soils to 95% of the soil's standard density to 12 inches below subgrade. Compact general fill areas to 90% of the standard density.

2. Compact the upper 12 inches of fill in structural fill areas and paving areas to 98% standard proctor density.

3. Preparation of sub-grade for slabs: Remove roots and debris subject to termite attack, rot or corrosion and other material not suitable for fill. Fill holes and minor depressions and compact fillings as specified herein including re-compaction of sub-grade. Place subgrade soils within +/-3% of the soils optimum moisture content per ASTM 698, contain no deleterious material and no rock fragments over 2” (inches) in diameter.

3.26 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 33.

B. Subsurface Drain: Place subsurface drainage geotextile material around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 6 inches of filter material, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 9 inches.

1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 9 inches.

1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.

2. Place and compact fill over drainage backfill in 6-inch thick compacted layers to final subgrade or as indicated by Geotechnical Engineer.

3.27 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Where specified, install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place base course material over subbase course under hot-mix asphalt pavement.

3. Shape subbase course and base course to required crown elevations and cross-slope grades.

4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer, or as indicated by Geotechnical Engineer.

5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick, or as indicated by Geotechnical Engineer.

6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698, or as indicated by Geotechnical Engineer.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of suitable soil materials and compact simultaneously with each subbase and base layer to not less than 98 percent of maximum dry unit weight according to ASTM D 1557.

3.28 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Where specified, install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place drainage course 6 inches or less in compacted thickness in a single layer.

3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, 4. with no compacted layer more than 6 inches thick or less than 3 inches thick.

4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.29 MODULAR UNIT RETAINING WALLS

See Section 323223

3.30 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and observations during Earthmoving operations.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Structural Fill and Paving Area Fill: At subgrade and at each two feet of compacted fill and backfill, at least one test for every 5,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.

2. Foundation Wall Backfill: At each two feet of compacted backfill layer, at least one test for every 50 feet or less of wall length, but no fewer than two tests.

3. Trench Backfill: At each two feet of compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

4. General Area Fill: At each two feet of compacted fill layout for every 10,000 sq.ft. of area.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained, at no cost to the Owner. Contractor to pay for all failed tests.

3.31 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Owner or Geotechnical Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing under guidance of the Geotechnical Engineer.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.32 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus suitable soil and waste materials, including unsuitable soil, trash, and debris, and legally dispose of them off Owner's property, unless otherwise directed by the Owner. Acquire all necessary permits.

B. During the construction and clean-up, do not dump debris on any part of the property or in any unauthorized place. Remove debris, construction material, equipment, logs, stumps, boulders, or any other extraneous material deposited during construction from the site. Remove existing debris or other extraneous material from undisturbed areas. Material that is removed from the site is the property of the Contractor.

END OF SECTION

SECTION 312230

AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The work covered by this section consists of the construction of a base composed of an approved aggregate material hauled to the site, placed on the site, compacted, and shaped to conform to the lines, grades, depths, and typical sections shown on the plans or established by the Engineer.

B. Related Sections:

1. Division 31 Section “Earth Moving”.
2. Division 32 Section “Bituminous Paving”.
3. Division 33 Section “Water Pipe and Appurtenances”.
4. Division 33 Section “Sanitary Sewer Pipe and Appurtenances”.
5. Division 33 Section “Storm Drainage Materials”.

1.3 PERFORMANCE REQUIREMENTS

A. The work under this section consists of furnishing all materials, labor, equipment, incidentals and services required for the complete installation of aggregate base course materials in the locations shown on the drawings and as specified herein.

B. All work in connection with installing aggregate base course materials shall comply with all current requirements of authorities having jurisdiction. The Contractor is responsible for being familiar with and adhering to these requirements.

C. The Contractor shall inspect the locations of the proposed work associated with this Section and shall familiarize themselves with the conditions under which the work will be performed, and with all necessary details and the suitability of their equipment and methods for the work required. The omission of any installation details which may not appear within the Contract Documents shall not relieve the Contractor of full responsibility for completing the work as necessary.

D. Construction shall be done in such a manner that will not interfere with the operation of any street, highway, railway, or other facility nor weaken or damage any embankment or structure. Barricades and lights shall be furnished and maintained to safeguard traffic and

pedestrians as required by authorities having jurisdiction until such time as the operation has been completed.

1.4 SUBMITTALS

A. Product Data and certificates: For all aggregate base course materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall utilize methods of handling, hauling, and placing which will minimize segregation and contamination of the aggregate used for the base course. If segregation occurs, the Engineer may require that changes be made in the Contractor's methods and may also require remixing of the aggregate to achieve the proper mixture. No additional compensation will be made for remixing, additional equipment, or other measures necessary to provide the coarse aggregate base course specified. Aggregate which becomes contaminated with foreign materials to the extent that the base course will not serve its intended use shall be removed and replaced by the Contractor at no additional expense to the Owner. The above requirements will be applicable regardless of the type of aggregate placed and regardless of prior acceptance.

1.6 COORDINATION

A. For all work within the Department of Transportation right-of-way, the Contractor shall notify the appropriate office of the Department of Transportation at least 72 hours prior to beginning construction.

1.7 WARRANTY

A. All materials shall be warranted to be free from defects in workmanship and materials for one (1) year following final acceptance by the Owner.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE COURSE

A. Aggregate base course materials shall consist of crushed stone or uncrushed gravel, or other similar material having hard, strong, durable particles free of adherent coatings meeting the requirements of the NCDOT Standard Specifications for Roads and Structures, latest edition for the project-specific use of the aggregate.

B. The Contractor shall furnish aggregate base course material produced in accordance with the requirements indicated herein for Type A, aggregate unless otherwise specified in the special provisions.

C. All aggregates shall be from approved sources. Sources will not be approved unless the material has satisfactory soundness and satisfactory resistance to abrasion. Satisfactory soundness will be considered to be a weighted average loss of not greater than 15 percent when subjected to five (5) alternations of the sodium sulfate soundness test in accordance

with AASHTO T104. Satisfactory resistance to abrasion will be considered to be a percentage of wear of not greater than 55 percent when tested in accordance with AASHTO T96.

D. Aggregates shall be handled in such a manner as to minimize segregation

E. Sites for aggregate stockpiles shall be grubbed and cleaned prior to storing aggregates, and the ground surface shall be firm, smooth, and well drained. A cover of at least 3" of aggregate shall be maintained over the ground surface in order to avoid the inclusion of soil or foreign material. Stockpiles shall be built in such a manner as to minimize segregation. When it is necessary to operate trucks or other equipment on a stockpile in the process of building the stockpile, it shall be done in a manner approved by the Engineer.

F. Stockpiles of different types or sizes of aggregates shall be spaced far enough apart, or else separated by suitable walls or partitions, to prevent the mixing of the aggregates.

G. Any method of stockpiling aggregates which allows the stockpile to become contaminated with foreign matter or causes excessive degradation of the aggregate will not be permitted. Excessive degradation will be determined by sieve tests of samples taken from any portion of the stockpile over which equipment has been operated, and failure of such samples to meet all grading requirements for the aggregate will be considered cause for discontinuance of such stockpiling procedure.

H. Gradation: All standard sizes of aggregates shall meet the gradation requirements when tested in accordance with AASHTO T27.

2.2 WATER

A. Water, if used in construction, shall be potable water, free from oil and other deleterious matter.

PART 3 – EXECUTION

3.1 SUBGRADE PREPARATION

A. The subgrade shall be dry and cleaned of all foreign substances prior to constructing the base course.

B. The surface of the subgrade shall be prepared as specified in Section 312000 "Earth Moving" based on the specified use of the aggregate base course.

3.2 PLACEMENT OF STONE BASE

A. The aggregate material shall be spread on the subgrade to a uniform loose depth and without segregation.

B. Where the required compacted thickness of base is 10 inches or less the base material may be spread and compacted in one layer. Where the required compacted thickness of base is more than 10 inches, the base material shall be spread and compacted in two (2) or

more approximately equal layers. The minimum compacted thickness of any one layer shall be approximately 4 inches.

C. Each layer of material shall have been sampled, tested, compacted, and approved prior to placing succeeding layers of base material or pavement. Such tests will be provided and paid for by the Owner, except that tests which reveal non-conformance with the Specifications and all succeeding tests for the same area, until conformance with the Specifications is established shall be at the expense of the Contractor. The Owner will be responsible for paying for only the successful tests. The minimum compaction for each layer shall be 100% standard proctor.

D. No base material shall be placed on frozen subgrade or base. Hauling equipment shall not be operated on subgrade or a previously completed layer of base material soft enough to rut or weave beneath the equipment.

E. The maximum speed of trucks hauling or traveling over any part of the subgrade or base shall be five (5) miles per hour.

3.3 QUALITY CONTROL

A. Weather and Temperature Limitations:

1. Coarse aggregate base course shall not be placed during rainy weather or on wet or frozen subgrade.

2. Stabilized aggregate base courses shall not be constructed when the atmospheric temperature is below thirty-five (35) degrees F. when measured in the shade away from artificial heat. 3. Any areas of completed base course that are damaged by elements such as rain, sleet, snow, hail, or freeze/thaw conditions shall be reconditioned, reshaped, and compacted in accordance with the Drawings and these Specifications.

B. Tolerances:

1. After final shaping and compacting the base, the Engineer will check the surface of the base for conformance to grade and typical section and will determine the base thickness.

2. The thickness of the base shall be within a tolerance of ±1/2-inch of the base thickness required by the plans.

C. Maintenance:

1. Where the base material is placed in a trench section, the Contractor shall provide adequate drainage through the shoulders to protect the subgrade and base until such time as shoulders are completed.

2. The Contractor shall maintain the surface of the base by watering, machining, and rolling or dragging when necessary to prevent damage to the base by weather or traffic.

3. Where the base or subgrade is damaged, repair the damaged area; reshape the base to required lines, grades and typical sections; and recompact the base to the required density at no cost to the Owner.

END OF SECTION 312230

SECTION 320523

CONCRETE FOR EXTERIOR IMPROVEMENTS

3.1 SUMMARY

A. Section Includes:

1. Subbase for concrete pavements.

2. Curbs, gutters, and wheel stops.

3. Pedestrian pavement: walks, curb ramps and patios.

3.2 RELATED REQUIREMENTS

A. Field Testing: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Subgrade Preparation and Subbase Compaction: Section 31 20 00, EARTHWORK.

3.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

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

1. M147-65-UL-04 - Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.

2. M233-86 - Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.

C. American Concrete Institute (ACI):

1. 305R-10 - Guide to Hot Weather Concreting.

2. 306R-10 - Guide to Cold Weather Concreting.

D. American National Standards Institute (ANSI):

1. B101.3 - Wet DOCF of Common Hard Surface Floor Materials (Including Action and Limit Thresholds for the Suitable Assessment of the Measured Values).

E. ASTM International (ASTM):

1. A615/A615M-16 - Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.

2. A996/A996M-15 - Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

3. A1064/A1064M-16 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

4. C33/C33M-16 - Concrete Aggregates.

5. C94/C94M-16 - Ready Mixed Concrete

6. C143/C143M-15a - Slump of Hydraulic Cement Concrete.

7. C150/C150M-16 - Portland Cement.

8. C171-16 - Sheet Materials for Curing Concrete.

9. C260/C260M-10a - Air Entraining Admixtures for Concrete.

10. C309-11 - Liquid Membrane Forming Compounds for Curing Concrete.

11. C494/C494M-15a - Chemical Admixtures for Concrete.

12. C618-15 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

13. C979/C979M-16 - Pigments for Integrally Colored Concrete.

14. C989/C989M-14 - Slag Cement for Use in Concrete and Mortars.

15. C1240-15 - Silica Fume Used in Cementitious Mixtures.

16. D1751-04(2013)e1 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

17. D5893/D5893M-10 - Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

18. D6690-15 - Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

3.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:

a. Contracting Officer's Representative.

b. Landscape Architect

c. Contractor.

d. Installer.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.

a. Installation schedule.

b. Installation sequence.

c. Preparatory work.

d. Protection before, during, and after installation.

e. Installation.

f. Terminations.

g. Transitions and connections to other work.

h. Inspecting and testing.

3.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.

2. Show reinforcing.

3. Include jointing plan for concrete pavements, curbs and gutters.

C. Manufacturer's Literature and Data:

1. Description of each product.

2. Installation instructions.

D. Samples:

1. Exposed Aggregate Concrete Panel: 4 sq. ft. by 2 inches thick.

E. Test reports: Certify products comply with specifications.

1. Concrete materials.

2. Select subbase materials.

3. Field test reports.

F. Certificates: Certify products comply with specifications.

1. Expansion joint filler.

2. Reinforcement.

3. Curing materials.

4. Concrete protective coating.

G. Qualifications: Substantiate qualifications comply with specifications.

1. Installer

2. Land surveyor.

H. Concrete mix design.

I. Select subbase job-mix design.

J. Proposed hot and cold weather concreting methods.

K. Land surveyor's construction staking notes, before placing concrete.

1. Identify discrepancies between field conditions and Drawings.

3.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Regularly installs specified products.

2. Installed specified products with satisfactory service on five similar installations
    a. Project Experience List: Provide contact names and addresses for completed projects

B. Land Surveyor: Professional land surveyor registered to provide land surveys in jurisdiction where project is located.

C. Preconstruction Testing:

1. Engage independent testing laboratory to perform tests and submit reports.

    a. Deliver samples to laboratory in number and quantity required for testing.

2. Concrete mix design.

3. Select subbase job-mix design. Report the following:

    a. Material sources.

b. Gradation.

c. Plasticity index.

d. Liquid limit.

e. Laboratory compaction curves indicating maximum density at optimum moisture content.

3.7 DELIVERY

A. Deliver steel reinforcement to prevent damage.

B. Before installation, return or dispose of distorted or damaged steel reinforcement.

C. Bulk Products: Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.

3.8 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

3.9 FIELD CONDITIONS

A. Hot Weather Concreting Procedures: ACI 305R.

B. Cold Weather Concreting Procedures: ACI 306R.

1. Use non-corrosive, non-chloride accelerator admixture.

2. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions.

3.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction

PART 4 - PRODUCTS

4.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II.

B. Pozzolans:

1. Fly Ash: ASTM C618, Class C or F including supplementary optional physical requirements.

2. Slag: ASTM C989/C989M; Grade 100

3. Silica Fume: ASTM C1240.

C. Coarse Aggregate: ASTM C33/C33M; size 3/8”-5/8”

D. Fine Aggregate: ASTM C33/C33M.

E. Mixing Water: Fresh, clean, and potable.

F. Air-Entraining Admixture: ASTM C260/C260M.

G. Chemical Admixtures: ASTM C494/C494M.

H. Reinforcing Steel: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

I. Welded Wire Fabric: ASTM A1064/A1064M, sized as indicated.

J. Expansion Joint Filler: ASTM D1751.

K. Sheet Materials for Curing Concrete: ASTM C171.

4.2 SELECT SUBBASE

A. Subbase: AASHTO M147; Grade B

1. Select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials.

B.Other Acceptable Gradations: Materials within three to five percent, plus or minus, of specified gradation, or as recommended by the geotechnical engineer and approved by the Contracting Officer's Representative.

SUBBASE GRADING REQUIREMENTS							
Sieve Size		Percentage Passing by Mass					
		Grades					
(mm)	(in)	A	B	C	D	E	F
50	2	100	100				
25	1		75-95	100	100	100	100
9.5	3/8	30-65	40-75	50-85	60-100		
4.47	No. 4	25-55	30-60	35-65	50-85	55-100	70-100
2.00	No. 10	15-40	20-45	25-50	40-70	40-100	55-100
0.425	No. 40	8-20	15-30	15-30	25-45	20-50	30-70
0.075	No. 200	2-8	5-20	5-15	5-20	6-20	8-25

4.3 FORMS

A. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer's Representative, of grade or type suitable to obtain type of finish specified.

1. Plywood: Exterior grade, free of defects and patches on contact surface.

2. Lumber: Sound, grade-marked, S4S stress graded softwood, minimum 50 mm (2 inches) thick, free from warp, twist, loose knots, splits, or other defects.

3. Form Coating: As recommended by Architect/Engineer.

B. Provide forms suitable in cross-section, depth, and strength to resist springing during depositing and consolidating concrete.

1. Do not use forms varying from straight line more than 3 mm in 3000 mm (1/8 inch in 10 feet), horizontally and vertically.

C. Provide flexible or curved forms for forming radii.

4.4 CONCRETE CURING MATERIALS

A. Concrete curing materials, conform to one of the following:
1. Burlap: Minimum 7 ounces/sq. yd. dry.
2. Sheet Materials for Curing Concrete: ASTM C171.
3. Curing Compound: ASTM C309, Type 1 clear liquid membrane forming type, without paraffin or petroleum.

4.5CONCRETE MIXES

A.Design concrete mixes according to ASTM C94/C94M, Option C.

B. Concrete Type: Air-entrained See Table I. TABLE I - CONCRETE TYPES

TABLE I - CONCRETE TYPES

TABLE I - CONCRETE TYPES					
Concrete Type	Minimum 28 Day Compressive Strength f'c MPa (psi)	Non-Air-Entrained		Air-Entrained	
		Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio
A	35 (5000)1,3	375 (630)	0.45	385 (650)	0.40
B	30 (4000)1,3	325 (550)	0.55	340 (570)	0.50
C	25 (3000)1,3	280 (470)	0.65	290 (490)	0.55
D	25 (3000)1,2	300 (500)	*	310 (520)	*

Footnotes:
1. If trial mixes are used, achieve compressive strength 8.3 MPa (1,200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve compressive strength 9.7 MPa (1,400 psi) in excess of f'c.
2. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44.
3. Laboratory Determined according to ACI 211.1 for normal weight concrete.

C. Maximum Slump: ASTM C143/C143M. See Table II.

TABLE II - MAXIMUM SLUMP	
APPLICATION	MAXIMUM SLUMP
Curb & Gutter	75 mm (3 inches)
Pedestrian Pavement	75 mm (3 inches)
Vehicular Pavement	50 mm (2 inches) Machine Finished 100 mm (4 inches) Hand Finished
Equipment Pad	75 to 100 mm (3 to 4 inches)

4.6 ACCESSORIES

A. Equipment and Tools: Obtain Contracting Officer's Representative's, approval of equipment and tools needed for handling materials and performing work before work begins.
B. Maintain equipment and tools in satisfactory working condition.

C. Sealants:

1. Concrete Paving Expansion Joints: ASTM D5893/D5893M, Type SL, single component, self-leveling, silicone joint sealant.

2. Concrete Paving Joints: ASTM D6690, Type IV, hot-applied, single component joint sealant.

D. Concrete Protective Coating: AASHTO M233 linseed oil mixture.

PART 5 - EXECUTION

5.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Prepare, construct, and finish subgrade. See Section 31 20 00, EARTHWORK.

D. Maintain subgrade in smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

5.2 SELECT SUBBASE

A. Placing:

1. Place subbase material on prepared subgrade in uniform layer to required contour and grades, and to maximum 200 mm (8 inches) loose depth.

2. When required compacted thickness exceeds 150 mm (6 inches), place subbase material in equal thickness layers.

3. When subbase elevation is 1/2 inch or more below required grade, excavate subbase minimum 3 inches deep. Place and compact subbase to required grade.

B. Compaction

1. Perform compaction with approved hand or mechanical equipment well suited to the material being compacted.

2. Maintain subbase at optimum moisture content for compaction.

3. Compact each subbase layer to minimum 95 percent or 100 percent of maximum density as specified in Section 31 20 00, EARTHWORK.

C. Subbase Tolerances:

1. Variation from Indicated Grade: Maximum 3/8 inch.

2. Variation from Indicated Thickness: Maximum 1/2 inch.

D. Protection:

1. Protect subbase from damage until concrete is placed.

2. Reconstruct damaged subbase before placing concrete.

5.3 SETTING FORMS

A. Form Substrate:

1. Compact form substrate to uniformly support forms along entire length.

2. Correct substrate imperfections and variations by cutting, filling, and compacting.

B. Form Setting:

1. Set forms to indicated line and grade with tight joints. Rigidly brace forms preventing movement.

2. Remove forms when removal will not damage concrete and when required for finishing.

3. Clean and oil forms before each use.

4. Correct forms, when required, immediately before placing concrete.

C. Land Surveyor: Establish control, alignment, and grade for forms and slip forming machine operations.

1. Notify Contracting Officer's Representative immediately when discrepancies exist between field conditions and drawings.

2. Correct discrepancies greater than 1 inch before placing concrete.

D. Form Tolerances:

1. Variation from Indicated Line: Maximum 1/4 inch.

2. Variation from Indicated Grade: Maximum 3 mm in 1/8 inch in 10 feet.

5.4 PLACING REINFORCEMENT

A. Keep reinforcement clean from contamination preventing concrete bond.

B. Install Reinforcement shown on drawings

C. Support and securely tie reinforcing steel to prevent displacement during concrete placement.

D. Obtain Contracting Officer's Representative's reinforcement placement approval before placing concrete.

5.5 JOINTS - GENERAL

A. Place joints, where shown on approved submittal Drawings.

1. Conform to details shown.

2. Install joints perpendicular to finished concrete surface.

B. Make joints straight and continuous from edge to edge of pavement.

5.6 CONSTRUCTION JOINTS

A. Place transverse construction joints of type shown, where indicated, and whenever concrete placement is suspended for more than 30 minutes.

B. Provide butt-type joint with dowels in curb and gutter at planned joint locations.

C. Provide keyed joints with tie bars when joint occurs in middle third of planned curb and gutter joint interval.

5.7 CONTRACTION JOINTS

A. Tool or cut joints to width, depth, and radius edge shown on drawings using grooving tool, jointer, or saw.

B. Construct joints in curbs and gutters by inserting 1/8 inch steel plates conforming to curb and gutter cross sections.

1. Keep plates in place until concrete can hold its shape.

C. Finish joint edges with edging tool.

D. Score pedestrian pavement with grooving tool or jointer.

5.8 EXPANSION JOINTS

A. Form expansion joints with expansion joint filler of thickness shown on drawings.

1. Locate joints around perimeter of structures and features abutting site work concrete.

2. Create complete, uniform separation between structure and site work concrete.

B. Extend expansion joint material full depth of concrete with top edge of joint filler below finished concrete surface where sealant is indicated on Drawings.

C. Cut and shape material matching cross section.

E. Round joint edges with edging tool.

5.9 PLACING CONCRETE - GENERAL

A. Preparation before Placing Concrete:

1. Obtain Contracting Officer's Representative approval.

2. Remove debris and other foreign material.

3. Uniformly moisten substrate, without standing water.

B. Convey concrete from mixer to final location without segregation or loss of ingredients. Deposit concrete to minimize handling.

C. During placement, consolidate concrete by spading or vibrating to minimize voids, honeycomb, and rock pockets.

1. Vibrate concrete against forms and along joints.

2. Avoid excess vibration and handling causing segregation.

D. Place concrete continuously between joints without bulkheads.

E. Install construction joint in concrete placement suspended for more than 30 minutes.

F. Replace concrete with cracks, chips, bird baths, and other defects to nearest joints, approved by Contracting Officer's Representative.

5.10 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

A. Place concrete in one layer conforming to cross section shown on Drawings after consolidating and finishing.

B. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

C. Strike concrete surface to proper section ready for consolidation.

D. Consolidate concrete by tamping and spading or with approved mechanical finishing equipment //.

E. Finish concrete surface with wood or metal float.

F. Construct concrete pads and pavements with sufficient slope to drain, preventing standing water.

5.11 PLACING CONCRETE FOR VEHICULAR PAVEMENT

A. Deposit concrete as close as possible to its final position.

B. Place concrete continuously between construction joints without cold joints

D. Finish concrete surface to elevation and crown shown on drawings.

E. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

F. Obtain Contracting Officer's Representative's approval before placing adjacent lanes.

G. Curb-Forming Machines: Curb-forming machines for constructing curbs and gutter will be approved based on trial use on the project. When equipment produces unsatisfactory results, discontinue use of the equipment at any time during construction and accomplish work by hand method construction. Remove unsatisfactory work and

reconstruct full length between regularly scheduled joints. Dispose of removed portions off the project site.

5.12 FORM REMOVAL

A. Keep forms in place minimum 12 hours after concrete placement. Remove forms without damaging concrete.

B. Do not use bars or heavy tools against concrete to remove forms. Repair damage concrete found after form removal.

5.13 CONCRETE FINISHING - GENERAL

A. Follow operation sequence below, unless otherwise indicated on Drawings:

1. Consolidating, floating, striking, troweling, texturing, and joint edging.

B. Use edging tool with 1/4 inch radius.

C. Keep finishing equipment and tools clean and suitable for use.

5.14 CONCRETE FINISHING - PEDESTRIAN PAVEMENT

A. Walks, Grade Slabs, Wheelchair Curb Ramps:

1. Finish concrete surfaces with metal float, troweled smooth, and finished with a broom moistened with clear water.

2. Finish slab edges and formed transverse joints with edger.

3. Broom surfaces transverse to traffic direction.

a. Use brooming to eliminate flat surface produced by edger.

b. Produce uniform corrugations, maximum (1/16 inch) deep profile.

4. Provide surface uniform in color and free of surface blemishes, form marks, and tool marks.

5. Paving Tolerances:

a.Variation from Indicated Plane: Maximum 3/16 inch in 10 feet.

b. Variation from Indicated Thickness: Maximum 1/4 inch.

6. Replace paving within joint boundary when paving exceeds specified tolerances.

5.15 CONCRETE FINISHING - CURBS AND GUTTERS

A. Round edges of gutter and top of curb with edging tool.

B. Gutter and Curb Top: Float surfaces and finish with smooth wood or metal float until true to grade and section and uniform color.

2. Finish surfaces, while still plastic, longitudinally with bristle brush.

C. Curb Face:

1. Remove curb form and immediately rub curb face with wood or concrete rubbing block removing blemishes, form marks, and tool marks and providing uniform color.

2. Brush curb face, while still plastic, matching gutter and curb top.

D. Curb and Gutter Tolerances: Except at grade changes or curves.

1. Variation from Indicated Plane and Grade:

a. Gutter: Maximum 1/8 inch in 10 feet.

b. Curb Top and Face: Maximum 1/4 inch in 10 feet.

E. Replace curbs and gutters within joint boundary when curbs and gutters exceed specified tolerances.

F. Correct depressions causing standing water.

5.16 CONCRETE FINISHING - EQUIPMENT PADS

A. Strike pad surface to elevation shown on Drawings.

B. Provide smooth, dense float finish, free from depressions or irregularities.

C. Finish pad edges with edger.

D. After removing forms, rub pad edge faces with wood or concrete rubbing block, removing blemishes, form marks, and tool marks and providing uniform color.

E. Pad Tolerances:

1. Variation from Indicated Plane: Maximum 1/8 inch in 10 feet.

2. Variation from Indicated Elevation: Maximum 1/4 inch.

3. Variation from Indicated Thickness: Maximum 1/4 inch.

F. Replace pads when pads exceed specified tolerances.

5.17 SPECIAL FINISHES

A. Exposed Aggregate Finish:

1. Prepare concrete base 3/8 to 1/2 inch lower than the finish grade.

2. Scatter aggregate over concrete base surface and embed by use of hand float, straight edge, or darby.

3. Apply concrete mix and mark off surface as indicated on Drawings with surface joints at least 3/8 inch deep. Level off finish to a true surface and compact with wood float, working as little as possible so that coarse material will remain at the top. Before finish has set, treat top surface with cement retarding material. When body of concrete finish has set, remove retarded surface film by wire brushes and fine water spray to remove mortar from top of colored aggregate. Continue washing and brushing until flush water runs clear and no noticeable cement film left on the aggregate.

5.18 CONCRETE CURING

A. Concrete Protection:

1. Protect unhardened concrete from rain and flowing water.

2. Provide sufficient curing and protection materials available and ready for use before concrete placement begins.

3. Protect concrete to prevent pavement cracking from ambient temperature changes during curing period.

a. Replace pavement damaged by curing method allowing concrete cracking.

b. Employ another curing method as directed by Contracting Officer's Representative.

B. Cure concrete for minimum 7 days by one of the following methods appropriate to weather conditions preventing moisture loss and rapid temperature change:

1. Burlap Mat: Provide minimum two layers kept saturated with water during curing period. Overlap Mats at least 150 mm (6 inches).

2. Sheet Materials:

a. Wet exposed concrete surface with fine water spray and cover with sheet materials.

b. Overlap sheets minimum 300 mm (12 inches).

c. Securely anchor sheet materials preventing displacement.

3. Curing Compound:

a.Protect joints indicated to receive sealants preventing contamination from curing compound

b. Insert moistened paper or fiber rope into joint or cover joint with waterproof paper.

c. Apply curing compound before concrete dries.

d. Apply curing compound in two coats at right angles to each other.

e. Application Rate: Maximum 5 sq. m/L (200 sq. ft./gallon), both coats.

f. Immediately reapply curing compound to surfaces damaged during curing period.

5.19 CONCRETE PROTECTIVE COATING

A. Apply protective coating of linseed oil mixture to exposed-to-view concrete surfaces, drainage structures, and features that project through, into, or against concrete exterior improvements to protect the concrete against deicing materials.

B. Complete backfilling and curing operation before applying protective coating.

C. Dry and thoroughly clean concrete before each application.

D. Apply two coats, with maximum coverage of 11 sq. m/L (50 sq. yds./gal.); first coat, and maximum 16 sq. m/L (70 sq. yds./gal.); second coat, except apply commercially prepared mixture according to manufacturer's instructions.

E. Protect coated surfaces from vehicular and pedestrian traffic until dry.

F. Do not heat protective coating, and do not expose protective coating to open flame, sparks, or fire adjacent to open containers or applicators. Do not apply material at temperatures lower than 10 degrees C (50 degrees F).

5.20 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

1. Compaction.

a. Pavement subgrade.

b. Curb, gutter, and sidewalk.

2. Concrete:

a. Delivery samples.

b. Field samples.

3. Slip Resistance: Steps and pedestrian paving.

5.21 CLEANING

A.After completing curing:

1.Remove burlap and sheet curing materials.

2.Sweep concrete clean, removing foreign matter from the joints.

3.Seal joints as specified.

5.22 PROTECTION

A.Protect exterior improvements from traffic and construction operations.

1.Prohibit traffic on paving for minimum seven days after placement, or longer as directed by Contracting Officer's Representative.

B.Remove protective materials immediately before acceptance.

C.Repair damage.

1.Replace concrete containing excessive cracking, fractures, spalling, and other defects within joint boundary, when directed by Contracting Officer’s Representative, and at no additional cost to the Government.

END of SECTION 320523

SECTION 321216

BITUMINOUS PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All work and materials required under this section of the specifications shall conform to the applicable sections of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and the North Carolina Department of Transportation Pavement Construction Section Superpave Hot Mix Asphalt / Quality Management System.

1.2 SUMMARY

A. Section Includes:

1. Cold milling of existing hot-mix asphalt pavement.

2. Hot-mix asphalt patching.

3. Hot-mix asphalt paving.

4. Hot-mix asphalt paving overlay.

5. Asphalt surface treatments.

6. Pavement-marking paint.

7. Traffic-calming devices.

B. Related Sections:

1. Division 02 Sections "Demolition" and/or “Selective Demolition” for demolition, removal, and recycling of existing asphalt pavements. 2. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.

3. Division 32 Sections for other paving installed as part of crosswalks in asphalt pavement areas.

4. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

2. Job-Mix Designs: For each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each paving fabric, 12 by 12 inches minimum.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each paving fabric, 12 by 12 inches minimum.

2. Each type and color of preformed traffic-calming device.

3. Each pattern and color of imprinted asphalt. E. Material Certificates: For each paving material, from manufacturer. F. Material Test Reports: For each paving material.

G. The Contractor shall furnish copies of certified weight tickets for all asphalt placed on the project. The original of all tickets, including any voided tickets or tickets for rejecting mixture, shall become the property of the Engineer.

1.5 QUALITY ASSURANCE

A. All aspects of the work, including, but limited to materials, equipment, application and installation procedures, quality control, and environmental conditions necessary for application/installation of materials shall be in accordance with the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Quality control and quality assurance are provided for through use of the Quality Management System, as discussed in Section 1 of the latest edition Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

C. All hot mix asphalt must be provided by a Certified Asphalt Plant, as covered in Section 5.3 of the latest edition Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

D. Asphalt plant equipment and operations shall meet the Specifications set forth in Section 5 and 6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

E. Delivery and Acceptance of Asphalt Materials must conform to Section 2.40.10 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

F. The Engineer reserves the right to sample and test any shipment and to reject any material not meeting the requirements of the specifications. G. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the North Carolina Department of Transportation for all asphalt paving work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Transportation of Bituminous Mixture: Asphalt Mixtures shall be hauled in accordance with Section 6.9 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Deliver paint and pavement-marking materials to Project site in original containers and packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

C. Store paint and pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Apply asphalt materials only when the environmental conditions for the specific material to be applied are in accordance with Section 9 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces in environmental conditions recommended by the manufacturer.

PART 2 - PRODUCTS 2.1 AGGREGATES

A. All aggregates utilized in bituminous pavement mixtures shall be in accordance with Section 2.5 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section with the exception of paragraph 2.5.2.D.

2.2 ASPHALT MATERIALS

A. All asphalt materials utilized on the project shall be in accordance with the requirements of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Water: Potable.

2.3 PAVEMENT MARKINGS

A. The following are minimum requirements and shall govern except all local, state and/or federal highway or transportation department standard specifications shall govern when their requirements are in excess thereof.

B. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type F, and colors complying with the latest revision of FS TT-P-1952.

1. Color: As indicated

. 2.4 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2,500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length

2.5 PRE-FORMED TRAFFIC-CALMING DEVICES

A. Speed Bumps, Humps, and Cushions: Solid, integrally colored, 100 percent postconsumer or commingled postconsumer and postindustrial recycled plastic; UV stabilized. Provide holes for anchoring to substrate.

1. Size: Modular bumps 2 inches high by 10 inches wide by 72 inches long, with overall length as dimensioned on Drawings.

2. Size: Modular assemblies 4 inches high by 14 feet in overall width, with overall length as dimensioned on Drawings.

3. Mounting Hardware: Galvanized-steel hardware as standard with device manufacturer.

4. Adhesive: As recommended by device manufacturer.

2.6 COMPOSITION OF MIXTURES

A. The asphalt mix formula shall be in accordance with Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. The job mix formula for each mixture will establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to the aggregate, and a single temperature at which the mixture is to be discharged from the plant and shall be within the design limits specified for the particular type of bituminous mixture.

C. The job mix formula for each mixture shall be in effect until modified in writing by the Engineer.

D. All mixtures furnished for the work shall conform to the job mix formula within the tolerance ranges specified for the particular mix involved as specified herein.

E. Should a change in sources of aggregate materials be made, a new job mix formula will be required before the new mixture is produced.

F. When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job mix formula.

G. Bituminous Base Course, Type B 25.0B: The bituminous base course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

H. Bituminous Intermediate Course, Type I 19.0B: The bituminous intermediate course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

I. Bituminous Surface Course (SF 9.5A and S 9.5B): The bituminous surface course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

J. Tack Coat: Tack Coat shall conform to Section 9.31 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction System.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.

2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation asphalt.

3.2 COLD MILLING

A. The equipment utilized in milling of existing asphalt pavements shall be in accordance with Section 8.7 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction System.

B. Additional equipment necessary to satisfactorily remove the pavement in the area of manholes, water valves, curb and gutter, and other obstructions shall be provided.

C. The pavement removal operations shall be conducted to effectively minimize the amount of dust being emitted in accordance with local, State, and Federal air pollution control laws and regulations. The operation shall be planned and conducted so that it is safe for persons and property adjacent to the work including the traveling public.

D. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

E. The existing pavement shall be milled in a manner which will restore the pavement surface to a uniform longitudinal profile and cross section at the locations and in accordance with typical sections shown on the plans. Where indicated in the plans, removal shall be to a specified depth and shall produce a specified cross slope.

F. The Contractor may elect to make multiple cuts to achieve the required depth of cut or cross slope required by the plans.

G. The longitudinal profile of the milled surface shall be established by a mobile string line on the side of the cut nearest the centerline of the road. The cross slope of the milled surface shall be established by an automatic cross slope control mechanism or by a second skid sensing device located on the outside edge of the cut. The Engineer may waive the requirement for automatic grade and cross slope controls where conditions warrant.

H. The milling equipment shall be operated in such a manner as to prevent damage to the underlying pavement structure, utilities, drainage facilities, curb and gutter, paved surfaces outside the milled area, and any other appurtenances. The milled pavement surface shall be reasonably smooth and free of excessive scarification marks or other damage as determined by the Engineer. Any leveling or patching required as a result of negligence by the Contractor shall be repaired with hot bituminous plant mix at no cost to the Owner and in a manner acceptable to the Engineer. The Contractor shall coordinate the adjustment of manholes, meter boxes and valves boxes with the milling operation.

I. The Engineer may require remilling any area where surface laminations or defects resulting from the Contractor's operations cause a non-uniform surface to occur. J. The milled pavement surface shall be thoroughly cleaned of all loose aggregate particles, dust and other objectionable material by the use of power brooms, power blowers, power vacuums or other means

3.3 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. The surface preparation necessary for asphalt patching shall be done in accordance with Section 3.5 below.

C. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.

2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

D. Tack Coat: Tack coat shall be applied in accordance with Section 9.3 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

E. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

F. Traffic Markings: The Contractor shall repair and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with the requirements described elsewhere in this section.

G. Existing Utilities: All existing manhole and valve covers shall be raised by the Contractor as necessary prior to paving so that the tops of the covers are flush with the final surface. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

3.4 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements. 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.

2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.5 SURFACE PREPARATION

A. Preparation of Subgrade: The work covered under this section of this specification shall be performed in strict accordance with Section 500 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures.

B. Application of Aggregate Base Course: The work covered under this section of this specification shall be performed in strict accordance with Section 520 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures.

C. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

D. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

E. Prime Coat: Prime coat shall be applied in accordance with Section 9.2 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

F. Tack Coat: The work covered under this section of this specification shall be performed in strict accordance with Section 605 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and Section 9.3 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

3.6 HOT-MIX ASPHALT PLACING

A. Asphalt Mixtures shall be hauled in accordance with Section 6.9 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System.

B. Bituminous Plant Mix - General: The work covered under this section of this specification shall be performed in strict accordance with Section 610 and Section 620 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and Sections 2 through 6 and Section 9 of the Superpave Hot Mix Asphalt / Quality Management System of the North Carolina Department of Transportation Pavement Construction Section. For pavement repairs, see Section 654 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures.

C. Base Course, Type B 25.0B); Intermediate Course (I 19.0B); Surface Courses (SF 9.5A and S 9.5B): All hot mix placement and compaction operations shall conform to Section 9.4 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management

System of the North Carolina Department of Transportation Pavement Construction Section.

D. Spreading and Finishing: Spreading and finishing of asphalt pavements shall be done in accordance with Section 9.5 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

E. Compaction: Compaction of asphalt pavements shall be done in accordance with Section 9.7 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

F. Joints:

1. Transverse Joints: Transverse joints are to be constructed in accordance with Section 9.9 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section

. 2. Longitudinal Joints: Longitudinal are to be constructed in accordance with Section 9.10 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

G. Weather and Seasonal Limitations: Placement of asphalt is limited in accordance with Section 9.4.3 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

3.7 ASPHALT CURBS

A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 degrees F. 1. Asphalt Mix: Same as pavement surface-course mix.

B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp handplaced materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.8 ASPHALT TRAFFIC-CALMING DEVICES

A. Construct hot-mix asphalt speed bumps, humps, cushions, and tables over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 degrees F.

1. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

2. Asphalt Mix: Same as pavement surface-course mix.

3. Before installation, mill pavement that will be in contact with bottom of traffic-calming device. Mill to a depth of 1 inch from top of pavement to a clean, rough profile.

B. Place hot-mix asphalt to cross section indicated, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.9 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

B. Paint shall only be applied when the atmospheric, surface, and material conditions are in accordance with the manufacturer’s requirements.

C. Contractor must insure that pavement surface to be painted shall be clean and dry before application. All surface contamination such as oil, grease, dirt, foreign matter, or other deleterious materials will be removed by the Contractor prior to application of paint.

D. Paint shall be applied with mechanical equipment to produce uniform straight edges in strict compliance with the manufacturer's instructions. Paint shall be applied in two (2) coats at the manufacturer's recommended rates.

3.10 WHEEL STOPS

A. Install wheel stops in bed of adhesive as recommended by manufacturer.

B. Securely attach wheel stops to pavement with not less than two galvanizedsteel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 PRE-FORMED TRAFFIC-CALMING DEVICES

A. Install pre-formed speed bumps, humps, and/or cushions in bed of adhesive as recommended by manufacturer for heavy traffic.

B. Securely attach preformed speed bumps, humps, and/or cushions to pavement with hardware spaced as recommended by manufacturer for heavy traffic. Recess head of hardware beneath top surface.

3.12 FIELD QUALITY CONTROL

A. The Owner will engage a qualified testing agency to perform tests and inspections and shall bear the responsibility for paying all costs associated with passing tests. The Contractor shall bear all costs in making all necessary repairs to make work satisfactory after a failed test and shall pay all costs associated with failed tests.

B. Sampling and testing shall be in accordance with Section 7 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

C. Mat cross-slope and thickness shall be tested according to Section 10.1.8 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

D. Surface texture shall conform to Section 10.1.9 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section. Smoothness shall conform to Section 10.2. Areas found to reveal non-conformance corrected by the Contractor by removal of the defective work and replacement with new material unless other corrective measures are permitted by the Engineer. The work and materials required in the correction of defective work shall be provided by the Contractor at no cost.

E. The Contractor shall repaint and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with NCDOT requirements and specifications. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

F. All existing manhole and valve covers shall be raised by the Contractor as necessary prior to paving so that the tops of the covers are flush with the final surface. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

G. Replace and compact hot-mix asphalt where core tests were taken.

H. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. The milled material shall become the property of the Contractor. All milled material shall be disposed of by the Contractor in an EPA-approved landfill, except where the milled material is used in the work or recycled. Do not allow milled materials to accumulate on-site.

END OF SECTION 321216

SECTION 32 1313 CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

2.01 SUMMARY

A. Section Includes Concrete Paving

1. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Walks.

B. Related Requirements:

1. ACI Publications.
2. Section 033053 "Miscellaneous Cast-in-Place Concrete" for general building applications of concrete.
3. Section 321316 "Decorative Concrete Paving" for stamped concrete other than stamped detectable warnings.
4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
5. Section 321713 "Parking Bumpers."
6. Section 321723 "Pavement Markings."
7. Section 321726 "Tactile Warning Surfacing" for detectable warning tiles mats and pavers.
8. Section 321729 "Manufactured Traffic-Calming Devices."

3.01 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

4.01 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

    a. Concrete mixture design.

    b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

    a. Contractor's superintendent.

    b. Independent testing agency responsible for concrete design mixtures.

    c. Ready-mix concrete manufacturer.

    d. Concrete paving Subcontractor.

    e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

5.01 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost, if required for LEED Credit.

2. Environmental Product Declaration (EPD): For each product, if required for LEED Credit.

3. Laboratory Test Reports: For concrete paving mixtures, documentation indicating that cured concrete complies with Solar Reflectance Index requirements, if required for LEED Credit.

C. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

D. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:

1. Exposed Aggregate: 10-lb Sample of each mix.

E. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

6.01 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates.

D. Field quality-control reports.

7.01 QUALITY ASSURANCE

A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.

2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Owner and not less than 96 inches by 96 inches.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

8.01 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner to engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures. Contractor to coordinate with testing agency and Owner.

9.01 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1, 330.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot- weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control

temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

D. Pavement Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature meeting manufacturer’s specifications.

PART 2 - PRODUCTS

1.01 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301, 330.1 and 330.2 unless otherwise indicated.

2.01 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

3.01 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from steel wire into flat sheets.

C. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

D. Epoxy-Coated Welded-Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.

E. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

F. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

G. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

H. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars; assembled with clips.

I. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn galvanized.

J. Deformed-Steel Wire: ASTM A 1064/A 1064M.

K. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated, plain deformed.

L. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars. Cut bars true to length with ends square and free of burrs.

M. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars.

N. Tie Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

O. Hook Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

P. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer- coated wire bar supports.

Q. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

R. Zinc Repair Material: ASTM A 780/A 780M.

4.01 CONCRETE MATERIALS

A. Regional Materials: If required for LEED Credit, verify concrete is manufactured within 100 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

B. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type I or Type III.

2. Fly Ash: ASTM C 618, Class C or Class F.

3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

4. Blended Hydraulic Cement: ASTM C 595/C 595M.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: Per State Department of Transportation requirements.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap- graded coarse aggregate as follows:

1. Aggregate Sizes: Per State Department of Transportation requirements.

E. Air-Entraining Admixture: ASTM C 260/C 260M.

F. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2. Retarding Admixture: ASTM C 494/C 494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

G. Water: Potable and complying with ASTM C 94/C 94M.

5.01 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

B. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1- 1/2 inches long.

6.01 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap- polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

7.01 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types I and II, nonload bearing or Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

F. Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

G. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

8.01 STAMPED DETECTABLE WARNING MATERIALS

A. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.

1. Size of Stamp: One piece, matching detectable warning area shown on Drawings.

B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

9.01 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.

2. Slag Cement: 50 percent.

3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal- weight concrete at point of placement having an air content as follows:

1. Air Content: 4.0 to 7.0 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete as required for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

G. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum W/C Ratio at Point of Placement: 0.50.
3. Slump Limit: 5 inches, plus or minus 1 inch.
4. Solar Reflectance (SR): Three-year-aged SR value of at least 0.28 or initial SR of at least 0.33, if required for LEED Credit.

10.01 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

1.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.01 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.01 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

4.01 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

5.01 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.

2. Provide tie bars at sides of paving strips where indicated.

3. Butt Joints: Use bonding agent or epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.

2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.

4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as at maximum spacing of 15 feet on center each way. Complete contraction jointing within twelve hours of concrete placement. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes.

   a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

   a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes.

6.01 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase 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.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an 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 dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

7.01 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.

2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float- finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

8.01 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:

1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.

2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.

3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one- third of

the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.

4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch.

1. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.

2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.

3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one- third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.

4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:

1. Uniformly spread at manufacturer's recommended rate of dampened, slip- resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.

2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.

3. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.

4. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

D. Rock-Salt Finish: After initial floating, uniformly spread rock salt over paving surface at the rate of 5 lb/100 sq. ft.

1. Embed rock salt into plastic concrete with roller or magnesium float.

2. Cover paving surface with 1-mil- thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.

3. After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes.

E. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:

1. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match paving color required.

2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.

3. After final power floating, apply a hand-troweled finish followed by a broom finish.

4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

9.01 DETECTABLE WARNING INSTALLATION

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Section 321726 "Tactile Warning Surfacing."

1. Tolerance for Opening Size: Plus 1/4 inch, no minus.

B. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.

1. Before using stamp mats, verify that the vent holes are unobstructed.

2. Apply liquid release agent to the concrete surface and the stamp mat.

3. Stamping: While initially finished concrete is plastic, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.

4. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.

5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

10.01 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover curing curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.

    b. Continuous water-fog spray.

    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture- retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

11.01 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.

2. Thickness: Plus 3/8 inch, minus 1/4 inch.

3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/2 inch.

4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.

5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

12.01 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner.

B. Allow asphalt paving or concrete surfaces to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint ap-plication beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

13.01 WHEEL STOPS

A. Install wheel stops in accordance with manufacturer’s written instructions unless otherwise indicated.

B. Securely anchor wheel stops to substrate with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

14.01 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing will provide fewer than five compressive- strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

15.01 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 1723

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

PAVEMENT MARKINGS

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

2.01 SUMMARY

A. Section Includes:

1. Painted markings applied to asphalt paving.
2. Painted markings applied to concrete surfaces.

B. Related Requirements:

1. Section 321216 “Asphalt Paving”.
2. Section 321313 “Concrete Paving”.

3.01 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

1. Pavement-marking paint, latex.
2. Glass beads.

4.01 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the Jurisdiction having authority for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

5.01 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature meeting manufacturer’s specifications.

PART 2 - PRODUCTS

1.01 MANUFACTURERS

A. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

2.01 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "ADA Standards for Accessible Design, latest edition".

3.01 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint, Latex: MPI #97, latex traffic-marking paint.

1. Roadway Markings: As required by authorities having jurisdiction.

2. Parking Lots: White or yellow, as indicated on drawings.

3. Handicapped Symbols: Blue.

B. Glass Beads: AASHTO M 247, Type 1 or FS TT-B-1325D, Type 1, made of 100 percent recycled glass.

1. Roundness: Minimum 80 percent true spheres by weight.

PART 3 - EXECUTION

1.01 EXAMINATION

A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

2.01 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner.

B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.01 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 322905

RESTORATION OF SURFACES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section covers the furnishing of all labor, equipment and materials necessary for the proper restoration of existing surfaces disturbed or damaged as a result of construction operations which are not specifically scheduled or specified for topsoil and seeding, paving, landscaping or other surfacing.

B. In general, the types of replacement included in this section are seeding along pipelines, concrete sidewalks, driveways, roadways, ditches, lawns and landscaped areas, and curb and gutter.

C. Any damage to existing structures shall be repaired using materials and workmanship equal to, or better than, those of the original construction.

1.3 DEFINITIONS

A. CABC – Crushed aggregate base course.

B. NCDOT – North Carolina Department of Transportation.

C. PSI – Pounds per square inch.

1.4 SUBMITTALS

A. All submittals shall be in accordance with the requirements of the pertinent specification sections referenced herein.

B. An appropriate concrete mix design shall be submitted for all concrete sidewalks, driveways, roadways, and curb and gutter restored as part of this project.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SEEDING DISTURBED AREAS

A. All ground surfaces disturbed by construction activity, which are not classified as lawns, landscaped areas, or pavement areas, but would be classified as open fields, shall be raked smooth and seeded in accordance with the appropriate paragraph(s) within Section 329200 entitled Turf and Grasses. Large rocks, clumps of earth and excessive spoil material shall be removed from the area prior to seeding.

B. Shoulders of all roads shall be restored as specified for lawns and landscaped areas.

C. Wooded areas not classified as lawns shall be restored to as near their original condition as possible.

3.2 CONCRETE SIDEWALKS

A. Concrete walks removed in connection with, or damaged as a result of, construction operations under the Contract shall be replaced with new construction. Such walks shall be constructed of 4,000 PSI concrete on a thoroughly compacted subgrade, shall have a vertical thickness, unless otherwise noted, of not less than 4 inches or the thickness of the replaced walk where greater than 4 inches.

B. Walks shall be float finished, edged with an edging tool, and grooved at intermediate intervals not in excess of the width of the walk, uniform throughout the length of the walk in any one direction.

3.3 DRIVEWAYS

A. Unless otherwise noted, unpaved driveways shall be surfaced with not less than 4 inches of CABC, topped with 4 inches of stone, gravel, or other materials equal to that found in the original driveway. Driveways shall be left in a condition better than their original condition.

B. Concrete drives shall be replaced with 4,000 PSI concrete and shall have equal thickness and reinforcing steel to that of the original drive. Prior to placing the concrete a 6-inch aggregate base course shall be placed in the drive area.

C. Unless otherwise noted, bituminous or asphaltic concrete drives shall be restored to original base and asphalt thicknesses or a minimum of 6 inches of aggregate base course and a 2-inch surface course, whichever is greater. Base material shall be compacted in 3-inch lifts and Type SF 9.5A or S 9.5B asphalt compacted in 2-inch lifts to match existing pavement section. All work shall be in accordance with the appropriate paragraph(s) of Section 321216 entitled Bituminous Paving.

3.4 ROADWAY REPLACEMENT

A. Bituminous or Asphaltic pavements shall include all areas paved with blacktop, built up pavements or oil and stone, tar and stone and similar pavements constructed with a bituminous or asphalt and stone materials.

B. Immediately upon completion of installation of underground piping and structures, the trench shall be backfilled and the roadway shall be repaired. Provide materials as specified in the Contract Drawings. If, in the opinion of the Engineer, the area adjacent to the excavation has not been damaged to the extent that the base course need to be replaced, restoration may consist of a surface course of sufficient thickness to meet the existing pavement.

C. Unless otherwise noted, bituminous or asphaltic concrete roadways shall be restored to original base and asphalt thicknesses or a minimum of 6 inches of aggregate base course and a 2-inch surface course, whichever is greater. Base material shall be

compacted in 3-inch lifts and Type SF 9.5A or S 9.5B asphalt compacted in 2-inch lifts to match existing pavement section. All work shall be in accordance with the appropriate paragraph(s) of Section 321216 entitled Bituminous Paving.

D. Concrete roadways shall be replaced with 4,000 PSI concrete and shall have equal thickness and reinforcing steel as the original roadway. An aggregate base course with a thickness of 6 inches shall be placed prior to the placing of concrete.

E. Differential settlement of restored pavements shall be corrected immediately.

F. The Contractor shall repair and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with NCDOT requirements and specifications.

G. All existing manhole and valve covers shall be raised, as required, by the Contractor prior to paving. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

3.5 DITCHES

A. Ditches shall be regraded to the original grade and line. The surface of all ditches shall be returned to the same condition as found before commencing work.

3.6 LAWNS AND LANDSCAPED AREAS

A. Lawns and landscaped areas shall be regraded and replaced as follows:

1. Grading shall be to the grade existing before construction of the work under this Contract.

2. Lawn replacement shall be in accordance with the appropriate paragraph(s) within Section 329200 entitled Turf and Grasses. Topsoiled areas shall be replaced with topsoil of equal quality and quantity.

B. Landscaped areas shall be replaced with shrubs, hedges, ornamental trees, flowers, or other items to original condition.

3.7 CURB AND GUTTER

A. Curb and gutter removed with or damaged as a result of construction operations, injured or disturbed by the Contractor, his agents, or employees, shall be replaced with new construction to a condition similar and equal to that existing before damage was incurred. 4,000 PSI concrete shall be used in curb and gutter replacement.

B. All work associated with curb and gutter replacement shall be in accordance with Section 846-3 of the NCDOT Standard Specifications for Roads and Structures (latest edition). Horizontal and vertical alignment of the curb and gutter shall match that of the existing to the greatest extent practical, unless directed otherwise by the Engineer.

3.8 DAMAGE TO STRUCTURES

A. Any damage to existing structures shall be repaired of materials and workmanship equal to those of original construction. Extensively damaged structures, where the

structural stability has been affected or which cannot be repaired in a suitable fashion shall be replaced entirely. Replacement shall not commence until approval of the plan of replacement has been given by the Engineer. Replacement costs shall be responsibility of the Contractor.

END OF SECTION 322905

SECTION 32 3223

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

SEGMENTAL RETAINING WALLS

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

2.01 SUMMARY

A. This Section includes single- and multiple-depth segmental retaining walls with and without soil reinforcement.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavation for segmental retaining walls.

3.01 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

4.01 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Environmental Product Declaration (EPD): For each product.

C. Samples: For each color and texture of concrete unit specified. Submit full-size units.

D. Design Submittal: For segmental retaining walls, the Civil Engineer of record will be provided a copy of the Action submittals in addition to the Professional Engineer designing the Segmental Retaining Wall to ensure conformance to the construction documents.

1. The SRW contractor shall provide to the Owner a minimum of 14-days prior to the anticipated start date for the SRW a submittal package including the following:

a) A set of detailed SRW design plans sealed by a registered professional engineer licensed in the State of North Carolina. The professional engineer shall have a minimum of five (5) years of experience in designing retaining wall systems of similar type and size to that which is being proposed. The SRW plans shall include all details, dimensions, quantities and cross sections necessary to construct the SRW and shall include:

b) Plan, elevation and cross section views for each wall,

c) Details for cap blocks, coping, or barriers constructed as part of the wall contract,

d) Construction specifications, and

e) Computer generated outputs demonstrating compliance with this Specification must be provided.

i. The computer program MSEW (v3.0) based on FHWA NHI-00-043 is acceptable. Detailed hand calculations demonstrating compliance with this Specification must be submitted if no computer program is used for design.

ii. The FHWA method based on NHI-00-043 and AASHTO 98/Demo 82 are the same with respect to external stability and internal stability. The difference between NHI-00-043 and AASHTO 98/Demo 82 is related to connection analyses as follows:

- AASHTO 98/Demo 82 (ASD) is based on *short-term connection tests*, which are commonly done at most testing labs.
- NHI-043 (ASD) is based on *long-term creep connection tests*. NHI- 043 (ASD) method is applicable only if a creep connection test is performed.
- If a creep connection test has not been performed, then AASHTO 98/Demo 82 (ASD) must be used for the connection analysis.

iii. Overall stability calculations with respect to global external, compound internal and translation stability can be determined using the following computer program: ReSSA (v3.0).

5.01 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Certificates: For each type of segmental retaining wall unit and soil reinforcement from manufacturer.

1. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.

2. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.

C. Product Test Reports: For each type of segmental retaining wall unit and soil reinforcement, for tests performed by a qualified testing agency.

1. Include test data for freeze-thaw durability of segmental retaining wall units.

2. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.

3. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.

D. Preconstruction test reports.

E. Source quality-control reports.

F. Field quality-control reports.

G. Documentation for the SRW units and soil reinforcement demonstrating compliance with the requirements of this specification including but not limited to SRW compressive strength, absorption and durability; SRW/geosynthetic reinforcement connection and block shear capacity; geosynthetic reinforcement coefficients for direct sliding and interaction; and geosynthetic reinforcement reduction factors for creep, durability, installation damage and pullout.

H. Manufacturer's certification that SRW units meet the requirements of this specification.

I. Manufacturer's certification that the geosynthetic reinforcement meets the requirements of this specification.

J. Contractor's certification that:

1. The specific SRW system proposed for use on this project has been successfully used on a minimum of ten (10) similar projects and has been successfully installed on a minimum of 1,000,000 square feet of retaining walls.

2. The contractor has a minimum of 1,000,000 square feet of experience within the previous five (5) years with the proposed SRW system. Contact names and telephone numbers shall be listed for projects used to document the 1,000,000 square feet.

K. Contractor shall be responsible for providing all required permits for the MSE wall.

6.01 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects.

1. Build mockup of segmental retaining wall approximately 72 inches long by not less than 36 inches high above finished grade at front of wall.

a. Include typical soil reinforcement.

b. Include typical base and cap or finished top construction.

c. Include backfill to typical finished grades at both sides of wall.

d. Include typical end construction at one end of mockup.

e. Include 36-inch return at one end of mockup, with typical corner construction.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

7.01 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform the following preconstruction testing:

1. Test soil reinforcement and backfill materials for pullout resistance according to ASTM D 6706.

2. Test soil reinforcement and backfill materials for coefficient of friction according to ASTM D 5321.

8.01 DELIVERY, STORAGE, AND HANDLING

A. Store and handle concrete units and accessories to prevent deterioration or damage due to contaminants, breaking, chipping, or other causes.

B. Store geosynthetics in manufacturer's original packaging with labels intact. Store and handle geosynthetics to prevent deterioration or damage due to sunlight, chemicals, flames, temperatures above 160 deg F or below 32 deg F, and other conditions that might damage them. Verify identification of geosynthetics before use, and examine them for defects as material is placed.

PART 2 - PRODUCTS

1.01 PERFORMANCE REQUIREMENTS

A. Basis of Design: Engage a qualified professional engineer to design segmental retaining walls.

B. Compliance Review: Qualified professional engineer responsible for segmental retaining wall design shall review and approve submittals and source and field quality- control reports for compliance of materials and construction with design.

C. Structural Performance: Engineering design shall be based on the project specific loads and be according to NCMA's "Design Manual for Segmental Retaining Walls."

2.01 SEGMENTAL RETAINING WALL UNITS

A. Concrete Units: ASTM C 1372, Normal Weight, except that maximum water absorption shall not exceed 7 percent by weight and units shall not differ in height more than plus or minus 1/16 inch from specified dimension.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allan Block Corporation.

b. Anchor Wall Systems, Inc.

c. CornerStone Wall Solutions Inc.

d. GeoStone Retaining Wall Systems, Inc.

e. GeoWestern, Inc.

f. ICD Corporation.

g. Keystone Retaining Wall Systems, Inc.

h. Risi Stone Systems.

i. Rockwood Retaining Walls, Inc.

j. Tensar Earth Technologies, Inc.

k. Versa-Lok Retaining Wall Systems.

2. Provide units that comply with requirements in ASTM C 1372 for freeze-thaw durability.

3. Provide units that interlock with courses above and below by means of integral lugs, lips, or tongues and grooves pins clips splines or hollow cores filled with drainage fill.

B. Regional Materials: If required for LEED, manufacture units within 100 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

C. Color: As selected by Owner from manufacturer's full range.

D. Shape and Texture: Provide units matching basic shape, dimensions, and face texture of basis-of-design product.

E. Batter: Provide units that offset from course below per manufacturer's recommendation. Contractor to verify that the project specific batter selected does not conflict with the geometry constraints of the site design.

F. Cap Units: Provide cap units with smooth, as-cast top surfaces without holes or lugs.

G. Special Units: Provide corner units, end units, and other shapes as needed to produce segmental retaining walls of dimensions and profiles indicated.

3.01 INSTALLATION MATERIALS

A. Pins: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

B. Clips: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

C. Cap Adhesive: Product supplied or recommended by segmental retaining wall unit manufacturer for adhering cap units to units below.

D. Leveling Base: Comply with requirements in Section 312000 "Earth Moving" for base course.

E. Drainage Fill: Comply with requirements in Section 312000 "Earth Moving" for drainage course.

F. Fill material used to construct the soil reinforced and retained zones (where applicable) shall consist of one of the following inorganic soil types according to their USCS designations (GP, GW, SW, SP, SM). The fill material must also meet the gradation below and the strength requirements noted below. Maximum particle size to be ¾-inches.

Sieve Size	Percent Passing
¾-inch	75-100
No. 4	20-100
No. 40	0-60
No. 200	0-35

1. Less than 35% passing the No. 200 sieve per ASTM D422.
2. Materials passing the No. 40 sieve should have a liquid limit less than 35 and a plasticity index less than 10 as per ASTM D4318.
3. An effective internal angle of friction greater than or equal to 30-degrees per ASTM D2166 or D3080 at the compaction standard.
4. The reinforced fill material shall have a maximum dry unit weight greater than or equal to 100-pcf as determined by standard Proctor (ASTM D 698).
5. Fill containing brush, sod, peat, roots, or other organic, perishable, or deleterious matter including, but not limited to snow, ice, or frozen soils, shall be considered unsuitable material and shall be removed. Less than 0.5% organic material.

G. Use of an effective friction angle greater than 30-degrees for design shall be verified by appropriate testing submitted to and approved by the Owners engineer prior to construction.

H. The pH of the backfill soil shall be between 5 and 8 when tested in accordance with ASTM G51.

I. Nonreinforced-Soil Fill: Comply with requirements in Section 312000 "Earth Moving" for satisfactory soils.

J. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent.

1. Apparent Opening Size: No. 70 to 100 sieve, maximum; ASTM D 4751.

2. Minimum Grab Tensile Strength: 110 lb; ASTM D 4632.

3. Minimum Weight: 6 oz./sq. yd.

K. Soil Reinforcement: Product specifically manufactured for use as soil reinforcement and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bonar Inc.; a Low & Bonar company.

b. Hanes Geo Components; Leggett & Platt Incorporated.

c. Huesker Inc.

d. Mirafi Construction Products.

e. Propex Fabrics Inc.

f. Strata Systems, Inc.

g. Synteen Technical Fabrics, Inc.

h. Tenax Corporation - USA.

i. Tensar Earth Technologies, Inc.

j. Versa-Lok Retaining Wall Systems.

k. Webtec, Inc.

2. Product Type: Knitted or woven geogrid made from polyester yarns with a protective coating, molded geogrid made from high-density polyethylene, or woven geotextile made from polyamides, polyesters, or polyolefins.

4.01 SOURCE QUALITY CONTROL

A. Factory test and inspect each roll of soil reinforcement for minimum average roll values for geosynthetic index property tests, including the following:

1. Weight.
2. Grab or single-rib strength.
3. Aperture opening.
4. Rib or yarn size.

PART 3 - EXECUTION

1.01 PREPARATION AND EXCAVATION

A. Include all means of subsurface improvement as required.

B. Comply with all state and local requirements for execution of the work, including local building codes and current OSHA excavation regulations. The General Contractor is responsible for stability of the area during excavation and wall construction. Any excavation support required to maintain/protect existing structures, utilities, landscape features or property shall be the responsibility of the General Contractor.

C. Prior to undertaking any grading or excavation of the site, confirm the location of the retaining walls and all underground features, including utility locations within the area of construction. Ensure surrounding structures are protected from effects of wall excavation.

D. Coordinate installation of underground utilities with wall installation.

E. Control surface water drainage and prevent inundation of the MSE wall area during construction.

F. Contractor shall excavate to the lines and grades shown on the construction drawings. Owner's representative shall inspect the excavation and approve prior to placement of leveling material or fill soils. Proofroll foundation area and perform on-site bearing capacity tests as directed to determine if foundation improvement is required.

G. Before construction of the reinforced wall, the contractor shall clear and grub the fill zone area removing topsoil, brush, sod, organics, or other deleterious materials. Any unsuitable soils shall be over-excavated and replaced before placing additional fill soils.

H. Over-excavation and replacement of unsuitable foundation soils and replacement with approved compacted fill will be compensated as agreed upon with the Owner.

I. Foundation bearing capacity shall be inspected by a qualified geotechnical testing company. The engineer shall confirm with a field inspection that the foundation has been properly prepared and the bearing capacity requirements are appropriate before placement of the geosynthetic reinforced zone.

1. Required Bearing Capacity (psf) > 3,000 psf "or" = Level Backfill: $q = \gamma H^{*}1.3$

= 2H:1V Backfill: $q = \gamma H^{*}1.6$

J. A pre-construction meeting shall be conducted by the General Contractor prior to beginning construction on segmental retaining walls. Owner and Architect shall be notified of the date, time, and location of the meeting. Mandatory attendees include the General Contractor, the wall design engineer of record, the project geotechnical engineer, the Contractor's testing agency, Owner's independent testing laboratory, and representatives of all sub-contractors involved with the foundation preparation, erection, and backfilling of the MSE wall. Meeting topics shall include, but are not limited to contractor qualifications as stated above; schedule and phasing of wall construction; coordination with other on-site construction activities; responsibilities of parties; and sources, quality, and acceptance of materials. Location and coordination of backfill soil sources for the retaining wall must be discussed and acknowledged prior to any site grading. If contractor fails to protect and utilize soils designated as suitable backfill for MSE walls contractor will be responsible for providing appropriate suitable backfill at their expense and at no additional cost to owner.

3.2 BASE LEVELING PAD

A. Leveling pad material shall be placed to the lines and grades shown on the construction drawings, to a minimum thickness of 6-inches and extend laterally a minimum of 6-inches in front and behind the concrete masonry unit.

B. Leveling pad materials to be compacted to a minimum 95% Standard Proctor density per ASTM D-698.

C. Leveling pad shall be prepared to insure full contact to the base surface of the SRW units.

D. First course of units shall be placed on the leveling pad at the appropriate line and grade. Alignment and level shall be checked in all directions and ensure that all units are in full contact with the base and properly seated.

3.3 SRW UNIT INSTALLATION

A. Place the front of unit's side-by-side. Do not leave gaps between adjacent units. Layout of corners and curves shall be in accordance with manufacturer's recommendations.

B. Install mechanical shear/connecting devices per manufacturer's recommendation.

C. Place and compact drainage fill within (frictional systems with vertically oriented cores) and behind wall units (all SRW systems). Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill.

D. Maximum-stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction, shall not exceed two courses or 16-inches whichever is less.

3.4 GEOSYNTHETIC INSTALLATION

A. Geosynthetic reinforcement shall be oriented with the highest strength axis (machine direction) perpendicular to the wall alignment. Contractor shall verify correct orientation.

B. Reinforced fill zone length is measured from the backside of the masonry block units unless otherwise noted on drawings.

C. Geosynthetic reinforcement shall be continuous throughout embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geosynthetic or gaps between adjacent pieces of geosynthetic are not permitted.

D. Before placing fill, the geosynthetic materials shall be placed to lay flat, or slightly sloping downward away from the wall face on compacted backfill and mechanically attached to the masonry block units. Place the next course of masonry block units over the geosynthetic. The geosynthetic shall be pulled taut to remove any slack in the geosynthetics, and anchored prior to backfill placement on the geosynthetic.

E. Tracked construction equipment shall not be operated directly on the geosynthetic reinforcement. A minimum fill thickness of 6 inches is required for operation of tracked vehicles over the geosynthetic reinforcement. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and the geosynthetic reinforcement.

F. Rubber-tired vehicles may pass over the geosynthetic reinforcement at slow speeds, less than 10-mph. Sudden braking and sharp turning shall be avoided.

G. Geosynthetic reinforcement shall be cut next to the cross machine direction (CMD) apertures. Cross machine direction apertures shall be placed along the front face of the MSE wall.

5.01 REINFORCED BACKFILL PLACEMENT

A. Construct wall in location and to top and bottom elevations shown on grading plans.

B. Reinforced backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the geosynthetic and installation damage. Reinforced backfill materials shall be placed from the wall face back toward the ends of the geosynthetic to ensure further tensioning of the reinforcement.

C. Reinforced backfill shall be placed and compacted in lifts not to exceed 6-inches where hand compaction is used, or 8-inches where heavy compaction equipment is used. Lift thickness shall be decreased to achieve the required density as required.

D. Reinforced backfill shall be compacted to 95% of the maximum density as determined by ASTM D698. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be within a range of 2% below to 2% above optimum moisture content.

E. Fill shall be placed in horizontal layers not exceeding 6-inches in uncompacted thickness for zones where compaction is accomplished with hand-operated equipment. Only lightweight hand-operated equipment shall be allowed within 4-feet from the face of the SRW unit.

F. The infill soil shall be compacted in maximum 8-inch compacted lifts to the following minimum densities (percentage of the maximum standard Proctor ASTM D698):

1. fine grained (SM) soils to a minimum of 95 percent Standard Proctor within -2/+2 percent of optimum moisture content, whichever is greater; and

2. coarse grained (GP, GW, SW, SP) soils to a minimum of 95 percent Standard Proctor.

G. Testing methods and frequency, and verification of material specifications and compaction shall be the responsibility of the project geotechnical engineer.

H. Wall including reinforced mass shall be constructed on foundation soils having a minimum internal friction angle of 30-degrees to a minimum depth of one third (1/3) the wall height or a net allowable bearing pressure as stated in Section 3.1.I.

I. Reinforced fill shall be compacted to the top of each row of masonry block units prior to the placement of the next row of masonry block units.

J. SRW units shall be placed not more than 2-courses or 16-inch above level backfill.

K. Contractor shall have an approved set of plans and specifications on site at all times during construction of the wall.

6.01 RETAINED BACKFILL PLACEMENT

A. Retained backfill shall be compacted to a minimum 95 percent Standard Proctor density (ASTM D698) in landscape areas. Retained backfill located in the upper two feet below crest slopes or pavement structures shall be compacted to a minimum 98 percent Standard Proctor density or to the density recommended by the project geotechnical engineer.

7.01 CAP INSTALLATION

A. If applicable, cap units shall be permanently secured to the masonry block units using an approved construction adhesive conforming to ASTM 2339.

B. The general contractor shall verify the in-place top of wall elevation before installing the top units. Top units may require shifting to comply with the design elevations.

C. Incorporate surface water drainage control (swale) into the finished grade at top of wall, as shown on the civil engineers grading and drainage plan, where applicable.

8.01 AS-BUILT CONSTRUCTION TOLERANCES

A. Vertical alignment: ±1.25-inch over any 10.0-foot distance.

B. Wall Batter: Must be within 2.0-degrees of design batter.

C. Horizontal alignment: ±1.5-inch over any 10.0-foot distance and in corners, bends and curves ± 1.0-foot of the theoretical location.

D. Maximum horizontal gap between erected units shall be 1/8-inch.

9.01 FIELD QUALITY CONTROL

A. The Owner shall engage inspection and testing services, including independent laboratories, to province quality assurance and testing services during construction. As a minimum, quality assurance testing should include foundations soil inspection, soil and backfill testing, verification of design parameters, and observation of construction for general compliance with design drawings and specifications. This does not relieve the Contractor form securing the necessary construction quality control testing during construction.

B. Quality control testing and inspections services shall only be performed by qualified soil technicians and geotechnical engineers.

C. Quality control testing, as a minimum shall include:

1. Special inspector shall verify / document each of the following:

    a. Correct reinforcement type, elevation, length, orientation, reinforcement tensioning procedures, placement of drainage materials and outlets to be observed by the project geotechnical engineer.

    b. Verification of entire foundation (entire reinforcement length, L) must be observed by the project geotechnical engineer.

    c. Field location in plan and elevation, wall batter to be observed by the project surveyor.

2. Reinforced Soil Testing

    a. Every new soil type and/or every 2,000 cy run pH, Atterberg Limits, Sieve Analysis, Proctor new soil type per geotechnical field personnel.

    b. Triaxial Test on every appreciable different soil type based on index testing.

    c. Run Consolidated-Undrained Triaxial Shear Tests and report the stress strain test results as well as present the Mohr-Coulomb failure diagram for peak and residual stress levels, as required by ASTM. The geotechnical consultant will provide a recommended effective internal friction angle based on their results.

    d. Run compaction tests as follows:

        1) Every two-foot change in height and interval of 100-feet of Wall length.

        2) Run 4 compaction tests one within 4-feet of face, and three others randomly throughout the reinforced soil zone.

3. Retained Soils Testing:

    a. Every new soil type and/or every 2,500-cy run Atterberg Limits, Sieve Analysis, Proctor per Geotech Field Personnel and if different from Reinforced Soil.

b. Cohesion in the retained soil should not be used in design even if the failure envelope determined from shear tests indicates that such value temporarily exists.

c. Run compaction tests as follows:

1) Every two-foot change in height and interval of 200-feet of Wall length.

2) Run 3 compaction tests one within 3-feet of reinforced zone and two others randomly throughout the retained soil zone.

4. Foundation Soils Testing

a. Strength testing at time of design. Generally, one in the worst area would suffice.

b. IF foundation fill is required, treat as if it were reinforced soil fill, those criteria apply.

c. Verify foundation bearing capacity by probe rod and static cone penetrometer testing every 10-feet of wall length for entire Reinforced soil zone. Also use hand auger borings to a depth of 12-feet or the reinforcement length whichever is shorter, every 30-feet along the wall length at third points of the reinforcement length.

d. For walls in excess of 20-feet tall, power auger holes with cone or SPT testing to depth equal to twice the wall height is required, every 50-feet of wall length or as required by the geotech to establish appropriate allowable bearing capacity, unless already performed in pre-Wall design geotechnical investigation. If there is soft soil, it should be done to the bottom of the soft soil layer.

5. Please note that the special inspector must notify the contractor of out-of- tolerance work. The inspector cannot observe or test and let out-of-spec work be covered. With all of the parameters established in the MSE wall specifications and the guidelines for testing frequency outlined above the geotechnical engineer can perform their role within those parameters.

6. The MSE wall shall be staked in the field and located as per the civil grading plan by a registered North Carolina Surveyor. Stakes shall be placed on 25-foot intervals so as to identify location along the wall alignment with respect to geogrid placement and soil compaction tests.

10.01 CHANGES TO GEOSYNTHETIC REINFORCEMENT LAYOUT AND PLACEMENT

A. No changes to the masonry block or geosynthetic reinforcement layout, including but not limited to, length, geosynthetic type, or elevation shall be made without the expressed prior written consent of the wall design engineer.

11.01 SITE DRAINAGE

A. Backfill shall be graded a minimum of 2-percent away from the wall face and rolled at the end of each work day to prevent ponding of water on the surface of the reinforced soil mass. A berm at the crest of the wall shall be constructed at the end of each workday to prevent rainwater from overtopping the wall. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

B. Care shall be taken not to contaminate the filter fabric, unit fill, blanket drains, chimney drains and/or the drainage composite with poor drainage material such as fine grained silt and clay.

C. Drainage aggregate shall extend one foot behind the back of the masonry block units to alleviate the build up of possible hydrostatic pressure behind the masonry block units.

D. The engineering, design, analysis, detailing and mitigation of surface water control related to the MSE wall shall be the responsibility of the project civil engineer.

E. The engineering, design, analysis, detailing and mitigation of groundwater seepage shall be the collective responsibility of the project geotechnical engineer and MSE wall engineer.

12.01 GENERAL CONSTRUCTION NOTES

A. Construction shall conform to all state and local and manufacturers' requirements.

B. General or grading contractor is responsible for location and protection of underground utilities in the vicinity of the wall and for maintaining safe excavations and working conditions.

C. All utilities located within the reinforced zone are to be installed concurrently with the reinforced backfill placement.

D. All liquid carrying utilities located within the reinforced backfill are to be encased in a drainage aggregate and geotextile filter. All liquid carrying utilities located outside of, but within 100-feet of the reinforced backfill shall be water tight to prevent migration of water into the surrounding soils.

E. Wall elevation views and locations and geometry of existing structures must be verified by the owner or owner's representative prior to construction.

F. Backfill and compact in front of wall prior to exceeding 5.0-feet of wall height.

G. A copy of the design report and the wall drawings should be provided to future owners of the developed property to provide them with a record of the location of the reinforced zone and recommendations regarding permissible construction activities.

13.01 WALL CERTIFICATION

A. A wall certification letter should be submitted at the completion of construction from the wall design engineer of record stating that the wall was designed, constructed, and tested in accordance with the project specifications. A pre-construction meeting should be held by all

parties involved in the design, construction, and testing of the MSE wall(s) to review the design documents and establish roles of responsibility for wall certification.

END OF SECTION

SECTION 323413 – FABRICATED PEDESTRIAN BRIDGES

PART 1 - GENERAL

1.1 GENERAL

A. The work under this section shall consist of constructing the pedestrian bridge structure to the lines, grades and geometric constraints shown on the plans, and in accordance with guidelines of the manufacturer's requirements and recommendations. The work includes designing, furnishing and installing the steel truss, floor beams, stringers, bridge joints, bearings, timber deck and steel railings. All items that are not specifically included in another section are to be considered incidental to this section. Payment shall be included under the Lump Sum price for this section.

B. The bridge shall be a bowstring tubular steel truss with a height from top of deck to top of top chord ranging from 11’-0” to 12’-0”. The bridge will be galvanized and painted with a two-coat system, color FS 17038. The depth of structure shall not result in lower chord elevation (at the north end of the bridge) than what is shown on the plans.

C. All required geometry constraints, as shown on the plans, are to be met. The truss is to have the same layout as shown on the plans. No horizontal braces will be allowed between the top chords, vertical or diagonal members, as shown on the plans.

D. A pre-construction survey shall be performed as indicated on the design plans.

1.2 DESIGN

A. The Contractor shall submit design computations for the prefabricated HSS tubular steel truss to the Engineer for review and approval. The computations shall be prepared in accordance with the latest AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges for the prescribed pedestrian load and H10 truck. Equestrian Load shall not be considered in the design.

PART 2 - PRODUCTS

2.1 BRIDGE TRUSS

A. The truss shall be constructed with painted galvanized steel. Connections shall conform to the requirements of MassDOT Standard Specification section 960.

2.2 BRIDGE DECK

A. The bridge decking shall consist of nominal 3x10 No. 1 or better dense grade Southern Yellow Pine timber treated to a 0.4 pcf retention. The gaps at the end of the bridge between the end of the truss and the abutment backwall shall be covered by extending the timber decking to the curtain wall.

2.3 BRIDGE JOINTS

A. Expansion joints shall be provided on both ends of the bridge and shall comply with ADA requirements. The type of bridge joint shall be chosen by the Truss Fabricator. Bridge joints shall be designed and fabricated to accommodate the anticipated expansion of the final truss superstructure design and any additional criteria that the Truss Fabricator believes will affect the superstructure design.

2.4 STEEL REINFORCEMENT FOR STRUCTURES – EPOXY COATED

A. The work to be performed under this heading shall conform to the requirements of Subsection M8.01 of the MassDOT Standard Specifications and the following:

B. Item 323413 shall include all costs associated with the steel reinforcing as specified on the contract drawings. The price shall include full compensation for all labor, materials, equipment and incidental costs required to complete the work.

C. All reinforcing bars and support devices shall be epoxy coated. 2.5 4000 PSI, 1-1/2", 565 CEMENT CONCRETE

A. The work to be done hereunder shall include construction of the reinforced concrete abutments and curtain walls for the bridge and shall conform to the relevant provisions of the MassDOT Standard Specifications, Section 901, and the following:

B. Bearing seat elevations shown in the Contract Drawings represent an approximate required elevation and can be revised with the approval of the Engineer based on the height requirements of the bridge bearings and truss superstructure, as designed by the Truss Fabricator. The truss low chord elevation shown on the Contract Drawings shall not be lowered. All abutment geometry to be verified by the contractor to meet the requirements shown in the truss shop drawings and anchor bolts shall be placed prior to forming concrete. 2.6 4000 PSI, 3/4", 610

2.5 CEMENT CONCRETE

A. The work to be done hereunder shall include construction of the reinforced concrete abutment backwalls for the bridge and shall conform to the relevant provisions of the Standard Specifications, Section 904, and the following:

B. Backwall geometry shall be verified to meet the requirements of the Truss Fabricator’s joint design. Any embedded elements shall be placed prior to the concrete being cast. No modifications after the backwall is cast will be permitted. If the backwall does not meet the Truss Fabricator’s requirements, full replacement of the backwall may be required, based on the recommendation of the Engineer and will be performed at the Contractor’s expense.

2.7 BEARINGS WITH ANCHOR BOLTS

A. Expansion bearings shall be provided at both ends of the bridge. The type of bearing used at this location shall be chosen by the Truss Fabricator. Bearings shall be designed and fabricated to accommodate the anticipated expansion of the final truss superstructure design and any additional criteria that the Truss Fabricator believes will affect the superstructure design.

B. Bridge bearings should have anchor bolts designed by the Truss Fabricator Anchor bolt design shall conform to the latest version of the AASHTO LRFD Bridge Design Specifications. Bolt type and strength shall conform to the MassDOT 2013 Standard Details, specifying ASTM F1554 Grade A bolts (high strength) and hot dip galvanized in accordance with AASHTO M 232.

2.8 BITUMINOUS DAMP-PROOFING

A. The work under this Item shall conform to the applicable provisions of Section 970 of the MassDOT Standard Specifications and the specific requirements stipulated below for the component parts of this Item. For those component parts where no specific requirement is stipulated under Item 970, the Standard Specification shall apply except for coal tar pitch materials of any type shall not be used.

B. Materials:

1. Primer: Use asphalt for primer according to ASTM D 41.

2. Seal Coat: Use one of the following:

i. Hot-Applied Asphalt Seal Coat. Refer to ASTM D 449, Type I.

ii. Cold-Applied Asphalt Seal Coat. Refer to ASTM D 449, Type I.

iii. Cold-Applied Emulsified Asphalt Seal Coat. Refer to ASTM D 1227, TypeIII.

C. Submittals:

1. Certification: The Contractor shall furnish a notarized Certificate of Compliance that all materials conform to the requirements of this specification.

D. Construction Methods:

1. Bituminous Damp Proofing for Below Grade Concrete Structures shall consist of a primer plus two (2) seal coats (mopped or sprayed). All coats shall be allowed to dry before applying the next coat. All other construction methods shall conform to Section 970.60.

2.9 STEEL BRIDGE RAILS

A. The steel bridge rail fabrication and installation shall conform to the limits as shown on the plans, as directed by the Engineer.

B. Steel bridge rail shall consist of horizontal hand rail with vertical pickets. Bridge rail shall match the color of the truss.

C. The railing shall conform to the requirements of the AASHTO pedestrian code for both pedestrian and bicycle criteria and all applicable requirements of ADA.

D. Galvanized connections, bolts, washers and nuts shall conform to AASHTO M 232.

E. Connection angles shall be galvanized according to AASHTO M 111.

F. Posts for bridge rail shall be set plumb and mounted on to the inside of the steel truss member. Posts shall extend securely from the top of the bridge deck to the required height. In setting the posts, precautions shall be taken to ensure proper offset, alignment and leveling to prevent bending or twisting of the rail.

G. Welded joints shall be used for all rail splices. All connections, screws, bolts, nuts, and washers shall be galvanized and painted to match the truss.

PART 3 - EXECUTION

3.1 FABRICATION & TESTING

A. All HSS Structural Tubes shall conform to the requirements of ASTM A1085 Grade A (50 ksi yield strength) with Supplemental Requirement S1 Heat Treatment and shall be hot-dipped galvanized, with best practices to limit heat related cracking in the corners, and painted in accordance with the Special Provisions below

B. The shop drawings shall indicate Fracture Critical Members (FCM). The AASHTO/AWS Fracture Control Plan of Non-redundant Members contained in AASHTO/AWS D1.5, Section 12, shall be applied to tubular members (HSS members), where required by AASHTO LRFD Articles 6.6.2 and C6.6.2.

C. All welding and preparation and assembly of material for welding of non-FCM tubular steel members shall conform to the latest edition of the ANSI/AWS D1.1 Structural Steel Welding Code. Only low hydrogen filler metal shall be used.

D. All welding and preparation and assembly of materials for welding of FCM designated tubular steel members shall conform to the latest edition of the ANSI/AWS D1.1 Structural Steel Welding Code and the latest ANSI/AASHTO/AWS D1.5 Bridge Welding Code as indicated below:

1. ASTM A1085 shall be added to those standards listed in Article 12.4.1 of AASHTO/AWS D1.5.

2. For the purpose of determining preheat and interpass temperatures, the values for AASHTO M270M/M 270 or ASTM A709 Grade 50 shall be used.

3. For the purposes of Charpy V-notch requirements of the filler metal, the filler material shall be treated as M270 and conform to the requirements of AASHTO/AWS D1.5 Table 12.1.

4. Welding details for cyclically loaded tubular members specified by ANSI/AWS D1.1 shall be used.

5. All welds require qualification using AWS D1.1 Clause 9, Part C E. All welds shall be tested as follows:

1. 100% of all CJP welds for FCM members shall be tested with UT in accordance with AASHTO/AWS D1.5.

2. 100% of all CJP welds in tension or reversal of stress for non-FCM members shall be tested with UT in accordance with AASHTO/AWS D1.5.

3. 25% of all CJP welds in compression shall be tested with UT in accordance with AASHTO/AWS D1.5.

4. 10% of all PJP and fillet weld joining primary members shall be MT in accordance with AASHTO/AWS D1.5.

5. All repair welds of FCM members shall be tested in accordance with Clause 12 of AASHTO/AWS D1.5.

F. Fabricator of prefabricated steel truss bridge shall be certified by American Institute of Steel Construction (AISC) Quality Certification Program for Intermediate Bridges and shall be a MassDOT approved Fabricator.

G. All non-HSS Structural Steel shall conform to AASHTO M 270, Grade 50, and shall be hot-dipped galvanized and painted in conformance with the Special Provisions.

H. Bolts shall conform to the ASTM F3125 Grade A325. Nuts and Washers shall be as recommended by A3125 and shall be hot-dip galvanized or mechanically galvanized and painted in accordance with the Special Provisions.

3.2 ERECTION

A. Complete erection and maintenance instructions shall be provided by the Fabricator.

B. Contractor shall be responsible for the final erection of the structure.

C. A qualified Professional Engineer, registered in the Commonwealth of Massachusetts, from the fabricator, shall be made available to advise the Contractor on site during erection for at least two (2) days. The contractor shall be completely responsible for the expense of the services of the required technical advisor and the bid contract price shall include full compensation for all costs in connection therewith.

D. Trusses too long to be shipped in one piece shall be supplied in two or three pieces that must be field connected with bolts before erection. Field connections shall be made in strict accordance with the plans and written instructions supplied with each truss bridge. All field connections of the trusses must be supervised by a qualified Professional Engineer registered in the Commonwealth of Massachusetts.

E. The Contractor shall be responsible for field touch-up of any galvanized coating and paint that is damaged during shipping and erection

F. The Contractor shall prepare and submit a plan indicating his/her proposed erection procedures and methods to be used including equipment, tools, crane capacity and location, schedule of operations, methods of utility protection, etc., to the Engineer for approval. The requirements for equipment and all procedures utilized shall be in conformance with Subsection 960. of the Standard Specification, and AASHTO LRFD Bridge Construction Specifications. The Erection procedures and any necessary calculations and drawings shall be stamped by a Professional Engineer, registered in the State of North Carolina, certifying that all structural members are suitably braced and supported throughout the erection process. The erection may not commence until the Engineer has given written approval.

G. The Contractor shall not allow debris, tools or incidental equipment of any kind to enter the Middle Fork New River. Proper shielding measures shall be taken to prevent this situation. Any material that accidentally falls into the river shall be removed immediately at the Contractor's expense. The Contractor shall ensure the stability of the structure during placement operations.

3.3 CERTIFICATION

A. All welds shall be tested as follows:

1. All welding shall be completed by certified welders. Copies of certification reports shall be made available on request.

2. All welding procedures and welding materials shall be in compliance with ANSI/AWS D1.1 Structural Steel Welding Code or ANSI/AASHTO/ AWS D1.5M/D1.5 BRIDGE WELDING CODE as appropriate, published by the American Welding Society.

3. All welds shall be visually inspected by qualified inspectors for size, continuity, absence of defects, etc., during the fabrication process.

4. All HSS Structural Tubes shall conform to the requirements of ASTM 1085 including Supplemental Requirement S1 and shall be hot-dipped galvanized and painted as noted.

5. All non-HSS Structural Steel shall conform to AASHTO M 270 grade 50 and shall be hot-dipped galvanized and painted as noted.

6. All connection bolts shall be ASTM F3125 grade A325 hot-dip galvanized high strength bolts.

7. The fabricator's facility shall be open for inspection by The Owner or his/her designated representative at any time during process of manufacture.

3.4 SUBMITTALS

A. In addition to the standard requirements, the following are required to be included in the shop drawing submittal to the engineer. The following submittals shall be stamped by a Professional Structural Engineer Registered in the State of North Carolina. Under no circumstance is any fabrication to begin without prior written approval of the engineer.

B. Calculations Submittals:

1. All calculations for the capacity of the truss. The truss capacity is to be checked for pedestrian loading and the H10 vehicle loading, in accordance with the applicable codes.

2. All calculations for the geometry of the truss. The calculations must also show that all project constraints are met, including conformance with the profile grade line as shown on the drawings and the minimum bottom of truss elevation.

3. All calculations for the design of the deck in accordance with the current AASHTO LRFD Guide for Pedestrian Bridges (for pedestrian loading), current AASHTO LRFD Specification (for H10 loading).

4. All calculations for the design of the bearings, anchor bolts and sole plates, as required, and performed in accordance with the current AASHTO LRFD Guide for Pedestrian Bridges (for pedestrian loading) and current AASHTO LRFD Specification (for H10 loading).

5. All joint calculations for the expansion and contraction of the truss performed in accordance with the current AASHTO LRFD Guide for Pedestrian Bridges (for pedestrian loading) and current AASHTO LRFD Specification (for H10 loading).

6. Anticipated method of assembly shall be provided as well as all dimensions and weights required for the shipment and installation of the truss.

7. Cut sheets are to be provided for all elements that are not standard MassDOT items. Specifically all information shall be provided for the joint system. The joint system shall include the design life expectancy and literature shall be provided to show that the proposed joint system meets this requirement.

END SECTION 323413

SECTION 329200

TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Seeding.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

C. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 INFORMATIONAL SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

B. Product Certificates: For fertilizers, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Accompany each delivery of bulk materials with appropriate certificates.

1.7 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Spring Planting: May 15 to October 15.

2. Fall Planting: October 15 to May 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

2. Sun and Partial Shade: Proportioned by weight as follows:

a. 40 percent Kentucky bluegrass (Poa pratensis).

b. 40 percent chewings red fescue (Festuca rubra variety).

c. 20 percent annual ryegrass (Lolium multiflorm).

2.2 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight, unless otherwise recommended in soil reports from a qualified soil-testing laboratory.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent waterinsoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight, unless otherwise recommended in soil reports from a qualified soil-testing laboratory.

2.3 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

PART 3 - EXECUTION 3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

3.3 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and place a minimum of 4” of topsoil over exposed subgrade. Utilize suitable, on-site topsoil if available. If sufficient topsoil is not available on-site, it shall be imported to site. All grass, weeds, roots, sticks, stones, and other debris are to be removed and the topsoil carefully brought to the finish grade by hand raking. The topsoil shall be sufficiently compacted, by tracking in the material, to prevent significant settlement. Promptly and thoroughly remove topsoil and other materials dropped on pavement surfaces before being compacted by traffic.

B. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

2. Do not use wet seed or seed that is moldy or otherwise damaged.

3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 3 to 4 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2.5 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

3.5 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.

2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches .

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow to a height of 1-1/2 to 2 inches.

D. Turf Postfertilization: Apply commercial fertilizer or slow-release fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.6 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches. Sharonville Fire Station 87 November 2019 B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.7 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.8 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin

maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 60 days from date of planting completion. a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

END OF SECTION 329200

SECTION 329300

TREES, SHRUBS, AND GROUND COVERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes planting trees, shrubs, and ground cover, including mulching, pruning, guying, and staking.

1.2 REFERENCES

A. AAN: American Association of Nureserymen

B. ANSI: American National Standards Institute

1. ANSI Z60.1: Nursery Stock

C. National Arborist Association Standard No. 3

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 329000, Landscape Maintenance

B. Section 329113, Soil Preparation

1.4 SUBMITTALS

A. Certify in writing, within five days of Notice to Proceed, confirmed orders for plants and provide the quantity, location, telephone number, and address of the grower who has agreed to provide any plant material.

B. Submit sample of bark mulch for review 10 days prior to delivery to the work area.

C. Certificates required by law shall accompany shipments. Deliver all certificates to the Port.

1.5 QUALITY ASSURANCE

A. The Contractor shall provide one person who:

1. Directs work performed under this section.

2. Is familiar with the materials and best methods for installation.

3. Is present at all times during execution of work in this section.

B. Government Inspection: Plants and planting material shall meet or exceed the specifications of federal, state and county laws requiring inspection for plant disease and control.

C. Industry Standards:

1. Sizes and Conditions: Quality definitions, grading tolerances and caliper to height ratios shall be no less than minimums specified in American Standards for Nursery Stock, published by American Association of Nurserymen, Inc., ANSI Z60.1.

2. Botanical Names: American Joint Committee on Horticultural Nomenclature, “Standard Plant Names” or “Hortus Third.”

D. The Port may inspect plants and planting materials at a growing or holding site in addition to the work area. Approval of material at a growing or holding site is a qualified endorsement of general quality only, and does not certify compliance with the specifications in all cases. Such approval does not preclude the right of rejection at the work area.

E. Nursery: Unless otherwise approved by the Port, obtain all plants of each type from the same nursery.

1.6 PREPARATION FOR DELIVERY

A. Bare root and balled and burlapped plants shall conform to ANSI Z60.1.

1.7 DELIVERY

A. Deliver fertilizer to the work area in original unopened containers bearing manufacturer’s guaranteed chemical analysis, name, trade name, and trademark.

B. Notify the Port of delivery schedule 24 hours in advance to allow inspection upon arrival at the work area.

C. Remove unacceptable plant material from the work area immediately.

D. Do not deliver more plant materials than can be planted in one week.

E. Protect plants during delivery to prevent damage to root ball or desiccation of leaves.

F. Spray deciduous trees in leaf with anti-desiccant during hot weather (greater than 80°F) with winds exceeding 10 mph, or other conditions that could produce desiccation. Anti-desiccant shall be Wiltproof, or equal, applied to tops and bottoms of leaves per manufacturer’s recommendations.

1.8 STORAGE

A. Heel-in bare-root or balled and burlapped plants immediately upon delivery if not planted within 4 hours.

B. Store plants in shade and protect from harmful weather until planted.

C. Water, maintain, and protect stored material from drying or other injury or damage.

D. Store plants in upright position and allow sufficient ventilation.

1.9 HANDLING

A. Do not pick up containerized or balled plants by stems or trunks.

B. Do not drop plants.

1.10 PROTECTION

A. See Section 015000, Temporary Facilities and Controls, for requirements for location and protection of underground utilities.

B. Barricade or cover excavations as necessary to protect pedestrians, workers, equipment, and adjacent property.

1.11 SITE CONDITIONS

A. Plant after preparation of plant beds and when soil conditions are suitable in accord with locally accepted practice.

B. Planting Conditions: Planting is not permitted under the following conditions, unless otherwise approved:

1. Cold Weather: Less than 32°F.

2. Hot Weather: Greater than 90°F.

3. Wet Weather: Saturated soil.

4. Windy Weather: Wind velocity greater than 20 mph.

C. Irrigation system shall be operational prior to any planting.

1.12 WARRANTY PERIOD

A. The Contractor will not be held responsible for vandalism, theft, atypical weather conditions or hidden peculiarities of work area during the warranty period.

B. Plant materials shall be in healthy condition at end of the warranty period.

C. Remove dead and rejected material within five days of being so directed. Replace as soon as possible.

D. Repair, at no additional cost to the Port, any damage to other plants or other property caused by the Contractor during replacement of plant materials during the warranty period.

PART 2 - PRODUCTS

2.1 GENERAL PLANT REQUIREMENTS

A. Quality and Size:

1. Provide healthy nursery stock, well branched and rooted, full foliaged when in leaf, healthy, sound, vigorous, and free from insects, diseases, weeds, weed roots, injuries, and defects such as knots, sun-scald, windburn, abrasions, or disfigurement, equal to or exceeding measurements specified in plant list.

2. Provide trees that are well shaped and properly pruned with normal branching configurations. Trees of the same species and size shall be headed to the same height unless noted otherwise.

3. Sizes and methods of handling shall be according to the American Standard for Nursery Stock recommended by the AAN.

4. Trees approved by the Port to be planted without the required tree wrap shall be marked with a small white dot of paint 12 inches from the ground at the nursery, on the true southern growing exposure. Trees not marked shall be wrapped.

B. Root Protection:

1. Shrubs and trees over 1 1/2-inch caliper shall be balled and burlapped or grown in the container in which they are delivered for a minimum of nine months.

2. Furnish small, container-grown plants in removable containers or integral peat pots, well rooted to ensure healthy growth.

3. Container-grown plants shall be in containers from six months to two years prior to delivery, with roots filling container but not root bound.

4. Greenhouse plants shall be acclimated outdoors for 30 days prior to delivery.

5. Bare-root stock shall have well-branched, fibrous root systems.

C. Trees shall be well-branched, with straight single leaders, tops, and trunks; no cross branches, dead or broken leaders or major branches; no fresh cuts over 1-inch diameter; and not “topped” or sheared. Grafted trees shall be base grafted or base budded, unless indicated otherwise.

2.2 PLANTING SOIL MATERIALS

A. Prepared soil mix for pocket planting shrubs and trees shall be two parts by volume of soil from pit thoroughly mixed with one part by volume of yard debris compost.

B. Bark mulch shall be standard commercial produce, medium-coarse ground bark mulch. Bark shall be ground red fir of uniform color, free from weeds, seed, sawdust, and splinters and shall not contain resin, tannin, wood fiber or other compounds detrimental to plant life. Source shall be from freshwater mill.

C. Fertilizer for trees shall be plant tablets 20-10-5, 21-gram size.

D. Fertilizer for ground cover shall be plant tablets 20-10-5, 10-gram size.

2.3 TREE SUPPORTS

A. Wood stakes shall be 2-inch round by 8 feet, Douglas fir, construction grade.

B. Guying materials shall include 1/4 inch steel cable, U-bolt fastener, rubber hose at tree crotch, 2 inches by 4 inches by 30 inches pressure-treated Douglas fir stakes and 1 inch diameter by 18 inches long white PVC pipe at base of each cable.

C. Tree ties shall be Chainlock or equal.

D. Provide approved safety flagging for guy wires.

2.4 TREE WRAP

A. Corrugated or crepe paper, designed specifically to resist insect infestation and sun scald.

2.5 SELECTIVE HERBICIDE

A. Selective pre-emergence, surface-applied herbicide shall be Devrinol, Surflan, or equal.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate pits for trees and shrubs as indicated in details and consistent with accepted horticultural practices.

B. Provide rough, not smooth, walls in planting pits.

C. Immediately notify the Port if an unusual condition is encountered which appears detrimental to the new planting.

3.2 PLANTING TREES AND SHRUBS

A. Field place trees and shrubs in locations shown on the drawings. If plants are marked with southern orientation, place same as grown in nursery. Placement shall meet approval of the Port prior to backfilling. The Port may request rotation of trees or shrubs to give a better appearance with respect to adjacent plants and structures.

B. Excavate pit two times the width and 6 inches deeper than root ball or container.

C. Place 6-inch minimum firmly compacted layer of prepared planting soil under root system of trees.

D. Plant upright and plumb.

E. Tamp sufficient prepared soil mix under plants to bring top of root ball [2 inches above level of] [to the level of] finished soil subsurface.

F. When setting balled plants, loosen and remove twine or wire binding and burlap from top two thirds of root balls after setting in pit. Do not pull wrapping from under ball. Do not plant if ball is cracked or broken. Remove all synthetic twine and wire cages.

G. When setting container grown plants, carefully remove from container without injury or damage. Superficially cut edge roots on three sides with knife. Do not plant if root ball breaks or loosens.

H. Backfill pit with prepared soil mix until 2/3 full and thoroughly mud-in each tree with water.

I. When pit is 2/3 full, insert fertilizer tablets evenly around perimeter of root balls of trees and shrubs.

1. For trees, insert 6 tablets, plus one per foot of tree height, to a maximum of 12 for each tree.

2. For 5-gallon size shrubs, insert 4 tablets.

3. For 1- to 5-gallon size shrubs, insert 2 tablets.

4. For ground cover, insert 1 tablet per plant.

J. Place and compact prepared soil mix carefully to avoid injury to roots, filling all voids.

K. When soil settles, fill pit with soil mix and water again.

L. Initial watering-in of trees by underground sprinkler system will not be permitted.

M. Hose down planted areas with fine water spray to wash leaves of plants if required.

N. Remove tags from plants.

3.3 HERBICIDE

A. Apply herbicide in planting areas per manufacturer's recommendations.

3.4 MULCH

A. Apply 2-inch layer of bark mulch over a properly cleaned and graded subsurface.

B. Around trees and shrubs, apply within two days after planting.

C. In ground cover areas, apply prior to planting.

3.5 PLANTING GROUND COVER

A. See Section 329113 for preparation of soil prior to applying herbicide and bark mulch.

B. Apply herbicide and mulch as specified above.

C. Plant ground cover in areas shown on the drawings.

D. Plant ground cover deep enough so that plant roots are embedded in soil.

E. Insert one fertilizer tablet adjacent to each plant when backfilling is halfway complete. Locate one inch from roots and at mid-depth.

3.6 WRAPPING AND INSTALLATION OF SUPPORTS

A. Wrap trees promptly after planting to prevent sun scald. Wrap as approved by American Association of Nurserymen. Wrap spirally from ground line to the height of the first branch. Wrap in neat and snug manner and secure with tape at bottom, top, and in the middle. Wrap before staking or guying.

B. Stake deciduous trees up to 2 1/2-inch caliper. Stake from three directions.

C. Guy deciduous trees larger than 2 1/2-inch caliper and guy all evergreen trees. Guy from three directions. Provide guying the same day trees are planted.

D. Install with an angle of approximately 120 degrees between guys or stakes.

3.7 FIELD PRUNING

A. Prune trees and shrubs to remove damaged branches, dead wood, and suckers to improve natural shape. Prune per National Arborist Association Standard No. 3.

3.8 ADJUSTMENT AND CLEANING

A. Remove and replace plants or materials not meeting specified standards.

B. Reinstall plants not located as indicated on the drawings.

C. Keep the work area clean during progress of the work until completion.

3.9 MAINTENANCE

A. Irrigate when necessary to avoid drying out of plant materials and to promote healthy growth, until date of substantial completion.

B. See Section 329000 for one-year maintenance program.

END OF SECTION 329300

SECTION 330500

COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Sleeves.
4. Identification devices.
5. Grout.
6. Flowable fill.
7. Piped utility demolition.
8. Piping system common requirements.
9. Equipment installation common requirements.
10. Painting.
11. Concrete bases.
12. Metal supports and anchorages.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic

1.4 SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.

2. Identification devices.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. As required, coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Division 03

PART 2 - PRODUCTS

2.1 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other Division 33 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.

2. Location: Accessible and visible.

C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.

1. Material: Brass.

2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, colorcoded, pressure-sensitive-vinyl type with permanent adhesive.

F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

H. Lettering: Manufacturer's standard preprinted captions as selected by Engineer.

I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, selfadhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.

2. Color: Comply with ASME A13.1, unless otherwise indicated.

K. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch thick, polished brass or aluminum.

2. Material: 0.0375-inch thick stainless steel.

3. Material: 3/32-inch thick plastic laminate with 2 black surfaces and a white inner layer.

4. Material: Valve manufacturer's standard solid plastic.

5. Size: 1-1/2 inches in diameter, unless otherwise indicated.

6. Shape: As indicated for each piping system.

L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.

2. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.

3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.

2. Yellow: Heating equipment and components.

3. Brown: Energy reclamation equipment and components.

4. Blue: Equipment and components that do not meet criteria above.

5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.

6. Terminology: Match schedules as closely as possible. Include the following:

a. Name and plan number.

b. Equipment service.

c. Design capacity.

d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3-1/4 by 5-5/8 inches.

2. Fasteners: Brass grommets and wire.

3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.2 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulicccement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged. 2.3 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.

2. Density: 115- to 145-lb/cu. Ft

3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.

4. Aggregates: ASTM C 33, natural sand, fine.

5. Admixture: ASTM C 618, fly-ash mineral.

6. Water: Comply with ASTM C 94.

7. Strength: 100 to 200 psig at 28 days.

PART 3 – EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.

3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.

5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Install dielectric fittings at connections of dissimilar metal pipes.

3.3 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.4 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Division 09 painting Sections.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.

2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.

3. Locate pipe markers on exposed piping according to the following:

a. Near each valve and control device.

b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.

c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.

d. At manholes and similar access points that permit view of concealed piping.

e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.

2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "[Cast-in-Place Concrete] [Miscellaneous Cast-in-Place Concrete]"

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 33050

SECTION 332660

WATER PIPE AND APPURTENANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Where specific standards are referenced within this document, the most current specification and/or latest revision shall apply.

1.2 SUMMARY

A. Section includes:

1. Pipe and fittings.
2. Valves and appurtenances.
3. Fire hydrants.
4. Manhole sections and appurtenances.
5. Transition couplings

1.3 SCOPE OF WORK

A. Furnish all labor, equipment, materials and incidentals necessary to install and complete installation of potable water lines and appurtenances in accordance with the plans. All pipe and appurtenance material shall be of the type and class specified herein.

B. All pipeline and appurtenance excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

1.4 DEFINITIONS

A. ANSI – American National Standards Institute

B. API – American Petroleum Institute

C. ASTM – American Society for Testing and Materials

D. AWWA – American Water Works Association

E. DIP – Ductile Iron Pipe

F. HDD – Horizontal Directional Drilling

G. HDPE – High Density Polyethylene

H. LB – Pound

I. MSS – Manufacturer's Standardization Society

J. NFPA – National Fire Protection Association

K. NSF – National Sanitation Foundation

L. PE – Polyethylene

M. PPM – Parts Per Million

N. PSI – Pounds per Square Inch

O. PVC – Polyvinyl Chloride

1.5 SUBMITTALS

A. All submittals shall be in accordance with the requirements of Division 1 of these specifications.

B. Shop drawings or submittals shall be required for the following:

1. All sizes and types of pipe.
2. All pipe fittings, valves and appurtenances.
3. All manholes and vaults
4. All transition couplings.
5. Wiring Diagrams: Power, signal, and control wiring for alarms.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Operation and Maintenance Data: For specialties valves and appurtenances to include in emergency, operation, and maintenance manuals.

1.6 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall coordinate material deliveries with the manufacturer/supplier. All materials shall be handled and stored in accordance with the manufacturer's recommendations using methods that will prevent damage to the materials.

B. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.
4. Protect pipe from vehicle exhaust by covering pipe materials with tarps.

C. The Contractor shall unload pipe so as to avoid deformation or other injury thereto. Pipe shall not be placed within pipe of a large size and shall not be rolled or dragged over gravel or rock during handling. If any defective material is discovered after installation, it shall be removed and replaced with sound pipe or shall be repaired by the Contractor in an approved manner and at his own expense.

D. The Contractor shall store all pipe and appurtenances on sills above storm drainage level and deliver for laying after the trench is excavated. Do not store any plastic materials in direct sunlight. All plastic materials shall be supported to prevent sagging and bending. All plastic materials shall also be covered with tarps if exposed to the elements for extended periods of time.

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

F. Handle all materials in accordance with the manufacturer's written instructions.

G. When any material is damaged during transporting, unloading, handling or storing, the undamaged portions may be used as needed, or, if damaged sufficiently, the Engineer will reject the material as being unfit for installation.

1.7 PROJECT CONDITIONS

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

1. Notify Engineer and utility Owner no fewer than 72 hours in advance of proposed interruption of service.

2. Do not proceed with interruption of water-distribution service without utility Owner’s written permission.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with all requirements of utility Owner supplying water including the tapping of water mains and backflow prevention.

2. Comply with all standards of authorities having jurisdiction for potable water service piping, including materials, installation, testing, and disinfection.

3. Comply with standards of authorities having jurisdiction for fire suppression water service piping, including materials, hose threads, installation, and testing.

B. All piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

E. NSF Compliance:

1. As applicable, comply with NSF 14 for plastic potable-water-service piping, including marking "NSF-pw" on piping.

2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water. February 2014 Project # 332660 – Page 5

1.9 COORDINATION

A. Coordinate any connections to the existing water distribution system with utility Owner.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

A. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs, and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Engineer at the plant, trench, or other point of delivery, for the purpose of culling and rejecting material which does not conform to the requirements of these specifications. Such material shall be marked by the Engineer, and the Contractor shall remove it from the project site upon notice being received of its rejection.

B. As particular specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding specifications under a new number, except provisions in revised specifications which are clearly inapplicable.

2.2 DUCTILE-IRON PIPE

A. Ductile Iron Pipe shall be manufactured in accordance with AWWA C151. All Ductile Iron Pipe shall be Class 350 unless otherwise specified and shall be lined with a cement mortar lining not less than 1/16” thick conforming to AWWA C104. Pipe wall thickness for all Ductile Iron Pipe shall conform to “Thickness Design for Ductile Iron Pipe,” AWWA C150. The standard laying condition shall be type 2. The exterior of all Ductile Iron Pipe shall have a protective coating of a coal tar or asphaltic material a minimum of 1 mil thickness conforming to AWWA C151. Ductile Iron Pipe larger than 12” in diameter that are to be field cut shall be gauged full length. Flanged Ductile Iron Pipe and any Ductile Iron Pipe that is to be coated in the field shall have a shop applied primer compatible with the field installed coating system.

B. Slip-Joint Ductile Iron Pipe:

1. Bells of “slip” joint pipe shall be contoured to receive a bulb-shaped circular rubber gasket, and plain ends shall have a slight taper to facilitate installation.

The gasket and associated lubricant shall be furnished by the pipe manufacturer and shall be manufactured in accordance with ANSI Specification.

2. The jointing shall be done by guiding the plain end into the bell until contact is made with the gasket and by exerting a sufficient compressive force to drive the joint home until plain end makes full contact with the base of the bell. In force main installations, no joint may exceed a maximum deflection of 11 inches in an 18-foot joint of pipe (3 degrees).

C. Mechanical-Joint Ductile Iron Pipe:

1. All mechanical joint pipe shall be manufactured in accordance with AWWA C111. Pipe shall be manufactured in accordance with AWWA C151, and the pipe thickness shall be Class 350 as determined by AWWA C150 unless otherwise noted.

2. All bolts shall be tightened by means of torque wrenches in such a manner that the follower shall be brought up toward the pipe evenly. If effective sealing is not obtained by tightening the bolts to the specified torques, the joint shall be disassembled and reassembled after thorough cleaning.

3. Bolts for mechanical joints shall be high grade steel, low alloy type, with tee or hex head and American Standard threads. Mechanical joint gland shall be gray iron and shall utilize a plain rubber gasket.

D. Flanged-Joint Ductile Iron Pipe:

1. Flanged pipe shall have flanges with long hubs, shop fitted on the threaded end of the pipe.

2. Where required, flanges shall be tapped for stud bolts. Flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true, and covered with coal tar pipe varnish or otherwise protected against corrosion of flange faces. Flange faces shall be cleaned to bare metal with wire brushed before installation of pipe.

3. Ductile iron flanged joint pipe shall have a thickness of Class 53 minimum and shall conform to AWWA C110 and AWWA C115. All pipe shall have Class 125 flanges conforming to AWWA C110 unless otherwise specified.

4. Flanged joints shall be made up with through bolts of the required size. Bolts shall be zinc plated, with good and sound, well-fitting threads, so that the nuts may be turned freely by hand.

5. Flanged joints shall be made up using only full face gaskets with a minimum thickness of 1/8-inch. Ring gaskets are not acceptable. Gasket material shall be rubber or approved equal as recommended by the Manufacturer.

6. Connecting flanges shall be in proper alignment and no external force shall be used to bring them together.

7. Field installed flanges shall be EBAA Series 1000 E-Z flange or equal. Restraint set screws must be tightened by use of a torque wrench per the manufacturer's instructions.

E. Restrained Push-on Joint Ductile Iron Pipe

1. Restrained joints shall be manufactured in accordance with ANSI/AWWA C111/A21.11. 2. Restrained push joints (positive locking segments) shall be American "Flex-Ring," or "Lok-Ring"; Clow "Super-Lock"; U.S. Pipe "TR Flex"; or Griffin "Snap-Lok." Use of setscrews bearing on the pipe wall will not be acceptable. 3. Restrained push joints (gaskets with stainless steel gripping segments) shall be U.S. Pipe "Field Lok 350 Gasket," or American "Fast Grip." 4. Restrained push joints (locking wedge type) shall be EBAA Iron "Megalug" Series 1700, Tyton "TR Flex Gripper Ring," or American "Field Flex Ring," without exception. F. Restrained Mechanical Joint Ductile Iron Pipe 1. Restrained mechanical joints shall be manufactured in accordance with ANSI/AWWA C111/A21.11.

2. Restrained mechanical joints (factory prepared spigot) shall be American "MJ coupled Joints," or Griffin "Bolt-Lok" or "Mech-Lok."

3. Restrained mechanical joints (field cut spigot) shall be manufactured in accordance with AWWA C151 and shall be EBAA Iron "Megalug" Series 1100 or equal.

2.3 POLYVINYL CHLORIDE PIPE

A. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs, and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Engineer at the plant, trench, or other point of delivery, for the purpose of culling and rejecting material which does not conform to the requirements of these specifications. Such material shall be marked by the Engineer, and the Contractor shall remove it from the project site upon notice being received of its rejection.

B. As specific specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding February 2014 Project # 332660 – Page 8 specifications under a new number, except provisions in revised specifications which are clearly inapplicable.

C. PVC pipe 4 inches in diameter and larger shall be manufactured in accordance with AWWA C900. All Pressure Rated PVC Pipe 3 inches diameter and smaller shall be manufactured in accordance with ASTM D2241 and have a standard dimension ratio (SDR) of 13.5 unless otherwise specified. All other Pressure Rated PVC Pipe shall have a minimum standard dimension ratio (DR) of 18 unless otherwise specified. The exterior of all PVC Pipe shall bear a stamp which shows the AWWA certification, SDR, size and NSF seal.

1. All PVC pipes 4-inches and larger in diameter shall have slip or "push-on" joints which are manufactured in accordance with AWWA C900. All PVC pipes 3-

inches and smaller in diameter shall have slip or "push-on” joints which are manufactured in accordance with AWWA C151. All pipes shall have a bell with integral rubber gasket.

2. Bells of "slip" joint pipe shall be contoured to receive a bulb shaped circular rubber gasket, and plain ends shall have a slight taper to facilitate installation. The lubricant used in making up the joints shall be furnished by the pipe manufacturer and shall be NSF approved. The jointing shall be done by guiding the plain end into the bell until contact is made with the gasket and by exerting a sufficient compressive force to drive the joint home until the assembly mark on the pipe barrel is flush with the end of the bell. No joint may exceed a maximum deflection of 11 inches in an 18- foot joint of pipe (3 degrees).

2.4 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

A. High-density polyethylene pipe may be used in the horizontal directional drilling of water distribution piping as indicated on the project drawings. Piping shall be extruded from a polyethylene compound and shall conform to the following requirements:

1. The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 3408 material with a cell classification of 335434C or better.

2. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration not less than 2 percent.

3. The maximum allowable hoop stress shall be 800 PSI at 73.4 degrees Fahrenheit.

4. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.

5. The pipe and bends shall have a minimum standard dimension ratio (SDR) wall thickness as specified by the Engineer. 6. Joining shall be performed by thermal butt-fusion in accordance with the manufacturer’s recommendations. 2.5 FITTINGS

A. All fittings for any type of water piping shall be ductile iron mechanical joint type in accordance with AWWA C153 (ductile iron, compact type) for 3 inch through 24 inch diameter fittings and AWWA C110 (ductile iron, full body type) for pipe diameters larger than 24 inches. Where flanged pipe is used ductile iron fittings shall be flanged in accordance with AWWA C153 or C110 where applicable for exposed piping. All flanges shall be Class 125 unless otherwise noted.

B. All fittings shall be lined with cement mortar not less than 1/16-inch thick in conformance with AWWA C104 and suitable for a minimum of 250 PSI working pressure unless otherwise specified.

C. All mechanical joints shall be manufactured in accordance with AWWA C111. The Contractor shall provide suitable 3-inch plugs with stainless steel threaded nipples and sleeves for connection of fittings for PVC pipe 2 inches in diameter and smaller.

D. Restraint devices for mechanical joint pipe for nominal pipe sizes 3-inch through 48-inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10. The devices shall have a working pressure rating of 350 psi for 3 through 16-inch and 250 psi for 18 through 48-inch. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes.

2.5 POLYETHLENE SERVICE PIPE

A. Polyethylene Tubing: Polyethylene water service tubing shall be manufactured in accordance with ASTM D-2737, using PE 3408 resin (ASTM D-1248, Type III, Class 5, Grade P34).

B. Polyethylene water service tubing shall be SDR-9, 200 psi pressure rating and shall comply with AWWA C-901 and NSF 14.

ULTRA-PURE® 4710

Silver-Line's Ultra-Pure® HDPE can be used as a water service line from meter or well to the house. Ultra-Pure® HDPE i made from 4710 material and conforms to ASTM D-2737. Its advantages are: resistance to environmental stress cracks chemical resistance, ductility, and toughness.

Ultra-Pure® Blue 4710 CTS SDR 9

Standard Compliances:

- ASTM D-2737, standard for pressure rated SDR polyethylene (NSF®-pw-G)

Material complies with ANSI / NSF® Standard 14 & 61
Made from PE 4710 material
Indent Print Color: White

ULTRA-PURE® BLUE CTS SDR 9

Nominal Size	Part # Series	Inside Diameter (Value)	Outside Diameter	Min. Wall Thickness	Max Working Pressure at 73° F	Wt/100'	Coil Lengths Available 100	200	300	500
3/4"	22	0.677	0.875	0.097	250 PSI	10	X		X	X
1"	22	0.870	1.125	0.125	250 PSI	17	X	X	X	X
1-1/4"	22	1.063	1.375	0.153	250 PSI	26	X		X	X
1-1/2"	22	1.256	1.625	0.181	250 PSI	36	X		X	X
2"	22	1.644	2.125	0.236	250 PSI	61	X	X	X	X

2.6 GASKETS

A. All rubber gaskets for DIP and PVC pipe and fittings shall be in accordance with AWWA C111. All gaskets shall be a product of the pipe manufacturer, made specifically for the pipe being installed, and shall match the shape and configuration of the joint.

2.7 WATER SERVICE PIPE AND APPURTENANCES

A. All water service piping shall be constructed of Type "K" flexible copper tubing in accordance with ASTM B 88 or SDR 9 HDPE as described above.

B. All fittings utilized for copper tubing shall be pressure-seal (compression-type) fittings.

C. Corporation stops shall be constructed of brass.

D. Meter boxes shall be of round style and made of Polyvinyl Chloride Plastic with a minimum wall thickness of 0.375 inches. Meter box shall be sized to accept a 5/8-inch water meter and shall have a minimum inside diameter of 18 inches with a 30-inch depth. Meter box shall have a non-locking cast iron lid.

E. The inlet and outlet pipes that pass through the box wall shall be brass and shall be locked in place with brass hex nuts on straight external pipe threads. The inlet and outlet of these nipples shall have external tapered pipe threads and shall be protected by Polyethylene Cap Plugs. An In-Line quarter turn shut off valve with internal tapered pipe thread inlet and water meter coupling outlet shall be used upstream of the water meter. The valves shall be soft seating with a padlock wing. The valves internal components shall be removable from the top of the valve body. An In-Line Dual Check Valve with independent acting checks shall be used downstream of the water meter. The check valve shall have a meter coupling inlet and shall be contained inside the box. The internal parts of the check valve shall be removable without disconnecting the check valve the outlet piping. All brass materials used in contact with the water shall have a minimum copper content of 80 percent and a maximum zinc content of 10 percent.

2.8 GATE VALVES

A. All gate valves shall be designed for a minimum working pressure of 250 PSI unless otherwise specified. Valves shall have a clear waterway equal to the full nominal diameter of the pipe. Valves shall be opened by turning counterclockwise. Each valve shall have the initials or name of the maker, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by hydraulic pressure equal to twice the specified working pressure. Valves shall be operated by handwheel for above ground installations or 2-inch square operating nut for below ground installations. Valves shall have an arrow cast in the metal indicating the direction of opening.

B. All valves to be installed underground (buried) shall be of the non-rising stem type and shall have mechanical joint connections.

C. All valves installed above ground or in structures shall have rising stems with outside stem and yoke and 18-inch diameter minimum hand wheel and shall have flanged ends with Class 125 flanges unless others noted.

D. Valves 1-1/2-inches and Smaller:

1. Valves 1-1/2 inches and smaller in diameter shall be full port, quarter turn ball valves suitable for underground installation. February 2014 Project # 332660 – Page 11

2. Valves shall have a forged brass body, adjustable packing, and threaded ends conforming to NPT standards.

3. Valves shall be manufactured in accordance with MSS-SP-110.

E. Resilient Seated Wedge Valves:

1. Gate valves 2 inches through 24 inches in diameter size shall be of cast iron or ductile iron body, resilient seated wedge type meeting the requirements set forth in AWWA C-509. All valves shall be from one manufacturer and parts interchangeable.

2. Gate valves shall have body, bonnet and gate manufactured of cast iron or ductile iron conforming to ASTM A-536. The shell thickness of all components shall conform to the thicknesses in Table 2, Section 4.4 of AWWA C-509. The valve body and bonnet shall be coated on both the interior and exterior surfaces with a fusion bonded epoxy paint conforming to AWWA C-550.

3. The gate shall be fully covered with a rubber cover over all exterior and interior ferrous surfaces. The rubber shall be securely bonded to the gate body, including the part which houses the stem nut. The gate and rubber coat shall conform to ASTM D429.

4. Valve stems shall be cast bronze. The stuffing box shall use “O”-ring seal type with two rings located above the thrust collar. The rings shall be replaceable with the valve fully open and under pressure.

5. Valves larger than 12 inches in diameter shall be designed for horizontal installation with beveled gear boxes with reduction gears to reduce the number of turns required to operate valve.

F. Double Disc Type Gate Valves:

1. Gate valves larger than 24 inches in diameter shall be of the ductile iron body, double disc parallel seat type meeting the requirements set forth in AWWA C-500. All valves shall be from one manufacturer and parts interchangeable. Valves shall have a working pressure of 150 PSI.

2. Gate valves shall have body, bonnet and gate manufactured of ductile iron conforming to ASTM A-536. The shell thickness of all components shall conform to the thicknesses in C-500. The valve body and bonnet shall be coated on both the interior and exterior surfaces.

3. The gates shall be high strength cast iron, sturdily proportioned without pockets on the backs. All cam surfaces shall open to the bottom. Gate rings shall be rolled into a dovetail groove under pressure to make a single insertable finish.

4. Valves shall use bottom wedging type design with a two part floating wedge contact. The wedge and hook shall be separate castings and not a single piece.

5. Valve stems shall be cast bronze. The stuffing box shall use “O”-ring seal type with two rings located above the thrust collar. The rings shall be replaceable with the valve fully open and under pressure.

6. Valves shall be designed for horizontal installation with beveled gear boxes with reduction gears to reduce the number of turns required to operate valve. Valves shall have bronze rollers, tracks, and scrapers.

7. All valves shall be supplied with a bypass as a part of the valve. Bypass shall be a minimum of 3 inches in diameter with a 3-inch resilient seated wedge valve.

2.9 BUTTERFLY VALVES

A. Valve shall be designed, manufactured, and tested in accordance with AWWA C504, latest revision, and include the following design features. Valve shall be rated and tested for absolute, zero leakage shut-off.

B. Valve body shall be cast iron per ASTM A 126 Class B or ductile iron per ASTM A536 Grade 65-45-12. Flanged end valves shall be faced and drilled per ANSI B16.1, Class 125, or as specified by purchaser. Mechanical joint ends shall be per ANSI A21.11 and include mechanical joint end accessories. Valve body shall include a stainless steel seat ring that is mechanically retained without use of clamping devices, adjusting segments, or other hardware being in the waterway.

C. Valve disc shall be solid type ductile iron without any external vanes, ribs, etc., to obstruct flow. Resilient seat shall be located on edge of disc, offset from the shaft, and seal against mating stainless steel body seat with 360 degree uninterrupted contact. The resilient seal shall be locked to the disc by three separate means of retention, and be field-adjustable, if necessary, with no tools other than a standard socket wrench. Replacement of seat in field shall be possible without valve disassembly. The disc shall be connected to the offset stainless steel shaft by locked taper wedge keys and stainless steel retaining nuts on the back side of the disc. Taper keys shall be heat treated 416 Stainless Steel for added strength. Shaft shall be stub type for valves 30 inches and larger in diameter; one piece for valves 24 inches in diameter and smaller. The valve shall be equipped with adjustable thruster for centering the disc on valves 30 inches and larger in diameter, if required.

D. Shaft shall have nylon sleeve or woven Teflon fiberglassed backed sleeve for bearing surfaces. Bearings shall be self-lubricating

E. Valve body shall be primed with manufacturer's standard primer.

F. Butterfly valves shall be manufactured by Val-Matic, DeZurik, Pratt, or Mueller.

2.10 VALVE BOXES

A. All valve boxes shall be cast iron and shall conform to ASTM A48 and AWWA M44. Valve boxes shall be of the adjustable screw type (based on depth of burial) with a base to fit the valve yoke with a removable cover with the word "WATER" cast thereon.

2.11 FIRE HYDRANTS

A. Fire hydrants shall comply with all of the applicable requirements of the AWWA C502, latest revision, for dry-barrel fire hydrants and with these specifications. Hydrants shall be of the traffic model type incorporating a break-away flange arrangement which will permit the upper section of the hydrant barrel to separate from the lower section upon impact. Each hydrant shall include an automatic system designed to lubricate the entire length of the threaded part of the valve stem each time the hydrant is operated. It shall

be further equipped with “O”-ring seals to insure that threads on the valve stem do not come into contact with water at any time.

B. Hydrants shall open counterclockwise with 4-1/2-inch diameter compression base valve opening against pressure and be capable of withstanding 250 PSI working pressures and 500 PSI hydrostatic test pressures, unless otherwise specified. The pentagonal operating nut shall be 1-1/2 inches from the point to the flat. Hydrants shall be equipped with one (1) 4-1/2-inch diameter pumper nozzle and two (2) 2-1/2-inch diameter hose nozzles, all with National Standard Threads per Appendix A of AWWA C502, and chained nozzle caps. Nozzles shall be reverse threaded into the fire hydrant barrel.

C. Unless otherwise indicated on the plans, all hydrants shall have 6-inch diameter mechanical joint bottom connections, 4-1/2-inch diameter valve openings and a bury to the bottom of the ditch plus the main line diameter. All hydrants shall be painted the manufacturer's standard red unless otherwise specified. Following installation and testing all hydrants shall be painted with two (2) 6-mil coats of epoxy paint.

D. All iron parts within fire hydrants shall be ductile iron.

E. The bury length (distance from ground line to insert of the hydrant inlet) shall be 4’-0” unless ground conditions shown on plans warrant a deeper bury.

F. The hydrant main valve shall be 4-1/2 inches minimum in diameter and shall be of the full compression design, opening against and closing with pressure. The February 2014 Project # 332660 – Page 14 valve seat ring shall thread into a bronze sub-seat, and all gaskets sealing the seat ring shall be a bronze-to-bronze surface.

G. Drain valves shall be all bronze and allow complete draining of all residual water in the hydrant barrel.

H. All bolting and fasteners below ground shall be stainless steel.

I. The operating machine shall utilize two (2) “O”-ring seals between the revolving nut and bronze-sheathed upper section of the valve rod. The top of the rod shall also be fitted with a travel stop nut to limit downward travel of the rod. Allweather grease shall be used to provide permanent lubrication. A thermoplastic thrust washer shall be used to reduce friction in the thrust collar while opening the hydrant.

J. The hydrant inlet shall be mechanical joint. Joint restraint, if specified, shall be accomplished for mechanical joint by use of mechanical joint gripper glands.

2.12 AIR RELIEF VALVES

A. Air relief valves shall be hydromechanical devices which automatically release to atmosphere small amounts of accumulated air within the water distribution piping system. Once the air has been exhausted, the valve shall seat tightly to prevent water leakage.

B. All valves shall have cast iron bodies and be manufactured in accordance with AWWA C512. Air relief valves shall be rated for a working pressure of 150 PSI and hydrostatic test pressure of 300 PSI.

2.13 TAPPING SLEEVES AND VALVES

A. Tapping sleeves shall consist of two piece split ductile iron, jointed by bolts manufactured of high strength cast iron and incorporating a longitudinal compound rubber gasket. The sleeves shall include split end gasket and two piece mechanical joint glands suitable for the class of pipe around which sleeves are to be placed. Glands will be joined by steel bolts and fastened to the bell openings of the sleeves to form totally enclosed rubber water tight seals around the periphery of the pipe and along the longitudinal joints.

B. The sleeves shall have flanged outlets which will accommodate the tapping valves. Valves will be identical to resilient wedge gate valves elsewhere specified with inlet and outlet ends adaptable to the tapping machine and to provide mechanical joint connections to discharge pipes.

2.14 AIR-CUSHIONED SWING CHECK VALVES

A. The valve shall have a heavy duty body shall be constructed of high-strength cast iron conforming to ASTM A126 Class B with integral flanges, faced and drilled per ANSI B16.1 Class 125 and be suitable for horizontal or vertical installation.

B. The valve body shall be the full waterway type, designed to provide a net flow area not less than the nominal inlet pipe size when swung open no more than 25 degrees. The body seat ring shall be replaceable and shall be constructed of stainless steel only. The stainless steel ring shall be mechanically retained by means of roll pins or stainless steel cap screws.

C. The valve disc shall be constructed of cast iron per ASTM A126 Class B and be attached to the disc arm by means of a single center pin permitting 360-degree articulation. The disc shall present a convex surface to the direction of flow to compensate for oscillation.

D. The disc arm shall be ductile iron or steel, suspended from and keyed to an austenitic stainless steel shaft which is completely above the waterway and supported at each end by heavy bronze bushings. The shaft shall rotate freely without the need for external lubrication. The shaft shall be sealed where it passes through the body by means of a stuffing box and adjustable packing. Simple O-ring shaft seals are not acceptable. Hinge shafts shall be constructed of 316 stainless steel

E. The valve shall be supplied with an outside lever and adjustable counterweight to initiate valve closure. Final closure shall be dampened by means of a single, side-mounted bronze air-cushion assembly directly mounted to the valve body on machined pads. The amount of cushioning shall be easily adjustable without the need for pre-charged air chambers. Commercial air cylinders, which pivot and/or are attached with fabricated brackets, are not acceptable.

F. The valve shall be GA Industries, Inc. Figure 250-DS or approval equal.

2.15 ALTITUDE CONTROL VALVES

A. Altitude control valves shall be hydraulically operated, pilot actuated diaphragm type globe or angle valve designed for ground level control of water in an elevated storage tank and reservoirs. The valve operates on a differential in pressure between the height of the water in the reservoir and an adjustable spring loaded pilot control. The valve is to be non-throttling and will remain in the full open position until the shut-off point is reached.

B. The valve shall be constructed with a cast iron body (ASTM A126) with stainless steel stem or shaft and spring, bronze seat (ring) and upper stem bushing, nylon reinforced diaphragms, bronze valve control pilots with stainless steel and Buna-N internal parts. It shall be designed for an internal working pressure of 175 PSI and maximum differential pressure across the diaphragm of basic valve and pilots is not to exceed 300 PSI. C. The installation shall be designed for either one-way flow or two-way flow as indicated on the Contract drawings.

1. One-way flow: The valve will be used where pressure on the inlet side of the valve is greater than the pressure created by the maximum reservoir or tank head. The valve's sole function is to fill an elevated tank or reservoir to a desired level.

2. Two-way flow: The valve will be used when pressure on the inlet side is variable. When inlet pressure falls below reservoir pressure the valve opens, allowing reverse falls below reservoir pressure the valve opens, allowing reverse flow from the reservoir and thus maintaining fluid pressure within the water distribution system.

3. The altitude control valve(s) shall be of the size and type indicated on the Contract drawings and as manufactured by GA Industries or approved equal.

2.16 PRESSURE-REDUCING VALVES

A. Construction: Pressure Reducing Valves larger than 2-inches in diameter shall consist of a main valve assembly and a pilot system, completely assembled tested as unit and ready for field installation.

1. Main valve body shall be globe style, constructed of high-strength cast iron conforming to ASTM A126 Class B with integral flanges, faced and drilled per ANSI B16.1 Class 125. The valve shall be "full-ported" with a flow area through the valve no less than the area of its nominal pipe size and have an integral bottom pad or feet to permit support directly beneath the body.

2. The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area and the area on the upper surface is greater than that of the underside. There shall be no diaphragms or springs in the main valve.

3. The valve piston shall be fully guided on its outside diameter and all guiding and sealing surfaces shall be bronze. To minimize the consequences of throttling, throttling shall be by long, stationary vee-ports located downstream of the seat

and not by the seat itself. Sawtooth attachments or other add-on devices are not permitted.

4. The valve shall be fully capable of operating in any position without the need of springs and shall not incorporate stems, stem guides or spokes in the waterway. A visual position indicator shall be provided.

5. The main valve shall be serviceable in the line through a single flanged cover which provides easy access to all internal components.

B. Pilot System:

1. Provide a system of pilots and controls to enable the valve to perform the function listed below. All controls and control piping shall be non-corrosive and suitable for the working pressure.

2. System shall include a normally open, direct-acting, diaphragm operated, spring loaded bronze pressure reducing pilot. Pilot shall be easily fieldadjustable from near zero to a minimum of 10 percent above the factory setting. Controls shall include adjustable closing speed control, y-strainer and pilot isolating valves.

C. Function: The valve shall function to reduce a higher, fluctuating inlet pressure to a lower, steady outlet pressure regardless of variations in demand.

D. The valve shall be GA Industries Figure 4500-D or approved equal.

2.17 MANHOLE SECTIONS AND APPURTENANCES

A. Precast concrete manhole bases, risers and cones shall conform to ASTM C478, latest revision, for precast reinforced concrete manhole sections. Tapered sections and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections. Flat slab tops shall be required for very shallow manholes and where shown or specified.

B. Minimum compressive strength of concrete shall be 4,000 PSI at 28 days and shall comply with ACI 318, ACI 350. The maximum permissible absorption shall be 6.0%. All cement used in the mixture shall be in accordance with ASTM C 150, Type II. Fine aggregate shall be sand, while coarse aggregate shall be crushed gravel, both in accordance with ASTM C 33. All water utilized in the concrete mix shall be potable water. Bases and risers shall be reinforced with a single cage of steel placed within the center third of the wall. Welded wire fabric shall be in accordance with ASTM A 185. Steel reinforcing bars shall be grade 60 deformed steel in accordance with ASTM A 615. The tongue or the groove of the joint shall contain one (1) line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches. Precast manhole sections shall fit together readily. February 2014 Project # 332660 – Page 18

C. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the Engineer. The manhole

sections shall be perpendicular to their longitudinal axis, within the limits listed in ASTM C478.

D. Manhole Frames and Covers

1. Frames and covers shall be cast iron of superior quality, tough and even texture. Castings shall be gray iron conforming to ASTM A 48, size as indicated, free from blow holes, porosity, hard spots, shrinkage distortion, or other defects, and well cleaned. The bearing surface between frame and cover shall be machined to prevent rocking and rattling.

2. The standard manhole casting shall be designed for heavy duty use with a 190 pound frame and 125 pound cover. All frames and covers shall comply with AASHTO HS20 loading requirements as well as North Carolina DOT standard 840.54. The minimum opening within the interior of the frame shall be 24-inches. The frame shall have a 4-inch minimum width flange with the cover being 26 inches in diameter and shall include an indented top design with lettering cast into the cover, using the wording "WATER". Acceptable products include U.S. Foundry USF 669 ring and KL cover, or an approved equal.

3. Special waterproof manhole frame and covers shall be installed only at those locations indicated on the contract drawings. Watertight rings and lids shall be U.S. Foundry 669-KL-BWTL with a 125-pound cover. Ring shall have a flat type gasket and cover shall be bolted down with a minimum of four (4) bolts.

4. After the manhole has been set in its final position, set the manhole frame to the required elevation using no more than 12 inches of precast concrete grade rings, or bricks sealing all joints between cone, adjusting rings, and manhole frame. When grade rings or bricks are used, grout with nonshrink grout. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted so as to conform to the exact slope, crown and grade of the existing surrounding pavement. Manhole frames which are placed above final grade will have frames attached to manhole cone section by means of 5/8-inch diameter stainless steel anchors and washers. One anchor bolt shall be provided per hole. 5. When flat slab tops are utilized, frames shall be cast into the top for access into manholes.

E. Brick for manholes and other structures shall conform to applicable requirements of ASTM C62, latest revision, Grade SW.

2.18 TRANSITION COUPLINGS

A. New Water System Construction

1. Transition couplings shall not be permitted in the construction of new water systems, except as necessary when joining dissimilar pipe materials required for horizontal directional drilling or where necessary clearances between water line and sewer or storm drainage piping cannot be achieved.

B. Rehabilitation of Existing Water Systems

1. In general, during the rehabilitation of existing water lines, the use of appropriate transition couplings shall be permitted as approved by the Engineer.

2. When the rehabilitation of an existing water line requires the use of a transition coupling, the use of such couplings shall be as approved by the Engineer. When the nominal diameter of the pipe does not change, an approved transition coupling may be used, as necessary. In these cases, a ductile iron, mechanical joint, solid sleeve shall be used to joint these materials. The solid sleeve shall be as specified above for fittings and shall be the long body-type. The appropriate gaskets shall be selected based on the outside diameter(s) of the material(s) being jointed. All gaskets shall be as specified above. In all cases, the gap between the pipe sections being jointed shall not exceed 0.25 inches.

3. Where the nominal diameter of an existing water line changes as part of a rehabilitation project, an appropriate ductile iron, mechanical joint reducer, as specified above for fittings, shall be used to joint these materials. The appropriate gaskets shall be selected based on the outside diameter(s) of the material(s) being jointed. All gaskets shall be as specified above.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, backfilling and compaction requirements are specified in Division 31 Section "Earth Moving."

3.2 PIPING AND VALVE APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications:

1. Do not use flanged pipe, fittings, or valves or unions for underground (buried) piping. Fittings and valves for underground (buried) piping shall be mechanical joint.

2. Flanged pipe, fittings and valves and unions shall be used on aboveground piping and piping in vaults.

3. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used as specified, unless otherwise indicated.

3.3 PIPING INSTALLATION

A. Existing Utilities and Separation Requirements:

1. The Contractor shall be required to excavate to determine the precise location of utilities or other underground obstructions which are shown on the Plans and/or marked by the utility Owners. Such location and excavation shall be at least 500 feet ahead of construction, unless otherwise noted.

2. All utility Owners shall be notified prior to excavation as required by the 1985 Underground Damage Prevention Act. Utility Owners who are members of NC

OneCall may be notified by calling 811 (toll free) before any excavation or drilling. The Contractor will be fully responsible for damage to any utilities if the Owners have not been properly notified as required by the Underground Damage Prevention Act. All damage to such structures and pipelines and all damage to property or persons resulting from damage to such structures and pipelines shall be borne by the Contractor and shall be completely repaired within a reasonable time. No claim shall be made against the Owner for damage or delay of the work on account of the proximity of, or the leakage from, such structures and pipelines. Where high pressure gas lines are to be crossed, they shall be uncovered by hand excavation methods before other excavation near them is started.

3. Utility Owners may, at their option, have representatives present to supervise excavation in the vicinity of their utilities. The cost of such supervision, if any, shall be borne by the Contractor.

4. Conflicts with underground utilities may necessitate changes in alignment and/or grade of this construction. All such changes will be approved by the Engineer before construction proceeds. February 2014 Project # 332660 – Page 21

5. When underground obstructions not shown on the Plans are encountered, the Contractor shall promptly report the conflict to the Engineer and shall not proceed with construction until the conflict is resolved.

6. All water lines shall have a minimum 18 inches of vertical separation from storm sewer.

7. Water lines shall be laid at least 10 feet laterally from existing or proposed sanitary sewers, unless local conditions or barriers prevent a 10-foot lateral separation--in which case:

a. The water line is laid in a separate trench, with the elevation of the bottom of the water line at least 18 inches above the top of the sanitary sewer; or

b. The water line is laid in the same trench as the sanitary sewer with the water line located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water line at least 18 inches above the top of the sanitary sewer.

8. Whenever it is necessary for a water line to cross over a sanitary sewer, the water main shall be laid at such an elevation that the bottom of the water line is at least 18 inches above the top of the sanitary sewer, unless local conditions or barriers prevent an 18 inch vertical separation--in which case both the water line and the sanitary sewer shall be constructed of ferrous materials and with joints that are equivalent to water line standards for a distance of 10 feet on each side of the point of crossing.

9. Whenever it is necessary for a water line to cross under a sanitary sewer, both the water line and the sanitary sewer shall be constructed of ferrous materials

and with joints equivalent to water line standards for a distance of 10 feet on each side of the point of crossing. A section of water line pipe shall be centered at the point of crossing.

B. All piping is to be installed in strict accordance with the manufacturer's recommendations, AWWA C600 and AWWA M41 (for ductile iron pipe and appurtenances), AWWA C605 and AWWA M23 (for PVC pipe and appurtenances) and the contract material specifications. Installation manuals from various material suppliers will be furnished to the Engineer for his review and approval prior to installation of any materials. The Engineer may augment any manufacturer's installation recommendations if, in his opinion, it will best serve the interest of the Owner.

C. All piping shall be laid with a minimum of 36 inches of soil cover over the top of the pipe.

D. No pipe shall be laid except in the presence of the Engineer or his Representative or with special permission from the Engineer.

E. Proper tools, implements and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe, fittings, valves, and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe, materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be clean and free of defects. It shall be laid on the prepared foundations, as specified elsewhere to produce a straight line on a uniform grade, each pipe being laid so as to form a smooth and straight inside flow line.

F. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.

G. When cutting short lengths of pipe, a pipe cutter, as approved by the Engineer, will be used and care will be taken to make the cut at right angles to the center line of the pipe or on the exact skew as shown on the plans. In the case of push-on pipe, the cut ends shall be tapered with a portable grinder or coarse file to match the manufactured taper.

H. All pipe joints shall be constructed in strict accordance with the pipe manufacturer’s specifications and materials and any deviation must have prior approval of the Engineer.

I. The maximum deflection per joint of flexible joint pipe shall be that deflection recommended by the manufacturer. However, at no time will a deflection greater than 3 degrees (11 inches in an 18’-0” pipe section) be allowed.

J. Detectable warning tape shall be installed over all nonferrous piping.

K. Exposed Piping:

1. All exposed piping to be installed inside tanks, wetwells, vaults and buildings shall be installed as shown on the Drawings and field painted as described below. All exposed pipe shall be ductile iron utilizing flanged joints unless otherwise noted.

2. All exposed ductile iron pipe, fittings and valves shall be field painted with two (2) coats of epoxy paint as recommended by the paint manufacturer. Color of paint shall be as selected by the Owner.

L. Horizontal Directional Drilling of HDPE Water Pipe:

1. The Contractor may install HDPE water piping by means of horizontal directional drilling where shown on the Drawings. The Contractor shall assemble, support, and pretest the pipeline prior to installation in the directional drill tunnel.

2. Horizontal directional drilling shall consist of the drilling of a small diameter pilot hole from one end of the alignment to the other, followed by enlarging the hole diameter for the pipeline insertion. The exact method and techniques for completing the directionally drilled installation will be determined by the Contractor, subject to the requirements of these specifications.

3. The Contractor shall prepare and submit a plan to the Engineer describing the insertion of the HDPE pipe into the opened bore hole. The plan shall include pullback procedure, ballasting, use of rollers, side booms and side rollers, coating protection, internal cleaning, internal gauging, hydrostatic tests, dewatering, and purging.

4. The required piping shall be assembled in a manner that does not obstruct adjacent roadways or public activities. The Contractor shall erect temporary fencing around the entry and exit pipe staging areas.

5. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining.

6. Pipes shall be joined to one another be means of thermal butt-fusion. Polyethylene pipe lengths to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.

7. Mechanical connections of the polyethylene pipe to auxiliary equipment shall be through flanged connections which shall consist of the following:

a. A polyethylene “sub end” shall be thermally butt-fused to the ends of the pipe.

b. Provide ASTM A240, Type 304 stainless steel backing flange, Class 125, ANSI B16.1 standard, and gaskets as required by the manufacturer.

c. Stainless steel bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer’s standard. Retorque the nuts after 4 hours.

d. Butt-fusion of pipes shall be performed in accordance with the manufacturer’s recommendation as to equipment and technique. Butt-fusion jointing shall be 100 percent efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe.

8. Pipe installed by the directional drilled method must be located in plan as shown on the drawings, and must be no shallower than shown on the drawings unless otherwise approved. The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 30 feet. The “Record Drawing” plan and profile shall be updated as the pilot bore is advanced. The Contractor shall at all times provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure. The Contractor shall grant the Engineer access to all data and readout pertaining to the position of the bore head and the fluid pressure and flows.

9. When requested, the Contractor shall provide explanations of this position monitoring and steering equipment. The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position monitoring and steering equipment. No information pertaining to the position or inclination of the pilot hole bores shall be withheld from the Engineer.

10. Each exit point shall be located as shown with an over-length tolerance of 10 feet for directional drills of 1,000 linear feet or less and 40 feet for directional drills of greater than 1,000 linear feet and an alignment tolerance of 5 feet left/right with due consideration of the position of the other exit points and the required permanent easement. The alignment of each pilot bore must be approved by the Engineer before pipe can be pulled. If the pilot bore fails to conform to the above tolerances, the Engineer may, at his option, require a new pilot boring to be made.

11. After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g. dents, buckles, gouges, and internal obstructions) greater than 2 percent of the nominal pipe diameter, or excessive ovality greater than 5 percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of 5 feet or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of 5 feet.

12. Reaming: Reaming operations shall be conducted to enlarge the pilot bore after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the Contractor.

13. Pulling Loads: The maximum allowable pull exerted on the HDPE pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not over stressed. February 2014 Project # 332660 – Page 25

14. Torsion and Stresses: A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe.

15. The lead end of the pipe shall be closed during the pullback operation.

16. Pipeline Support: The pipelines shall be adequately supported by rollers and side booms and monitored during installation so as to prevent over stressing or buckling during pullback operation. Such support/rollers shall be spaced at a maximum of 60 feet on centers, and the rollers to be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback. Surface damage shall be repaired by the Contractor before pulling operations resume.

17. The Contractor shall at all times handle the HDPE pipe in a manner that does not over stress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50 percent of yield stress for flexural bending of the HDPE pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The Contractor shall take appropriate steps during pullback to ensure that the HDPE pipe will be installed without damage.

18. During drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. To the greatest extent practical, these fluids must not be discharged into the waterway. When the Contractor’s provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. The Contractor shall conduct his directional drilling operation in such a manner that drilling fluids are not forced through the subbottom into the waterway. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

19. Pits constructed at the entry or exit point area shall be so constructed to completely contain the drill fluid and prevent its escape to the beach or waterway.

20. The Contractor shall utilize drilling tools and procedures which will minimize the discharge of any drill fluids. The Contractor shall comply with all mitigation measures listed in the required permits and elsewhere in these specifications.

21. To the extent practical, the Contractor shall maintain a closed loop drilling fluid system.

22. The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system which allows the returned fluids to be reused.

23. As part of the installation plan specified herein before, the Contractor shall submit a drilling fluid plan which details types of drilling fluids, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escape.

24. All drilling operations shall be performed by supervisors and personnel experienced in horizontal directional drilling. All required support, including drilling

tool suppliers, survey systems, mud cleaning, mud disposal, and other required support systems used during this operation shall be provided by the Contractor.

25. A smoothly drilled pilot hole shall follow the design of the pipe profile and alignment described on the construction drawings.

26. The position of the drill string shall be monitored by the Contractor with the downhole survey instruments. Contractor shall compute the position in the X, Y, and Z axis relative to ground surface from downhole survey data a minimum of once per length of each drilling pipe (approximately 31 foot interval). Deviations from the acceptable tolerances described in the specifications shall be documented and immediately brought to the attention of the Engineer for discussion and/or approval. The profile and alignment defined on the construction drawings for the bore holes define the minimum depth and radius of curvature. The Contractor shall maintain and provide to the Engineer, upon request, the data generated by the downhole survey tools in a form suitable for independent calculation of the pilot hole profile.

27. Between the water's edge and the entry or exit point the Contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU-TRACKER" or equal wherever possible. The exit point shall fall within a rectangle 10 wide and 40 feet long centered on the planned exit point.

28. During the entire operation, waste and leftover drilling fluids from the pits and cuttings shall be dewatered and disposed of in accordance with all permits and regulatory agencies requirements. Remaining water shall be cleaned by Contractor to meet permit requirements.

29. Technical criteria for bentonite shall be as given in API Spec. 13A, Specification for Oil Well Drilling Fluids Material for fresh water drilling fluids. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included on Contractor's drilling plan presented to the Engineer. The Owner retains the right to sample and monitor the waste drilling mud, cuttings, and water.

30. The horizontal directional drilling operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to the adjacent creek or land areas involved during the construction process. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. All excavated pits used in the drilling operation shall be lined by Contractor with heavy-duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water.

31. The Contractor shall visit the site and must be aware of all structures and site limitations at the directional drill crossing and provide the Engineer with a drilling plan outlining procedures to prevent drilling fluid from adversely affecting the surrounding area.

32. The general work areas on the entry and exit sides of the crossing shall be enclosed by a berm to contain unplanned spills or discharge.

33. Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desalter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the drilling program. The cuttings and excess drilling fluids shall be dewatered by the Contractor to the extent necessary for disposal in offsite landfills. Water from the dewatering process shall be treated by the Contractor to meet permit requirements and disposed of legally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of unplanned leaks or seeps.

34. Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps, or spills.

35. Waste drilling mud and cuttings shall be dewatered, dried, and stock piled such that it can be loaded by a front end loader, transferred to a truck and hauled offsite to a suitable legal disposal site. The maximum allowed water content of these solids is 50 percent of weight.

36. Due to a limited storage space at the worksites, dewatering and disposal work shall be concurrent with drilling operations. Treatment of water shall satisfy regulatory agencies before it is discharged.

3.4 THRUST BLOCK INSTALLATION

A. All plugs, caps, tees, bends, and other fittings shall be provided with adequate thrust blocks. Thrust blocks shall be constructed to the minimum shown on the drawings or as directed by the Engineer. Thrust blocks shall be made of ready mix concrete having a compressive strength of 28 days of 3,000 PSI and shall bear directly against the undisturbed trench wall. Where possible, the concrete shall be so placed that the fitting joints will be accessible for repair. All bolts and pipe joints shall be protected against contact with thrust block concrete by the installation of a 20 mil polyethylene film placed between the fittings and the concrete. Where any section of a main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until three days after installation of the concrete thrust blocks unless otherwise approved by the Engineer. Where trench conditions are, in the opinion of the Engineer, unsuitable for thrust blocks, the Contractor shall provide steel tie rods and socket clamps to adequately anchor the piping. All tie rods and clamps shall be given a bituminous protective coating or shall be galvanized. B. Concrete for thrust blocks shall consist of a ready mix of Portland Cement, fine and coarse aggregate, and water to produce concrete with a minimum compressive strength at 28 days of not less than 3,000 PSI when tested in accordance with ASTM C39. Sakrete or any similar material will not be permitted under any circumstances.

3.5 VALVE INSTALLATION

A. All valves shall be installed in accordance with the manufacturer's instructions. Before setting each valve, the Contractor shall make sure the interior is clean and test opening and closing. Valves shall be set with stems plumb, unless horizontal installation is called for on the plans, and at the exact locations shown. Trench backfill shall be tamped thoroughly for a distance of 3'-0" on each side of valves boxes.

3.6 VALVE BOX INSTALLATION

A. All valve boxes shall be installed in accordance with the manufacturer's instructions. A valve box shall be installed over each underground valve. All boxes shall be installed in accordance with the manufacturer's instructions and set plumb with their top flush with finished grade.

3.7 FIRE HYDRANT INSTALLATION

A. All fire hydrants shall be installed in accordance with the manufacturer's instructions. Fire hydrants shall be located as shown. Each hydrant shall be connected to the main with a 6-inch branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with the pumper nozzle facing the roadway and with the center of the lowest outlet not less than 18 inches above the finished grade. Hydrants shall be rodded to the 6-inch branch tee. Unless otherwise specified, the backfill around hydrants shall be thoroughly compacted to the final grade immediately after installation in order to put the hydrant into service as soon as practicable. Not less than seven (7) cubic feet of clean crushed stone shall be placed around the base of the hydrant to insure drainage of the hydrant barrel. A cap block shall be set under the fire hydrant foot for a solid bottom.

3.8 AIR RELIEF VALVE INSTALLATION

A. All air relief valves shall be installed in accordance with the manufacturer's recommendations at locations shown and in accordance with details provided on the Project Plans.

3.9 CONNECTIONS TO EXISTING WATER SYSTEMS

A. Connections to existing water distribution systems will be allowed when proper precautions are taken to protect the existing system. The Contractor shall be responsible for determining and utilizing all measures required by the water utility Owner in tapping existing water mains. The Contractor shall also make appropriate arrangements with the water utility Owner based on the size and location of the tap indicated on the drawings.

B. If the proposed water extension does not begin at an existing valve, a new tapping sleeve and valve of the size specified shall be installed at the required location as specified. All tapping sleeves and valves shall be installed in accordance with MSS SP-60. Alternately, if water service interruption is acceptable to the Owner, a valve may be installed at the appropriate location in the existing water piping.

C. The Contractor shall be responsible for installing all backflow prevention devices or other “jumpers” as may be required by the Plans or the water utility Owner at the point of connection with the existing water system. For extensions of the existing system, the valve isolating the new system from the existing system will not be opened until all other water system construction has been completed and satisfactorily passed all testing in compliance with these specifications unless specifically authorized by the water utility Owner.

3.10 INSTALLING NEW WATER SERVICE LINES

A. For extensions of the existing water system, all buildable lots adjacent to the extension shall have a water service line provided unless otherwise directed. Additional service lines may be installed by the Contractor as directed and authorized by the Engineer.

B. In general, service lines shall be constructed from the public water system to a point located at the edge of the public right-of-way or the water easement. Domestic service lines shall consist of a ¾- inch (for a single service) or 1-inch diameter pipe (for a double service), as listed in the Bid Schedule and/or shown on the Plans.

C. The standard water service connection shall be Type “K” flexible copper tubing unless shown otherwise on the drawings, and shall connect to the main at a brass corporation stop tapped into the main line.

D. The Owner-maintained portion of each water service line shall have a minimum of 3 feet of cover.

E. The meter box unit shall be a complete unit with all pipe nipples, valves, yoke, and bottom installed and connected prior to delivery.

3.11 REINSTATING EXISTING WATER SERVICE LINES

A. Where existing water mains are being rehabilitated, water service lines shall be constructed for each property that is occupied by a business or dwelling if it is currently served by the system being rehabilitated.

B. The Contractor shall be responsible to locate and connect all existing water service lines to the new main. In the event a service is missed during construction, the Contractor shall return to the site and perform all work necessary to reinstate the connection. The Contractor will be compensated in accordance with the original contract unit pricing; however, re-mobilization to the site will not be paid for.

3.12 JOINT CONSTRUCTION

A. Make pipe joints in accordance with the following requirements:

1. Gasketed joints for ductile-iron water piping shall be made in accordance with AWWA C600 and AWWA M41.

2. Gasketed joints for PVC piping shall be made using jointing materials in accordance with AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D2774 or ASTM D3139 and pipe manufacturer's written instructions.

3. Pressure-sealed joints for copper tubing shall be made using proprietary crimping tool and procedure recommended by copper, pressure-sealfitting manufacturer.

3.13 FIELD QUALITY CONTROL

A. Testing:

1. After the pipeline has been satisfactorily constructed, complete with the required fire hydrants, services, and all other appurtenances, and the trench sufficiently backfilled, the newly constructed pipeline and valved sections shall be subjected to a hydrostatic pressure test. Each completed section of the pipeline shall be plugged at both ends and slowly filled with potable water. At no time shall more than 4,000 linear feet of main be tested. As the main is being filled with water in preparation of the tests, all air shall be expelled from the pipe. The main shall be subjected to hydrostatic pressure of 200 pounds per square inch (at the lowest point of the line section under test) for a period of two (2) hours unless otherwise specified. Pressure shall be applied to the main by means of a hand pump for small lines or by use of a gasoline pump or fire engine for larger lines.

2. The Contractor shall be responsible for paying any costs that may be associated with the water utilized in the flushing, testing and sterilization process in accordance with the requirements of the authorities having jurisdiction. Any costs associated with paying for this water shall be incorporated into the unit price for water line installation.

3. Air removal: Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at these points to expel the air as the line is filled with water. After the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of a successful pressure test, the corporation cocks shall be removed and the pipe plugged.

4. Examination: Any exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with reliable material, and the test shall be repeated until satisfactory results are obtained.

5. The test allowance shall be determined at 15 minute intervals by means of volumetric measurement of the water added during the test until the rate has stabilized at the constant value for three consecutive 15 minute periods.

6. Test allowance is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified test pressure after the pipe has been filled with water and the air expelled. Allowable leaking within the new water line shall be determined using the following equation: L = SDP0.5 148,000 Where: L = testing allowance (makeup water), in gallons per hour S = length of pipe tested, in feet D = nominal diameter of the

pipe, in inches P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

7. The allowable leakage for various pipe sizes and test pressures is graphically represented below

8. No leakage will be allowed under the above tests for piping in buildings and structures.

9. Cracked or defective pipe, joints, fittings, valves, or hydrants discovered in consequence of this test shall be removed and replaced with sound materials, and the test shall be repeated until the test results are satisfactory. Precautions shall be taken to remove or otherwise protect equipment in, or attached to, pipe to prevent damage or injury thereto.

10. Tests of insulated and concealed piping shall be made before the piping is covered or concealed. No leakage will be allowed under the above tests for piping under or in buildings.

11. The Contractor shall notify the Engineer when the work is ready for testing with all testing done in the presence of the Engineer. All labor, equipment, water and materials, including meters and gauges shall be furnished by the Contractor at his own expense.

12. When hydrants are in the test section, the test shall be made against the main valve in the hydrant.

B. Sterilization:

1. After the pressure-leakage test is completed and before the use of water is permitted from any portion of newly constructed water line which will hold or carry potable water, it shall be flushed, cleaned and chlorinated in the presence of and as directed by the Engineer or his Representative. The Contractor shall chlorinate the new water mains by the use of calcium hypochlorite granules.

2. Pipelines may, at the option of the Contractor, be chlorinated in sections isolated by means of gate valves or other approved means.

3. Each unit of the completed water line shall be sterilized as specified below as prescribed by AWWA C651 “continuous feed” method. The unit to be sterilized shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall provide a chlorine dosage of not less than 50 PPM and shall be introduced into the water line in an approved manner. The retention time shall be at least 24 hours and shall produce not less than 25 PPM of chlorine at the extreme end of the line at the end of the retention period. All valves on the lines being sterilized shall be opened and closed several times during the contact period.

4. Following chlorination, all treated water shall be thoroughly flushed from the pipe until the replacement water shall, upon test, both chemically and bacteriologically, be proven equal to the water quality served to the public from the existing water supply system, and be approved by authorities having

jurisdiction. The Contractor shall be responsible for taking the necessary precautions, such as dechlorination, to ensure that the flushing does not harm the environment and complies with all appropriate regulatory requirements. The Contractor shall pay for all bacteriological testing costs. Bacteriological tests shall be performed by a State Approved Laboratory.

5. During the flushing period, each fire hydrant on the line shall be opened and closed several times to remove potential concentrations of chlorinated water. The Contractor shall arrange for the collection of water samples in properly sterilized containers for bacterial examination and shall coordinate the testing of collected samples. The requirements of AWWA C651 shall dictate the number and locations of samples to be collected and tested based on the length and configuration of the constructed system. No water samples shall be collected from a fire hydrant. All cost for testing shall be included in the unit price for water line installation. Prior to acceptance of the water system improvements, two (2) complete, consecutive sets of samples, collected at least 24 hours apart, must pass the required bacteriological testing or the sterilization process repeated until these results are achieved. Test results shall be provided to the Engineer by the authorized testing agency/firm immediately upon completion of the testing procedure.

6. Final connections to existing mains shall be made where indicated on the drawings or as directed after satisfactory samples have been obtained.

END OF SECTION 332660

SECTION 332700

SANITARY SEWER PIPE AND APPURTENANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Where specific standards are referenced within this document, the most current specification and/or latest revision shall apply.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Valves and appurtenances.
3. Transition couplings.
4. Manholes and appurtenances.

1.3 SCOPE OF WORK

A. Furnish all labor, equipment, materials, incidentals, and temporary facilities necessary to install and complete the sanitary sewer and/or force main installation in accordance with the plans. All pipe and appurtenance material shall be of the type and class specified herein.

B. All pipeline and appurtenance excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

1.4 DEFINITIONS

A. AASHTO – American Association of State Highway and Transportation Officials

B. ACPA – American Concrete Pavement Association

C. ANSI – American National Standards Institute

D. API – American Petroleum Institute

E. ASTM – American Society for Testing and Materials

F. AWWA – American Water Works Association

G. CFM – Cubic Feet per Minute

H. DIP – Ductile Iron Pipe

I. HDD – Horizontal Directional Drilling

J. HDPE – High Density Polyethylene

K. LB – Pound

L. Min. – Minute

M. NFPA – National Fire Protection Association

N. NSF – National Sanitation Foundation

O. NSPT – National Standard Pipe Thread

P. PE – Polyethylene

Q. PPM – Parts Per Million

R. PSI – Pounds per Square Inch

S. PSIG – Pounds per Square Inch (Gauge)

T. PVC – Polyvinyl Chloride

U. RCP – Reinforced Concrete Pipe

1.5 SUBMITTALS

A. All submittals shall be in accordance with the requirements of Division 1 of these specifications.

B. Shop drawings or submittals shall be required for the following:

1. Drawings and descriptive data on manholes (including wall thicknesses, vertical dimensions, and deflection angles), concrete used in manufacture of manholes and precast inverts, rubber gaskets, joint sealant, flexible manhole sleeves and joints, frames and covers, inverts, and manhole steps shall be submitted to the Engineer for review prior to their manufacture.

2. All sizes and types of pipe.

3. All pipe fittings, valves and appurtenances.

4. All transition couplings.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Operation and Maintenance Data: For specialties valves and appurtenances to include in emergency, operation, and maintenance manuals.

E. When utilized on the project, the Contractor shall submit detailed plans and a description outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows during the sewer line connections, replacement or startup of the sewage pumps. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment,

materials and all other incidental items necessary and/or required to ensure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions. The submitted work schedule shall minimize the interruption and/or bypassing of wastewater flow during construction. The plan shall include the use of a “High Water Alarm” in the manhole or structure used for bypass pumping. The submittals shall include electrical schematics and control panel information for the pumps including start/stop and alarming configurations. No construction shall begin until all provisions and requirements have been reviewed by the Owner. The Contractor shall allow 30 days for review of this plan.

1. The plan shall include but not limited to details of the following: a. Staging areas for pumps;

b. Plan showing proposed equipment and piping layouts including details of tie-ins to existing sewer lines and/or force mains;

c. List of pump sizes, valves, piping, fittings and other appurtenances;

d. Method of noise control for each pump and/or generator;

e. Method for controlling and monitoring the pumps.

f. Contingency plan for a sanitary sewer overflow caused by the diversion of the sewer flow.

1.6 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall coordinate material deliveries with the manufacturer/supplier. All materials shall be handled and stored in accordance with the manufacturer’s recommendations using methods that will prevent damage to the materials. Further, all manhole components shall be handled and stored in accordance with the ASTM C891.

B. Preparation for Transport: Prepare valves according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

C. The Contractor shall unload pipe and appurtenances so as to avoid deformation or other injury thereto. Pipe shall not be placed within pipe of a larger size and shall not be rolled or dragged over gravel or rock during handling. If any defective material is discovered after installation, it shall be removed and replaced with sound pipe or shall be repaired by the Contractor in an approved manner and at his own expense.

D. The Contractor shall store all pipe and appurtenances on sills above storm drainage level and deliver for laying after the trench is excavated. Do not store any plastic materials in direct sunlight. All plastic materials shall be supported to prevent sagging and bending. All plastic materials shall also be covered with tarps if exposed to the elements for extended periods of time.

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

F. Handle all materials in accordance with the manufacturer's written instructions.

G. When any material is damaged during transporting, unloading, handling or storing, the undamaged portions may be used as needed, or, if damaged sufficiently, the Engineer will reject the material as being unfit for installation. The Engineer will reject any ductile iron pipe with a damaged cement lining.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: The interruption of sewer flows within the collection system or service to any occupied structure or facility will not be permitted unless specifically approved by the utility owner. The Contractor shall be responsible for maintaining sewer flows at all times.

1. When by-pass pumping of sewer flows is necessary, the Contractor shall submit a by-pass pumping work plan to the Engineer and utility owner in conjunction with the submittal of a construction schedule. The plan shall include a primary pump and an identical standby pump.

2. Notify Engineer and utility owner no fewer than 72 hours in advance of proposed by-pass pumping of sewer flows.

3. Do not proceed with by-pass pumping of sewer flows without utility owner’s written permission.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with all requirements of utility owner providing sanitary sewer service including the connection of new collection system piping.

2. Comply with all standards of authorities having jurisdiction for sanitary sewer service piping, including materials, installation, and testing.

B. All piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: All associated materials shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. The design, installation and operation of any temporary pumping system, when required to maintain sewer flows in the existing system, shall be the Contractor's responsibility. The Contractor shall demonstrate experience in the design and operation of temporary bypass pumping systems or employ the services of a vendor who can demonstrate this experience. The Contractor or vendor shall provide at least five (5) references of projects of a similar size and complexity as this project performed within the past three (3) years. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

1.9 COORDINATION

A. Coordinate any connections to the existing sanitary sewer with the utility owner.

PART 2 – PRODUCTS

2.1 BYPASS PUMPING EQUIPMENT

A. Equipment:

1. All pumps utilized for bypass pumping shall be centrifugal, end suction, fully automatic self-priming units that do not require the use of foot valves in the priming system. The pumps may be electric or diesel powered. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of sewer flows. The pumps shall not be hydraulic submersible type.

2. Pumps shall be equipped with sound attenuation enclosures which reduce operating noise to 66 dB at 30 feet. Pump sizing shall be in accordance with this Specification.

3. The bypass pumping system shall include the necessary stop/start controls for the pumps.

4. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. A backup pump of size equal to the largest bypass pump shall be included. The backup pump shall be on-line, isolated from the primary system by a valve.

5. Temporary discharge piping shall be constructed of rigid pipe with positive, restrained joints. Aluminum “irrigation” type piping or glued PVC pipe will not be allowed. Discharge hose will only be allowed in short sections and as accepted by the Owner.

6. Allowable piping shall be as specified herein or as otherwise approved in writing by the Engineer.

B. System Description:

1. Design Requirements:

a. The bypass pumping system shall have sufficient capacity to pump a peak flow equal to or greater than the capacity of the sewer line being bypassed. The Contractor shall provide, maintain and operate all necessary pipeline plugs, pumps of adequate size to handle the peak flow, and temporary discharge piping to ensure that the total influent flow can be safely diverted around the affected section to be repaired or replaced. Bypass pumping systems will be required to be operated 24 hours per day from the time the existing sewer line is removed from service until the new sewer line is put into service and has been determined to be Substantially Complete by the Owner.

b. Temporary bypass pumping during construction may be accomplished by utilizing existing sanitary sewer manholes upstream and downstream of the affected section. The Contractor shall verify location of all utilities, size of fittings, couplings and all other bypass requirements as previously noted. The bypass connection and piping shall be installed and tested prior to bypassing.

c. When bypass pumping from an existing valve vault or pump station, the Contractor shall verify that all necessary components of the existing system are in good working condition. The Owner shall be responsible for operating these valves during construction/upgrades at existing facilities. The Contractor shall coordinate with the Owner's personnel regarding the operation of these facilities and providing a minimum of five (5) days' notice to the Owner prior to conducting any verification or performing any construction operations.

2.2 PIPE MATERIALS

A. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Engineer at the plant, trench, or other point of delivery, for the purpose of culling and rejecting materials which do not conform to the requirements of these specifications. Such material shall be marked by the Engineer and the Contractor shall remove it from the project site upon notice being received of its rejection.

B. As particular specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding specifications under a new number except provisions in revised specifications which are clearly inapplicable.

2.3 DUCTILE IRON SEWER PIPE (DIP) – GRAVITY SEWER AND FORCE MAINS

A. Ductile Iron Pipe shall be as manufactured in accordance with AWWA C151, ASTM A-746, ANSI Specification A21.50 and A21.51 and shall be Class 350 unless otherwise specified on the drawings or in the Bid Schedule.

1. The pipe interior shall be cement mortar lined and seal coated, standard thickness, in accordance with ANSI Specification A21.4.

2. The exterior of all pipe shall be coated with either a coal or asphaltic base bituminous pipe coating in accordance with ANSI Specification A21.8. Pipe shall be furnished with Slip Joints, Mechanical Joints, or Flanged Joints as indicated on the drawings and in accordance with the specifications described below:

B. Slip Joints: Slip or "push-on" joints shall be manufactured in accordance with AWWA C111. Pipe thickness shall be Class 350 as determined by AWWA C150.

1. Bells of “slip” joint pipe shall be contoured to receive a bulbshaped circular rubber gasket, and plain ends shall have a slight taper to facilitate installation. The gasket and associated lubricant shall be furnished by the pipe manufacturer and shall be manufactured in accordance with ANSI Specification A21.11.

2. The jointing shall be done by guiding the plain end into the bell until contact is made with the gasket and by exerting a sufficient compressive force to drive the joint home until plain end makes full contact with the base of the bell. In force main installations, no joint may exceed a maximum deflection of 11 inches in an 18-foot joint of pipe (3 degrees).

C. Restrained-Joint Ductile Iron Pipe:

1. All restrained joint pipe shall be ductile iron, manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. The rated working pressure for pipe sizes 4-inch through 24-inch shall be 350 PSI and 250 PSI for pipe sizes 30-inch through 64-inch as determined by AWWA C150 unless otherwise noted. Push-on joints for such pipe shall be in accordance with ANSI/AWWA C111/A21.11.

2. Restrained joints shall be restrained push-on joints, TR Flex by U.S. Pipe and Foundry; Lok-Fast by American Cast Iron Pipe Company, or equal. Joints shall be suitable for 250 psi working pressure and be fabricated of heavy section ductile iron casting. Bolts and nuts shall be low carbon steel conforming to ASTM A307, Grade B. 3. External loading conditions shall not deflect the pipe more than 3% in the horizontal direction.

D. Mechanical-Joint Ductile Iron Pipe:

1. All mechanical joint pipe shall be ductile iron manufactured in accordance with AWWA C111. Pipe shall be manufactured in accordance with AWWA C151, and the pipe thickness shall be Class 350 as determined by AWWA C150 unless otherwise noted.

2. All bolts shall be tightened by means of torque wrenches in such a manner that the follower shall be brought up toward the pipe evenly. If effective April 2014 Project # 332700 – Page 9 sealing is not obtained by tightening the bolts to the specified torques, the joint shall be disassembled and reassembled after thorough cleaning.

3. Bolts for mechanical joints shall be high grade steel, low alloy type, with tee or hex head and American Standard threads. Mechanical joint gland shall be gray iron and shall utilize a plain rubber gasket.

E. Flanged-Joint Ductile Iron Pipe:

1. Flanged pipe shall have flanges with long hubs, shop fitted on the threaded end of the pipe.

2. Where required, flanges shall be tapped for stud bolts. Flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true, and covered with coal tar pipe varnish or otherwise protected against

corrosion of flange faces. Flange faces shall be cleaned to bare metal with wire brushed before installation of pipe.

3. Ductile iron flanged joint pipe shall have a thickness of Class 53 minimum and shall conform to AWWA C110 and AWWA C115. Pipe shall be ordered in lengths needed as no pipe shall be cut, threaded or flanged in the field. All pipe shall have Class 125 flanges conforming to AWWA C110 unless otherwise specified.

4. Flanged joints shall be made up with through bolts of the required size. Bolts shall be zinc plated, with good and sound, well fitting threads, so that the nuts may be turned freely by hand.

5. Flanged joints shall be made up using only full face gaskets with a minimum thickness of 1/8-inch. Ring gaskets are not acceptable. Gasket material shall be rubber or approved equal as recommended by the Manufacturer.

6. Connecting flanges shall be in proper alignment and no external force shall be used to bring them together.

F. Long Span Pipe: “Long span” type ductile iron pipe shall be used for unsupported spans greater than 20’-0”. “Long span” ductile iron pipe and associated pipe joints shall be designed by the pipe manufacturer specifically for elevated crossings with unsupported spans shown on the drawings. The Contractor shall submit shop drawings from the pipe manufacturer for the long span pipe. Shop drawings shall include material specifications for the pipe and joints, and shall specify locations of joints with respect to the pier locations shown on the drawings. Long span ductile iron pipe shall be as manufactured by American, U.S. Pipe, or equal.

10 2.4 POLYVINYL CHLORIDE SEWER PIPE (PVC)

A. Gravity: Polyvinyl Chloride Pipe shall be as manufactured in accordance with ASTM D-3034, latest edition, and shall be suitable for use as a gravity sanitary sewer pipe. The standard dimension ratio (SDR) shall be 35 unless otherwise specified on the contract drawings.

B. All polyvinyl chloride pipe joints shall be of an integral bell and spigot of the same material as the pipe. It shall have a solid cross-section with rubber “0” ring securely locked in place at the point of manufacture.

C. Force Main: Polyvinyl chloride pipe shall be as manufactured in accordance with ASTM D-2241, latest edition, and shall be suitable for use as a sanitary sewer force main pipe. The standard dimension ratio (SDR) shall be 18 or 21 as shown on the contract drawings. PVC force main piping shall have a green exterior color. Under no circumstances shall pipe with a blue exterior color be accepted. No pipe joint may exceed a maximum deflection of 11 inches in an 18-foot joint of pipe (3 degrees).

D. Where PVC pipe is installed in iron pipe size (IPS), an IPS gasket shall be furnished with each fitting to insure compatibility.

2.5 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

A. High-density polyethylene pipe may be used in the horizontal directional drilling (HDD) of sewer force mains as indicated on the project drawings. Piping shall be extruded from a polyethylene compound and shall conform to the following requirements:

1. The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 3408 material with a cell classification of 335434C or better.

2. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration not less than 2 percent.

3. The maximum allowable hoop stress shall be 800 psi at 73.4 °F.

4. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.

5. The pipe and bends shall have a minimum standard dimension ratio (SDR) wall thickness as specified by the Engineer.

6. Joining shall be performed by thermal butt-fusion in accordance with the manufacturer's recommendations.

7. Sanitary sewer pipe exterior shall be green in color or contain green striping.

2.6 BRASS PIPE AND FITTINGS (For Use In Force Main Appurtenances Only)

A. Brass goods furnished under this specification shall be new and unused. All brass pipe and fittings utilized in the assembly of force main appurtenances shall be seamless red brass (copper alloy 230) in accordance with ASTM B43. Metal alloy composition shall be as follows:

1. Copper: 84.0% to 86.0%

2. Lead: 0.05% max.

3. Iron: 0.05% max.

4. Zinc: Remainder (approximately 15%)

B. All brass pipe and fittings shall be regular weight (schedule 40) with threaded ends in accordance with ANSI B1.20.1.

C. Unless otherwise noted, all pipe and fittings shall have a minimum working water pressure of 150 psi and shall conform to AWWA Standard C800.

D. All fittings shall either be stamped or embossed with the manufacturer's name.

2.7 FITTINGS – DIP AND PVC FORCE MAINS

A. Fittings in DIP and PVC force mains shall be required where the sanitary sewer force main has a significant change in alignment or grade. The specifications for the force main fittings are described below:

1. All fittings for any type of sewer force main shall be ductile iron mechanical joint fittings manufactured in accordance with ANSI Specification A-21.1 and AWWA Standard C153 (compact body type) for underground piping for 3 inch through 24 inch diameter fittings and AWWA C110 (full body type) for pipe diameters larger than 24 inches. Where flanged pipe is used ductile iron fittings shall be flanged in accordance with AWWA C153 or AWWA C110 (based on sizing as stated above) for exposed piping. All flanges shall be Class 125 unless otherwise noted.

2. The interior of all fittings shall be cement mortar lined (not less then 1/16-inch), seal coated in accordance with ANSI Specification A21.4 and AWWA C-104, and suitable for a minimum working pressure of 250 PSI unless otherwise specified.

2.8 GASKETS

A. All rubber gaskets for DIP and PVC pipe and fittings shall be in accordance with AWWA C111. All gaskets shall be a product of the pipe manufacturer, made specifically for the pipe being installed, and shall match the shape and configuration of the joint.

B. Gaskets for ductile iron restrained joint shall be push-on pipe shall provide a trouble-free means of joint restraint for the pipe. These restraining systems shall include gaskets provided by the pipe manufacturer that contain high-strength stainless steel elements spaced around the gasket that develop a dependable gripping action. These push-on restrained joint gaskets shall be rated for a working pressure of 350 PSI for pipe sizes 4-inch through 24-inch and 150 psi for 30-inch pipe.

2.9 WYES, SADDLES, AND SERVICES

A. The materials described within this paragraph shall include all materials to construct a complete sanitary sewer service connection from the gravity sanitary sewer main to the edge of the permanent easement or right-of-way.

B. Wyes and saddles shall be of the same material and strength as the sewer mains on which they are installed. Saddle type fittings shall not be used on new construction or existing mains for pipes 12 inches in diameter or smaller, unless specifically called for in the Plans and/or Specifications or approved in writing by the Engineer. For ductile iron mains greater than 12 inches in diameter, “CB” Romac tapping saddles as manufactured by Romac Industries, Inc. or an approved equal may be used. Unless otherwise specified in the Plans and/or Specifications, house services shall be constructed of 4-inch diameter Schedule 40 PVC pipe or Class 350 psi ductile iron pipe.

C. For taps and services on an existing PVC or VCP sewer mains that are being repaired by trenchless construction methods, flexible saddles as manufactured by NDS/HPI or an approved equal may be utilized. Flexible saddles shall be affixed to the

sewer main by stainless steel bands or straps as provided by the manufacturer and by using a two-part epoxy glue uniformly spread over the contact surface of the saddle.

D. A compression coupling by Inserta-Tee or approved equal shall be used to reconnect services to existing 8-inch and larger diameter sewer mains that are being rehabilitated by trenchless construction methods.

E. Wyes shall be placed in sanitary sewers so as to properly serve each existing house and each vacant lot facing or butting on the street or alley in which the sewer is being laid, and at such other locations as may be designated by the Engineer.

F. The location of all wyes, cleanouts, and service lines installed in the work shall be identified on the plans submitted by the Contractor at the end of the project.

2.10 TRANSITION COUPLINGS

A. New Sewer System Construction:

1. In general, transition couplings shall not be permitted in the construction of new sewer systems. For new gravity sewer system construction, the same pipe material shall extend between manholes with no transitions.

2. The pipe material associated with a sewer force main may change, when and where indicated on the Drawings or as approved by the Engineer. When the nominal diameter of the pipe does not change, an approved transition coupling may be used, as necessary, to joint these dissimilar materials. In these cases, a ductile iron, mechanical joint, solid sleeve shall be used to joint these dissimilar materials. The solid sleeve shall be as specified above for fittings and shall be the long body-type. The appropriate gaskets shall be selected based on the outside diameters of the materials being jointed. All gaskets shall be as specified above. In all cases, the gap between the pipe sections being jointed shall not exceed 0.25 inches.

3. Where the nominal diameter of a sewer force main changes, an appropriate ductile iron, mechanical joint reducer, as specified above for fittings, shall be used to joint these materials. The appropriate gaskets shall be selected based on the outside diameters of the material being jointed. All gaskets shall be as specified above.

B. Rehabilitation of Existing Sewer Systems:

1. In general, during the rehabilitation of existing sewer lines, the use of appropriate transition couplings shall be permitted as approved by the Engineer. All changes in pipe size within the gravity sewer collection system shall require the installation of a manhole as specified elsewhere.

2. Jointing for gravity sewer lines shall require an appropriate shielded rubber sewer coupling. In all cases, the gap between the pipe sections being jointed shall not exceed 0.25 inches. The coupling shall consist of a rubber sleeve conforming to ASTM C425 and ASTM C1173 with a Grade 316 stainless steel shear ring and clamps conforming to ASTM A240. Clamps shall be included with

nut and bolt or worm drive take-up fasteners. “O” ring-type seals shall be provided under each sealing clamp to prevent slippage and provide a positive seal.

3. When the rehabilitation of a sanitary sewer force main requires the use of a transition coupling, the use of such couplings shall be as approved by the Engineer. When the nominal diameter of the pipe does not change, an approved transition coupling may be used, as necessary. In these cases, a ductile iron, mechanical joint, solid sleeve shall be used to joint these materials. The solid sleeve shall be as specified above for fittings and shall be the long body-type. The appropriate gaskets shall be selected based on the outside diameter(s) of the material(s) being jointed. All gaskets shall be as specified above. In all cases, the gap between the pipe sections being jointed shall not exceed 0.25 inches.

4. Where the nominal diameter of a sewer force main changes as part of a rehabilitation project, an appropriate ductile iron, mechanical joint reducer, as specified above for fittings, shall be used to joint these materials. The appropriate gaskets shall be selected based on the outside diameters of the material being jointed. All gaskets shall be as specified above.

2.11 MANHOLES

A. Standard precast concrete manholes sections shall conform to the latest revision of ASTM C 478. Tapered section and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections. Flat slab tops shall be required for very shallow manholes where shown or specified. Flat slab tops shall ONLY be utilized when/where approved for use by the Engineer. All manholes shall be constructed to the sizes, shapes and dimensions and at the locations shown on the plans. Unless otherwise shown on the plans, manhole diameters, wall thicknesses and bottom thicknesses shall be as follows: Pipe Size (inches) Diameter (feet) Wall Thickness (inches) Bottom Thickness (inches) 8 through 18 4 5 6 21 through 36 5 5 8 39 through 54 6 6 8 Larger than 54 8 8 8

B. The minimum wall thickness of all manhole riser sections shall be as shown in the table above. Cone sections shall have a minimum wall thickness of 8 inches at their top. Suitable openings for inlet and outlet pipes shall be cast into April 2014 Project # 332700 – Page 15 the base section for standard connections and into the riser section for drop connections. These openings shall be circular, accurately located and appropriately sized for each manhole.

C. The height or depth of each manhole will vary with the location, but unless otherwise indicated, it shall be constructed such that the top of the manhole matches that of the finished grade surrounding the manhole and the invert is constructed at elevation shown on the plans. As directed by the Engineer (or as otherwise indicated on the plans) the top elevations of some manholes maybe elevated above the finished grade of the surrounding area in wooded or other natural (unmaintained) areas. In all cases, the number of manhole sections (joints) necessary to construct the required height shall be minimized.

D. All manhole and wet well bases shall be monolithically poured complete with a bottom. When indicated on the drawings, precast concrete base sections shall be provided with extended base sections or increased bottom thickness to provide ballast to prevent flotation. Extended bases, as required by the drawings, may be included in the monolithic pour of the base or integrally cast as approved by the Engineer.

E. Minimum compressive strength of concrete shall be 4,000 psi at 28 days and shall comply with ACI 318, and ACI 350. The maximum permissible absorption shall be 6.0 percent. All cement used in the mixture shall be in accordance with ASTM C 150, Type II. Fine aggregate shall be sand, while coarse aggregate shall be crushed gravel, both in accordance with ASTM C 33. All water utilized in the concrete mix shall be potable water. Bases and risers shall be reinforced with a single cage of steel placed within the center third of the wall. Welded wire fabric shall be in accordance with ASTM A 185. Steel reinforcing bars shall be grade 60 deformed steel in accordance with ASTM A 615. The tongue or the groove of the joint shall contain one (1) line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches. Precast manhole sections shall fit together readily.

F. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the Engineer. The manhole sections shall be perpendicular to their longitudinal axis within the limits listed in ASTM C 478.

G. Joint Sealing Materials: Joints shall be sealed by two (2) butyl rubber seals. Each seal shall be as described below:

1. Butyl Seals shall consist of a plastic or paper-backed butyl rubber rope no less than 1 inch cross section. When manholes are larger than 4 feet diameter or have a larger than normal space between the joints, the length and or diameter of the rope shall be increased as required to achieve a seal. Butyl rubber material shall conform to Federal Specification SSS210A, AASHTO M-198, Type B - Butyl Rubber and as follows: maximum of 1 percent volatile matter and suitable for application temperatures between 10 and 100 degrees F. Butyl rubber shall be applied to clean, dry surfaces only. Use of 2 independent wraps of Butyl Rubber placed side-by-side (not stacked) qualifies for the requirement of two seals.

2. Internal O-Ring Gaskets and Internal Rubber Gaskets shall not be used.

H. Manhole Sleeves and Entrance Joints: Flexible manhole sleeves or flexible manhole entrance joints shall be installed on all pipes entering and leaving precast manholes. Manhole openings shall be accurately core drilled or cast in place. Sleeve and joint material shall be of high quality synthetic rubber which complies with the requirements of ASTM Specification C 923. Sleeve hardware (clamps, bands, straps, draw bolts, nuts, etc.) shall be stainless steel and make a watertight union. Sleeves shall be Kor-N-Seal I, Kor-N-Seal II, flexible connectors models 72, 73, 74, 107, 117, 126, 127, 128, 1610, or 1612 as manufactured by EPCO, or shall be as manufactured by Lock Joint a subsidiary of Gifford-Hill-American, Inc. or comparable sleeves as manufactured by the Press Seal Gasket Corporation, or equal. Flexible manhole entrance joints may be cast into the wall of the manhole base or may be installed by coring the manhole wall and installing the

flexible connector to form a tight waterstop. Joints shall be watertight under a 30 foot head of water. Flexible manhole entrance joints shall be A-LOK Joints as manufactured by the A-LOK Products Corp., Press Wedge II as manufactured by the Press Seal Gasket Corp., or equal. Flexible manhole sleeves and flexible manhole entrance joints shall be installed in accordance with instructions of their manufacturer.

I. Manhole Steps:

1. Steps shall be a copolymer polypropylene plastic reinforced with a ½ inch diameter, grade 60 bar and have serrated tread and tall end lugs. Step pull out strength shall be a minimum of 2,000 pounds when tested according to ASTM C-497.

2. Steps shall be required in all structures with a depth greater than four (4) feet. Steps shall be vertically aligned and uniformly spaced for the entire depth of the structure. Steps shall be located in the structures along the vertical face of the eccentric cone and so as to land upon a bench.

3. Steps shall be vertically spaced between 12 and 16 inches on center. Step width shall be a minimum of 12 inches. Steps shall protrude from the wall of the structure a minimum of five (5) inches and a maximum of seven (7) inches.

4. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place. April 2014 Project # 332700 – Page 17

J. Precast Grade Rings and Brick:

1. Precast reinforced concrete grade rings or brick shall be used to adjust ring and covers to finished grade. No more than 12 vertical inches of grade rings or brick will be allowed per manhole. Grade rings shall conform to ASTM C478 and shall be no less than 6 inches and no more than 9 inches in height with a diameter matching that of the frame and cover.

2. All brick used shall be solid and shall be made from Concrete, Clay, or Shale, and shall be of standard building size.

K. Manhole Frames and Covers:

1. Frames and covers shall be cast iron of superior quality, tough and even texture. Castings shall be gray iron conforming to ASTM A 48, size as indicated, free from blow holes, porosity, hard spots, shrinkage distortion, or other defects, and well cleaned. The bearing surface between frame and cover shall be machined to prevent rocking and rattling.

2. The standard manhole casting shall be designed for heavy duty use with a 190 pound frame and 125 pound cover. All frames and covers shall comply with AASHTO HS20 loading requirements as well as North Carolina DOT standard 840.54. The minimum opening within the interior of the frame shall be 24-inches. The frame shall have a 4-inch minimum width flange with the cover being 26 inches in diameter and shall include an indented top design with lettering cast

into the cover, using the wording "SANITARY SEWER." Acceptable products include U.S. Foundry USF 669 ring and KL cover, or an approved equal.

3. Special waterproof manhole frame and covers shall be installed only at those locations indicated on the contract drawings. Watertight rings and lids shall be U.S. Foundry 669-KL-BWTL with a 125-pound cover. Ring shall have a flat type gasket and cover shall be bolted down with a minimum of four (4) bolts.

4. After the manhole has been set in its final position, set the manhole frame to the required elevation using no more than 12 inches of precast concrete grade rings, or bricks sealing all joints between cone, adjusting rings, and manhole frame. When grade rings or bricks are used, grout with nonshrink grout. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted so as to conform to the exact slope, crown and grade of the existing surrounding pavement. Manhole frames which are placed above final grade will have frames attached to manhole cone section by means of 5/8-inch diameter stainless steel anchors and washers. One anchor bolt shall be provided per hole.

5. When flat slab tops are utilized, frames shall be cast into the top for access into manholes.

L. Manhole Inverts and Benches:

1. All sanitary sewer manholes (excluding wet well structures) shall include inverts and benches. Manhole inverts and benches shall be constructed of brick and cement grout or precast concrete in accordance with the standard details shown on the drawings. Inverts shall have a "U" shaped cross section of the same diameter as the invert of the sewers which they connect. "U" shaped inverts shall be constructed to a minimum depth of 6 inches for 8 inch sewers and to full pipe diameter depth of the outlet sewer main for larger mains. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the manhole, whether horizontal or vertical, shall be made with true tangent curve(s) with as large a radius as the size of the manhole will permit. Provide a ½ inch radius at the intersection of 2 or more channels. The minimum concrete thickness in the invert of the channel shall be 2 inches, not including the manhole base thickness. The fall across the manhole invert shall be as noted on the plans.

2. Manhole benches shall be constructed with a slope of 1 inch per foot (8 percent) sloped toward the invert channel. Finish benches shall provide a uniform slope from the high point at the manhole wall to the low point at invert channel. Provide a radius (1/8 inch to 1 inch range is acceptable) at the edge of the bench and channel.

3. When the invert and bench are not constructed by the precast manufacturer, the Contractor shall construct the invert and bench using 3,000 psi concrete or non-shrink grout. Non-shrink grout may be plastered over layered brick and mortar in lieu of solid non-shrink grout invert.

4. Gradual smooth sided depressions and high spots may be allowed so long as diameter of invert channel ranges from 1/4 inch less than, or 1/2 inch more than the nominal pipe diameter are maintained. Voids, chips, or fractures over 1/8 inch in diameter or depth shall be filled with a non-shrink grout and finished to a texture reasonably consistent with the bench surface. All work from collar down shall have a steel trowel finish.

5. Pipe Openings: Pipe openings shall provide clearance for pipe projecting a minimum of 2 inches inside the manhole. The crown of smaller diameter pipes shall be no lower than the crown of the outlet pipe. Grout pipe penetrations, including pipe crown, to provide a smooth, uniform finish using non-shrink grout.

M. Manhole Drops: Standard drop manholes will be constructed only at those locations shown on the drawings or as approved by the Engineer. The design of the drop connection shall be in accordance with the standard detail drawing. The cost of the extra pipe, labor, etc. required to construct a drop manhole will be included in the unit price for the drop manhole at the depths indicated.

N. Manhole Vents:

1. Where designated on the contract drawings, a 4-inch diameter vent pipe shall be installed as an integral part of the manhole. The vent pipe is to be tapped into the upper most section of the manhole, anchored in concrete and extended vertically to the elevation shown on the drawings. The pipe shall have a reverse bend and screen to prohibit rain and foreign materials from entering pipe.

2. The pipe material shall be Schedule 40 Steel with a coal tar interior lining in accordance with AWWA C203 and have an exterior finish consisting of two (2) coats of epoxy paint as approved by the Engineer.

2.12 SWING CHECK VALVES

A. Swing check valves smaller than 3 inches in diameter shall be single disc with renewable bronze seat rings, bronze discs or disc rings and bronze disc hinges and pins and shall be designed to give a full diameter passage.

B. Swing check valves 3 inches in diameter and larger shall be constructed with heavy cast-iron or cast-steel body with a bronze or stainless steel seat ring and a non-corrosive shaft for attachment of weight and lever. The valves shall absolutely prevent the return of water back through the valve when the inlet pressure decreases below the outlet pressure. The valve disc shall be of cast-iron or cast-steel and shall be suspended from a non-corrosive shaft.

2.13 PLUG VALVES

A. Plug valves shall be solid one piece, cast of ASTM A536 ductile iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the shaft. Plug shall not contact the seat prior to 90 percent closed. Plug facing shall be Chloroprene (CR), or other resilient facing suitable for the application.

B. Bodies shall be of ASTM A126 Class B cast iron. Port shall be rectangular. Port area shall be 100 percent of Standard class pipe area. Bearings shall be sleeve type and made of sintered, oil-impregnated permanently lubricated type 316 stainless steel per ASTM A743 Grade CF8M.

C. Seats shall be 1/8-inch thick welded overlay of not less than 95 percent pure nickel. Seat shall be at least ½-inch wide and raised. The raised surface shall be completely covered with nickel to insure that the resilient plug face contacts only the nickel seat.

D. Adjustable Packing shall be of the multiple V-ring type, with a packing gland follower. Shaft seals shall permit inspection, adjustment or complete replacement of packing without disturbing any part of the valve or actuator assembly except the packing gland follower.

E. Grit Excluders made of PTFE shall be provided to prevent the entry of grit and solids into the bearing areas.

F. Pressure ratings shall be bi-directional and 175 psi on sizes 3-inch through 12- inch diameters and 150 psi for 14-inch through 36-inch diameters. Every valve shall be given a certified hydrostatic and seat test, with test reports being available upon request.

G. Worm gear actuators shall be provided on all valves six inches and larger. Actuators shall be enclosed in a cast iron housing, with outboard seals to protect the bearings and other internal components. The actuator shaft and gear quadrant shall be supported on permanently lubricated bronze bearings.

H. Buried actuators shall be 90 percent grease filled. Input shaft and fasteners shall be stainless steel. Actuator mounting brackets shall be totally enclosed.

I. Eccentric plug valves and actuators shall meet or exceed the latest revisions of AWWA C517 and other applicable standards. Flanged ends shall be per ANSI B16.1 and mechanical joint ends per AWWA C111.

2.14 BUTTERFLY VALVES (For Use In Reclaimed Water Systems Only)

A. Valve shall be designed, manufactured, and tested in accordance with AWWA C504, latest revision, and include the following design features. Valve shall be rated and tested for absolute, zero leakage shut-off.

B. Valve body shall be cast iron per ASTM A 126 Class B or ductile iron per ASTM A536 Grade 65-45-12. Flanged end valves shall be faced and drilled per ANSI B16.1, Class 125, or as specified by purchaser. Mechanical joint ends shall be per ANSI A21.11 and include mechanical joint end accessories. Valve body shall include a stainless steel seat ring that is mechanically retained without use of clamping devices, adjusting segments, or other hardware being in the waterway.

C. Valve disc shall be solid type ductile iron without any external vanes, ribs, etc., to obstruct flow. Resilient seat shall be located on edge of disc, offset from the shaft, and seal against mating stainless steel body seat with 36 degree uninterrupted contact. The resilient seal shall be locked to the disc by three separate means of retention, and be field-adjustable, if necessary, with no tools other than a standard socket wrench.

Replacement of seat in field shall be possible without valve disassembly. The disc shall be connected to the offset stainless steel shaft by locked taper wedge keys and stainless steel retaining nuts on the back side of the disc. Taper keys shall be heat treated 416 Stainless Steel for added strength. Shaft shall be stub type for valves 30inches and larger in diameter; one piece for valves 24 inches in diameter and smaller. The valve shall be equipped with adjustable thruster for centering the disc on valves 30 inches and larger in diameter, if required.

D. Shaft shall have nylon sleeve or woven Teflon fiberglass-backed sleeve for bearing surfaces. Bearings shall be self lubricating. E. Valve body shall be primed with manufacturer's standard primer.

2.15 VALVE BOXES

A. All valve boxes shall be cast iron and shall conform to ASTM A48 and AWWA M44. Valve boxes shall be of the adjustable screw type (based on depth of burial) with a base to fit the valve yoke with a removable cover with the word "SEWER" cast thereon. 2.16 SEWAGE AIR/VACUUM RELEASE VALVES A. Acceptable Products:

1. The air/vacuum release valve shall be designed specifically for use on sanitary sewer pressure (force) mains. It shall exhaust large volumes of air that may be present in a system during filling of the main or on pump start-up. It shall also allow air to re-enter when the system is drained intentionally or due to a break in the main (prevents vacuum from forming).

2. Three inch and smaller combination air valves with operating pressures of 150 psi or less shall be of the integral type with a valve assembly which functions as both an air and vacuum valve and an air release valve. The valves shall be DeZurik Apco/Hilton "Series 400", GA Industries "Figure 942", Crispin “Type SA", Val-Matic "Models 801A/802A/803A" or ARI “D-020”.

3. Four inch and larger combination air valves shall consist of an air and vacuum valve with an externally mounted air release valve. The valves shall be DeZurik Apco/Hilton "Series 400C", GA Industries "Figure 950 Kinetic Custom Combination Air Valves", Crispin “Type SL", or Val-Matic "Model No. 48A/49A".

B. Materials:

1. Except as modified or supplemented herein, materials of construction shall comply with the standards of the authorities having jurisdiction. The use of stressed thermoplastic components will not be acceptable.

a. Valve Trim: Bronze or austenitic stainless steel.

b. Float: Austenitic stainless steel.

c. Seats: Buna-N C. Shop Coating and Painting:

1. All interior and exterior ferrous metal surfaces, except stainless steel components, shall be shop painted for corrosion protection. The valve manufacturer's standard coating will be acceptable. Field painting is covered in the protective coatings section.

D. Shutoff Valves:

1. A shutoff valve shall be provided in the piping leading to each air release valve and combination air valve. Each 4-inch and larger combination air valve shall be provided with a shutoff valve between the air and vacuum valve and the air release valve.

PART 3 – EXECUTION

3.1 BYPASS PUMPING

A. Under this item the Contractor is required to furnish all materials, labor, equipment, power, maintenance, etc. to implement a temporary pumping system for the purpose of diverting the existing flow around the work area for the duration of the project.

B. Field Quality Control and Maintenance:

1. Testing:

a. The Contractor shall perform leakage and pressure tests on the new bypass pumping discharge piping using clean water prior to actual operation. The Owner and Engineer shall be given 24-hours' notice prior to testing.

b. The bypass pumping system shall be tested and operated successfully for 24 continuous hours, and the wet well shall be emptied, prior to start of work.

2. Inspection:

a. The Contractor shall monitor the bypass pumping operation at all times to ensure that the system is working correctly.

3. Maintenance Service:

a. The Contractor shall insure that the temporary pumping system is properly maintained and a responsible operator shall be on-site when pumps are operating. b. A factory-trained service technician shall be located within at least 120 miles from the project site with a full complement of in-stock spare parts for pumps and piping.

4. Extra Materials:

a. Spare parts for pumps and piping shall be kept on site as required.

b. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.

C. Preparation:

1. Precautions:

a. The Contractor shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. System must overcome any existing force main pressure on discharge.

b. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate the bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the Owner. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.

c. During all bypass pumping operation, the Contractor shall protect the Owner's pump station and/or sewer mains and all local sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the pumping station and main and all sewer lines caused by human or mechanical failure.

D. Performance Requirements:

1. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

2. The Contractor shall provide all necessary means to safely convey the incoming sewage past the work area. The Contractor will not be permitted to stop or impede the flows in existing force mains.

3. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers and that will protect public and private property from damage and flooding. Any sanitary sewer overflow that occurs due to a failure in the bypass system will be the responsibility of the Contractor. Any penalties issued by authorities having jurisdiction will be reimbursed to the Owner by the Contractor.

4. The Contractor shall protect water resources, wetlands and other natural resources. No sewage or water from the bypass pumping operation shall be spilled on the ground or allowed to drain to storm drains. When disassembling bypass pumping pipe, the Contractor shall ensure that any sewage remaining in the pipe is drained back to the sewer collection system. All spills shall be reported to the Owner, contained and cleaned up immediately by the Contractor.

E. Installation and Removal:

1. The Contractor shall remove manhole sections or make connections to the existing sewer and construct temporary bypass pumping structures only at the access location indicated on the Drawings and as may be required to provide adequate suction conduit.

2. Plugging or blocking of sewage flows shall incorporate primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance or work, it is to be removed in a manner that permits the sewage

flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.

3. When working inside manholes or sewer lines, the Contractor shall comply with OSHA requirements when working in the presence of sewer gases, combustible oxygen-deficient atmospheres, and confined spaces.

4. The installation of the bypass pipelines is prohibited in all saltmarsh/wetland areas. The bypass pipeline must be located off streets and sidewalks and on shoulders of the roads. When the bypass pipeline crosses local streets and private driveways, the contractor must place the bypass pipelines in trenches and cover with temporary pavement. Upon completion of the bypass pumping operations, and after the receipt of written permission from the Owner, the Contractor shall remove all the piping, restore all property to preconstruction condition and restore all pavement. The Contractor is responsible for obtaining any approvals for placement of the temporary pipeline within public ways from authorities having jurisdiction. If, at any time during construction, effluent from the existing sewer is not fully contained by the bypass system, gravity service will be restored by a temporary tie to the new construction and work will be suspended until the problem is resolved to the satisfaction of the Engineer.

3.2 EARTHWORK

A. Excavating, trenching, backfilling and compaction requirements are specified in Division 31 Section "Earth Moving."

3.3 PIPING AND VALVE APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications:

1. Do not use flanged pipe, fittings or valves or unions for underground (buried) piping. Fittings and valves for underground (buried) piping shall be mechanical joint.

2. Flanged pipe, fittings and valves and unions shall be used on aboveground piping and piping in vaults.

3. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used as specified, unless otherwise indicated.

3.4 PIPING INSTALLATION

A. Existing Utilities and Separation Requirements:

1. The Contractor shall be required to excavate to determine the precise location of utilities or other underground obstructions which are shown on the Plans and/or marked by the utility owners. Such location and excavation shall be at least 500 feet ahead of construction, unless otherwise noted. This work shall be done at no additional cost to the Owner.

2. All utility owners shall be notified prior to excavation as required by the 1985 Underground Damage Prevention Act. Utility owners who are members of NC OneCall may be notified by calling 811 (toll free) before any excavation or drilling. The Contractor will be fully responsible for damage to any utilities if the owners have not been properly notified as required by the Underground Damage Prevention Act. All damage to such structures and pipelines and all damage to property or persons resulting from damage to such structures and pipelines shall be borne by the Contractor and shall be completely repaired within a reasonable time. No claim shall be made against the Owner for damage or delay of the work on account of the proximity of, or the leakage from, such structures and pipelines. Where high pressure gas lines are to be crossed, they shall be uncovered by hand excavation methods before other excavation near them is started.

3. Utility owners may, at their option, have representatives present to supervise excavation in the vicinity of their utilities. The cost of such supervision, if any, shall be borne by the Contractor.

4. Conflicts with underground utilities may necessitate changes in alignment and/or grade of this construction. All such changes will be approved by the Engineer before construction proceeds.

5. When underground obstructions not shown on the Plans are encountered, the Contractor shall promptly report the conflict to the Engineer and shall not proceed with construction until the conflict is resolved.

6. When a sewer main or lateral crosses an existing water main or other utility, the Contractor shall make the installation in accordance with the minimum specifications of the Controlling Agency and in accordance with the following minimum requirements. When a sewer main or lateral crosses or parallels an existing utility, the following clearance requirements are to be met or ferrous sewer pipe with water tight joints shall be used for a distance of 10 feet outside said point of crossing or until horizontal separation requirements are achieved.

a. Min. Vertical Separation for Sewer Crossings:

1) Storm Sewers - 24" Vertical

2) Under Water - 18" Vertical

3) Over Water - 18" Vertical * Sewer over water requires that both pipes shall be ferrous pipe with a 20 foot jointless span centered at crossing. *

4) Cable - 24" Vertical

5) Power - 24" Vertical

6) Gas - 24" Vertical

b. Horizontal Separations:

1) Storm Sewers - 5'

2) Water Mains - 10'

3) Water Supply - 100' (WS-I Waters, Class I or Class II impounded reservoirs)

4) Water Supply - 50' (WS-II, WS-III, B, SA, ORW, HQW or SB Waters – from Normal High Water)

5) Designated Trout Streams - 25'

6) Other Stream, Lake or Impoundment - 10'

7) Building Foundation - 5'

8) Basement - 10'

9) Ground Water Lowering and Surface Drainage Ditch 10’

10) Swimming Pool - 10'

11) Private Wells - 25'

12) Public Wells - 50'

B. Conventional Pipe Laying:

1. The layout of gravity sanitary sewer lines and invert elevations at governing points shall be as shown on the drawings.

2. The Contractor shall do all layout work for lines and grades from that information shown on the drawings or as furnished by the Engineer.

a. When a laser beam instrument is used to set line and grade, the unit must be maintained in good working order, and the calibration checked daily for both alignment and percent grade. In the event the required accuracy of alignment and grade is not adhered to, the Engineer will prohibit the use of laser beams.

b. Install piping beginning at low point, true to the grades and alignment indicated with unbroken continuity. Pipe shall be laid with bell ends facing in the direction of pipe laying, unless directed otherwise by the Engineer. In all cases, pipe is to be installed in strict accordance with the manufacturer's recommendations and the contract material specifications. The Engineer may augment any manufacturer's installation recommendations if, in his opinion, it will best serve the interest of the Owner.

c. Proper tools, implements, and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe, materials, to the protective

coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be clean, sound and free from defects. It shall be laid on the prepared foundation, as specified elsewhere to produce a straight line on a uniform grade, each pipe being laid so as to form a smooth and straight inside flow line. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.

d. When cutting short lengths of pipe, a pipe cutter, as approved by the Engineer, will be used and care will be taken to make the cut at right angles to the centerline of the pipe or on the exact skew as shown on the plans. In the case of push-on pipe, the cut ends shall be tapered with a portable grinder, or coarse file to match the manufactured taper.

e. Place a plug in the end of incomplete piping at end of day and when work stops. No trench water or other material shall be permitted to enter the pipe. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

f. Where the pipe is laid on a grade of 20 percent or greater, the laying shall start at the bottom of the slope and proceed upward with the bell end of the new pipe upgrade. All pipe laid on a grade of 20 percent or greater shall require thrust blocking or keying as shown on the drawings and standard details.

g. Install ductile iron, gravity sewer piping in accordance with ASTM A 746.

h. Install PVC gravity sewer piping in accordance with ASTM D 2321 and ASTM F 1668.

i. Install reinforced-concrete sewer piping in accordance with ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

j. All sanitary sewer force main piping shall be installed with 36-inch minimum cover over the top of the pipe.

k. Install ductile iron force main piping in accordance with AWWA C600 or AWWA M41.

l. Install PVC force main piping in accordance with AWWA M23 or ASTM D 2774 and ASTM F 1668.

m. Install detectable warning tape over all nonferrous piping.

C. Exposed Piping:

1. All exposed piping to be installed inside wetwells, vaults and buildings shall be installed as shown on the Drawings and field painted as described below. All exposed pipe shall be ductile iron utilizing flanged joints unless otherwise noted.

2. All exposed ductile iron pipe, fittings and valves shall be field painted with two (2) coats of epoxy paint as recommended by the paint manufacturer. Color of paint shall be as selected by the Owner.

D. Horizontal Directional Drilling of HDPE Force Mains:

1. The Contractor may install HDPE force mains by means of horizontal directional drilling. The Contractor shall assemble, support, and pretest the pipeline prior to installation in the directional drill tunnel.

2. Horizontal directional drilling shall consist of the drilling of a small diameter pilot hole from one end of the alignment to the other, followed by enlarging the hole diameter for the pipeline insertion. The exact method and techniques for completing the directionally drilled installation will be determined by the Contractor, subject to the requirements of these specifications.

3. The Contractor shall prepare and submit a plan to the Engineer describing the insertion of the HDPE pipe into the opened bore hole. The plan shall include pullback procedure, ballasting, use of rollers, side booms and side rollers, coating protection, internal cleaning, internal gauging, hydrostatic tests, dewatering, and purging.

4. The required piping shall be assembled in a manner that does not obstruct adjacent roadways or public activities. The Contractor shall erect temporary fencing around the entry and exit pipe staging areas.

5. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining.

6. Pipes shall be joined to one another be means of thermal butt-fusion. Polyethylene pipe lengths to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.

7. Mechanical connections of the polyethylene pipe to auxiliary equipment shall be through flanged connections which shall consist of the following:

a. A polyethylene “sub end” shall be thermally butt-fused to the ends of the pipe.

b. Provide ASTM A240, Type 304 stainless steel backing flange, 125-pound, ANSI B16.1 standard, and gaskets as required by the manufacturer.

c. Stainless steel bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer’s standard. Retorque the nuts after 4 hours.

d. Butt-fusion of pipes shall be performed in accordance with the manufacturer’s recommendation as to equipment and technique. Butt-fusion jointing shall be 100% efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe.

8. Pipe installed by the directional drilled method must be located in plan as shown on the drawings, and must be no shallower than shown on the drawings unless otherwise approved. The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 30 feet. The “as built” plan and profile shall be updated as the pilot bore is advanced. The Contractor shall at all times provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure. The Contractor shall grant the Engineer access to all data and readout pertaining to the position of the bore head and the fluid pressure and flows.

9. When requested, the Contractor shall provide explanations of this position monitoring and steering equipment. The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position monitoring and steering equipment. No information pertaining to the position or inclination of the pilot hole bores shall be withheld from the Engineer.

10. Each exit point shall be located as shown with an over-length tolerance of 10 feet for directional drills of 1,000 linear feet or less and 40 feet for directional drills of greater than 1,000 linear feet and an alignment tolerance of 5 feet left/right with due consideration of the position of the other exit points and the required permanent easement. The alignment of each pilot bore must be approved by the Engineer before pipe can be pulled. If the pilot bore fails to conform to the above tolerances, the Engineer may, at his option, require a new pilot boring to be made.

11. After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g. dents, buckles, gouges, and internal obstructions) greater than 2 percent of the nominal pipe diameter, or excessive ovality greater than 5 percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of 5 feet or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of 5 feet.

12. Reaming: Reaming operations shall be conducted to enlarge the pilot bore after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the Contractor.

13. Pulling Loads: The maximum allowable pull exerted on the HDPE pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not over stressed.

14. Torsion and Stresses: A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe.

15. The lead end of the pipe shall be closed during the pullback operation.

16. Pipeline Support: The pipelines shall be adequately supported by rollers and side booms and monitored during installation so as to prevent over stressing or buckling during pullback operation. Such support/rollers shall be spaced at a maximum of 60 feet on centers, and the rollers to be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback. Surface damage shall be repaired by the Contractor before pulling operations resume.

17. The Contractor shall at all times handle the HDPE pipe in a manner that does not over stress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50 percent of yield stress for flexural bending of the HDPE pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The Contractor shall take appropriate steps during pullback to ensure that the HDPE pipe will be installed without damage.

18. During drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. To the greatest extent practical, these fluids must not be discharged into the waterway. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. The Contractor shall conduct his directional drilling operation in such a manner that drilling fluids are not forced through the subbottom into the waterway. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

19. Pits constructed at the entry or exit point area shall be so constructed to completely contain the drill fluid and prevent its escape to the beach or waterway.

20. The Contractor shall utilize drilling tools and procedures which will minimize the discharge of any drill fluids. The Contractor shall comply with all mitigation measures listed in the required permits and elsewhere in these specifications.

21. To the extent practical, the Contractor shall maintain a closed loop drilling fluid system.

22. The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system which allows the returned fluids to be reused.

23. As part of the installation plan specified herein before, the Contractor shall submit a drilling fluid plan which details types of drilling fluids, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escape.

24. All drilling operations shall be performed by supervisors and personnel experienced in horizontal directional drilling. All required support, including drilling tool suppliers, survey systems, mud cleaning, mud disposal, and other required support systems used during this operation shall be provided by the Contractor.

25. A smoothly drilled pilot hole shall follow the design of the pipe profile and alignment described on the construction drawings.

26. The position of the drill string shall be monitored by the Contractor with the downhole survey instruments. Contractor shall compute the position in the X, Y, and Z axis relative to ground surface from downhole survey data a minimum of once per length of each drilling pipe (approximately 31 foot interval). Deviations from the acceptable tolerances described in the specifications shall be documented and immediately brought to the attention of the Engineer for discussion and/or approval. The profile and alignment defined on the construction drawings for the bore holes define the minimum depth and radius of curvature. The Contractor shall maintain and provide to the Engineer, upon request, the data generated by the downhole survey tools in a form suitable for independent calculation of the pilot hole profile.

27. Between the water's edge and the entry or exit point the Contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU-TRACKER" or equal wherever possible. The exit point shall fall within a rectangle 10 wide and 40 feet long centered on the planned exit point.

28. During the entire operation, waste and leftover drilling fluids from the pits and cuttings shall be dewatered and disposed of in accordance with all permits and regulatory agencies requirements. Remaining water shall be cleaned by Contractor to meet permit requirements.

29. Technical criteria for bentonite shall be as given in API Spec. 13A, Specification for Oil Well Drilling Fluids Material for fresh water drilling fluids. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included on Contractor's drilling plan presented to the Engineer. The Owner retains the right to sample and monitor the waste drilling mud, cuttings, and water.

30. The horizontal directional drilling operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to the adjacent creek or land areas involved during the construction process. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. All excavated pits used in the drilling operation shall be lined by Contractor with heavy-duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water.

31. The Contractor shall visit the site and must be aware of all structures and site limitations at the directional drill crossing and provide the Engineer with a drilling plan outlining procedures to prevent drilling fluid from adversely affecting the surrounding area.

32. The general work areas on the entry and exit sides of the crossing shall be enclosed by a berm to contain unplanned spills or discharge.

33. Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desalter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the drilling program. The cuttings and excess drilling fluids shall be dewatered by the Contractor to the extent necessary for disposal in offsite landfills. Water from the dewatering process shall be treated by the Contractor to meet permit requirements and disposed of legally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of unplanned leaks or seeps.

34. Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps, or spills.

35. Waste drilling mud and cuttings shall be dewatered, dried, and stock piled such that it can be loaded by a front end loader, transferred to a truck and hauled offsite to a suitable legal disposal site. The maximum allowed water content of these solids is 50 percent of weight.

36. Due to a limited storage space at the worksites, dewatering and disposal work shall be concurrent with drilling operations. Treatment of water shall satisfy regulatory agencies before it is discharged.

3.5 MANHOLE INSTALLATION

A. Sanitary sewer manholes shall be installed at each change in line or grade in each gravity sanitary sewer line as shown on the contract drawings.

B. The manhole foundation shall be prepared so as to provide a firm, level area on which to place the precast concrete manhole base section. When poor foundation soil is encountered or excess groundwater exists, the foundation shall be excavated 12 inches or greater below the final subgrade elevation, as determined by the Engineer and backfilled with washed stone to provide a proper foundation.

C. The manhole sections shall be lifted from the side of the excavation to the bottom of the trench with equipment and support slings capable of safely handling the heavy concrete pieces without damaging them. The manhole shall be set plumb and adjusted to the final finished surface grade with brick or grade rings and non-shrink grout.

D. Thoroughly clean the bells and spigots of each manhole section to remove dirt and other foreign materials that may prevent sealing. Unroll the butyl sealant directly against the base of the spigot. Leave protective wrapper attached until sealant is entirely unrolled against spigot. Do not stretch. Overlap from side to side - not top to bottom.

E. Pipe openings shall be exactly aligned to that of the pipe entering and leaving the manhole. The gravity sanitary sewer pipe lines shall be placed in the manhole openings, properly aligned, and set to grade. Sanitary sewer shall be connected to the manholes using flexible manhole sleeves as described above.

F. For large diameter pipe where a flexible rubber sleeve is not available, the pipe line shall be sealed into the manhole using an expanding type or non-shrink type grout.

G. For manhole steps, refer to the precast manhole section above.

H. After the manhole has been set in its final position, set the manhole frames to the required elevation using no more than 12 inches of precast concrete grade rings, or bricks sealing all joints between cone, adjusting rings, and manhole frame. When grade rings or bricks are used, grout with non-shrink grout. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted so as to conform to the exact slope, crown and grade of the existing surrounding pavement. Manhole frames which are placed above final grade will have frames attached to manhole cone section by means of 5/8- inch diameter stainless steel anchors and washers. One anchor bolt shall be provided per hole. Seal pipe penetrations, including pipe crown, to provide a smooth, uniform finish using non-shrink grout.

I. After the placement of manhole frame and vacuum testing, perform the final finishing to the manhole interior by filling all chips or fractures greater than 1/2 inch in length, width or depth (1/8 Inch deep in inverts) with non-shrink grout. Grout the interior joints between the precast concrete sections with non-shrink grout. Sharp edges or rough finishes shall be removed providing a smooth surface throughout the manhole. Clean the interior of the manhole, removing all dirt, spills, or other foreign matter.

3.6 CONNECTIONS TO EXISTING SEWER SYSTEMS

A. Connections to existing collection systems will be allowed when proper precautions are taken to protect the existing collection system.

B. If the proposed sewer does not begin at an existing manhole, a new manhole will be "cut in" at the required location and the existing pipe(s) repaired as specified. For extensions of the existing system, the new "cut in" manhole or the connection to the existing manhole will not be constructed until all other sewer construction has been completed and tested in compliance with these specifications.

C. Pipelines or manholes which contain silt, sedimentation, or other foreign material shall not be connected to any portion of the existing collection system. The Contractor shall, at his own expense, flush, or otherwise cause the line (and manholes) to be cleaned out without any discharge into the existing system.

D. Any connection with 18-inch and smaller pipe at an existing precast or cast-in place manhole will require the Contractor to core the necessary opening through the manhole wall and install a flexible manhole sleeve. Sleeve shall be as specified elsewhere. Connections to existing brick manholes do not require coring and an opening may be carefully hammered or sawed. Connections to existing manholes for pipe larger than 18 inches in diameter may be cored or sawed as approved by the Engineer.

E. The existing manhole bench and invert shall be constructed and/or repaired in compliance with these specifications.

3.7 INSTALLING NEW SEWER SERVICE LINES

A. For extensions of the existing sewer system, all buildable lots adjacent to the extension shall have a sewer service line provided. Additional service lines may be installed by the Contractor as directed and authorized by the Engineer.

B. In general, service lines shall be constructed from the public sewer to a point located at the edge of the public right-of-way or the sewer easement. Service lines shall consist of a 4-inch or 6-inch diameter pipe, as listed in the Bid Schedule and/or shown on the Plans. Install a cleanout at the end of the service line at the public right-of-way.

C. Service lines built for vacant lots/future connections shall have a cleanout assembly constructed, which includes a 1 foot capped stub-out on the service line. The vertical cleanout pipe shall also be capped, and shall be a minimum of 3 feet above the finished grade.

D. The standard sewer service connection shall be 4 inches in diameter unless shown otherwise on the drawings, and shall connect to the main at a wye branch connection installed with the pipe line as it is being laid. Service lines 4 inches or less shall not be made into a manhole. Service connections 6 inches or greater shall only be made into an existing or proposed manhole, unless otherwise approved by the Engineer.

E. The Owner -maintained portion of each sewer service line shall have a minimum of 3 feet of cover, unless approved by the Engineer.

F. Sewer service lines and clean-outs shall be Class 350 DIP (with Class 350 appurtenances) if: 1. The service line installed will have less than 3 feet of cover; or 2. The service line crosses a creek or drainage ditch (whether aerial or subaqueous).

G. The minimum slope on any residential sewer service line shall not be less than 2 percent.

H. At the edge of the public or utility right-of-way, a "cleanout" shall be installed. The cleanout shall consist of a "wye" branch connection, 45-degree bend, riser pipe, and threaded plug installed flush with finished ground elevation. The end of the utility owner's sewer service connection shall terminate at the end of the pipe which will normally extend five feet beyond the "wye" branch for the cleanout. A watertight plug shall be installed at the end of this line until such time as the property owner connects their facilities to the sewer system. In addition, one cleanout shall be constructed for:

> 1. Every four 45-degree changes located in series (a long sweep is equivalent to two 45-degree bends); and 2. At intervals no greater than 100 feet.

I. When the depth of cut is over 8 feet and the grade of a sanitary sewer is lower than necessary to serve abutting property, and at such other locations as may be designated by the Engineer, the Contractor may install the service line with a 22 ½ or 45 degree bend just upstream of the cleanout assembly to bring the service line up to the necessary elevation.

J. Unless required service depth is noted on construction Plans, the Contractor shall contact the Engineer and request confirmation of grade prior to constructing any sewer service line at a depth greater than 8 feet.

3.8 REINSTATING EXISTING SEWER SERVICE LINES

A. Where existing sewer mains are being rehabilitated, sewer service lines shall be constructed for each property that is occupied by a business or dwelling if it is currently served by the system being rehabilitated.

B. The Contractor shall be responsible to locate and connect all existing sewer service lines to the new main. In the event a service is missed during construction, the Contractor shall return to the site and perform all work necessary to reinstate the connection. The Contractor will be compensated in accordance with the original contract unit pricing; however, re-mobilization to the site will not be paid for. In addition, the Contractor shall be responsible for any costs associated with a sanitary sewer overflow and associated damage to public or private property through the omission of reinstating an active sewer service.

C. Service lines 4 inches or less in diameter shall be tapped into the sewer main, not into a manhole. Service connections 6 inches or greater shall only be made into an existing or proposed manhole, unless otherwise approved by the Engineer.

3.9 ABANDONMENT OF EXISTING SEWERS AND MANHOLES

A. Manholes which are to be abandoned shall first have both influent and effluent lines plugged inside the manhole with watertight masonry or concrete. The manhole will then be filled with non-compressible material (crushed stone or materials approved by the Engineer), to a point not less than 3 feet below the finish grade. The remainder of the manhole shall be broken down and removed. Then the excavation shall be backfilled to finish grade as specified in Division 31 Section "Earth Moving".

B. Abandoned mains at active manholes shall be completely disconnected from the manhole by cutting the pipe outside the manhole and then plugging the abandoned main and the manhole wall with watertight masonry. The invert shall then be rebuilt to conform to these specifications.

C. Exposed sections of abandoned mains shall be removed to a point not less than 5 feet from the adjacent banks or surface waters. The remaining ends of the pipe shall be plugged with watertight masonry. Concrete piers or collars in the creek channel shall be removed completely. Concrete piers or collars not located in the creek channel shall be removed to a point 3 feet below the finish grade. Steel piers shall be cut off 3 feet below finish grade.

D. The minimum length of watertight masonry plugs will be the diameter of the abandoned pipe plus 1 foot.

3.10 FIELD QUALITY CONTROL

A. The Contractor shall maintain the project, insofar as his construction work is concerned, in first class condition for such time as is necessary to satisfy the Engineer that all installations are correct and acceptable.

B. Line Cleaning: Prior to inspection of any section(s) of gravity sanitary sewer pipe or force main the Contractor shall completely clean the lines of all debris, silt, etc. The pipe

line shall be ready for use by the Owner and shall be proved to be in first class condition and constructed properly in accordance with the drawings and specifications.

C. The Contractor shall notify the Engineer that all or portions of the work are ready for testing. All testing shall be scheduled with the Engineer, who will coordinate with the Owner, and respond to the Contractor regarding a mutually available date and time for the necessary testing. All testing shall be done in the presence of the Engineer. All labor, equipment, water and other materials, including meters and gauges, shall be furnished by the Contractor at his own expense.

D. Inspection and Testing of Gravity Sewers:

1. Alignment and grade between manholes shall be tested by the Engineer by flashing a light between manholes. A full circle of light shall be seen when reviewed from the adjoining end of the line. All defects disclosed as a result of this test shall be corrected by the Contractor at his expense.

2. PVC pipe shall pass a go-no go mandrel sized to 95 percent of the pipe diameter (as defined in ASTM D-3034) with the pipe in place and properly backfilled. All pipe which will not pass the mandrel shall be relaid or replaced by the Contractor at no additional cost. The chart that follows indicates the required mandrel diameter for specific sizes of SDR 35 PVC piping. The allowable deflection (less than 5 percent) for other pipe sizes and types shall be calculated using the pipe stiffness formula in ASTM D 2321. The mandrel test shall not take place until the final backfill has been in place for a minimum of 30 days.

Nominal Pipe Size	Pipe I.D. (SDR 35)	Required Mandrel O.D.
8”	7.665”	7.28”
10”	9.568”	9.08”
12”	11.361”	10.79”
15”	13.898”	13.20”

3. The mandrel shall be pulled through each section of pipe from manhole to manhole. The mandrel must slide freely through the pipe with only a nominal hand force applied. No mechanical device shall be used in pulling the mandrel. Any pipe which refuses the mandrel shall be removed and replaced. Such sections shall be re-tested for deflection 30 days after completion of trench backfill.

4. Mandrel testing may be performed by the Owner at any time prior to the expiration of the one year warranty. Any pipe which refuses the mandrel shall be replaced by the Contractor as described above at no cost to the Owner.

5. When the sewers are completed they shall be inspected by the Engineer for conformance with the provisions of the plans and specifications, particularly line and grade. All visible and audible leaks will be repaired.

6. The infiltration into each section of the sewer shall be measured in wet weather by the temporary installation of suitable V-notch weir. This weir shall be furnished, installed and removed by the Contractor. Infiltration test limits shall be

applied to single reaches of pipe, up to one mile in length, of the same diameter. For pipes 8 inches through 15 inches in diameter, infiltration into the sewer system (including manholes) shall not exceed 50 gallons per mile of sewer per inch of inside diameter of the sewer per 24 hours, and in no case shall it exceed 3,000 gallons per mile per 24 hours. For all pipe sizes larger than 15 inches in diameter, infiltration into the sewer system (including manholes) shall not exceed 100 gallons per mile of sewer per inch of inside diameter of the sewer per 24 hours, and in no case shall it exceed 3,000 gallons per mile per 24 hours.

7. If infiltration into the whole system or any segment thereof exceeds the requirements described above, necessary corrective measures shall be taken by the Contractor to limit the infiltration to the maximum specified above. The Engineer shall decide the number and length of segments of sewer line on which the testing shall be performed.

8. The Contractor shall furnish all facilities and personnel and conduct low pressure air tests on all completed sections of gravity sewer. Air tests for PVC and DIP lines shall be performed in accordance with ASTM C828. Air tests for concrete pipe 30 inches in diameter and smaller shall be performed in accordance with ASTM C924. Air tests will not be required on pipe with diameters exceeding 30 inches. Acceptance of pipes exceeding 30 inches will be based on infiltration tests and/or visual inspection of the joints.

9. The acceptance air test shall be made after backfilling has been completed and compacted and in the presence of the Engineer. For ductile iron pipelines, test in accordance with the applicable requirements of ASTM C924. For PVC pipelines test in accordance with ASTM F1417- 98.

10. The Contractor shall furnish an air compressor of the necessary capacity along with all necessary plugs, valves, pressure gages, air hoses, connections, and other equipment necessary to conduct the air tests. Plugs in sewers 18 inches in size and larger shall be connected by steel cable for thrust reaction.

11. Compressor capacity shall be sufficient to pressurize the sewer main to 4 PSIG within a time equal to or less than the required test time. The following equation may be used to insure compliance with this requirement:

C= 0.17 x D2 x L +Q T

Where: C=Required Compressor Capacity (cfm)

T=Required Test Time (min) D=Pipe Internal Diameter (feet)

L=Length of Test Section (feet)

Q=Allowable Air Loss Rate (cfm)

The following allowable air loss rates will be used for all pipe tests:

Pipe Size	Q (sfm)	Pipe Size	Q (cfm)
4”	2.0	15”	4.0
6”	2.0	18”	5.0

8”	2.0	21”	5.5
10”	2.5	24”	6.0
12”	3.0		

12. The sewer section shall be plugged at both ends and air pressure shall be applied until the pressure inside the pipe reaches 4 PSIG. When a stable condition has been reached, the pressure shall be bled back to 3.5 PSIG. At 3.5 PSIG, the time and pressure shall be observed and recorded. If groundwater is present at the sewer, the height of the groundwater above the top of the pipe shall be added to the above air pressure readings (height of water in feet X 0.433 = air pressure in psig). A minimum of five (5) readings will be required for each test.

13. If the time for the air pressure to decrease from 3.5 PSIG to 2.5 PSIG is equal to or greater than that shown in the following table, the pipe shall be presumed to be free from defect. When these times are not attained, pipe breakage, joint leakage, or leaking plugs are indicated and the cause must be determined and corrected. After repairs have been made, the sewer sections shall be retested. This process shall be repeated until all sewer sections pass the air tests. Pipe Diameter (inches) Specification Time for Length Shown (Minutes : Seconds)

Pipe diameter (inches)	**100 ft**	**150 ft**	**200 ft**	**250 ft**	**300 ft**	**350 ft**	**400 ft**	**450 ft**
8	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	14:10	17:48	22:15	26:42	31:09	35:35	40:04
18	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33

14. For testing a sewer system with one or more installed service lateral pipes, an effective pipe length shall be added to the total sewer main pipe length. The equation used to calculate Effective Pipe Length is as follows:

Le= d2 x l % D2

Where: Le=Effective Pipe Length (added to Total Test Length)

d=Diameter of Service Lateral Pipe

l=Length of Sewer Lateral

D=Diameter of Sewer Main Pipe being tested

15. Failure of any section of the pipeline to meet the requirements of this test shall cause the Contractor to determine, at his own expense, the source(s) of leakage, and repair or replace all defective materials or workmanship. The

repaired section(s) of line shall be re-tested to insure conformance with the requirements of these contract specifications.

E. Inspection and Testing of Sewer Force Mains:

1. When the sanitary sewer force main is completed, the Engineer shall inspect the line for conformance with the provisions of the drawings and specifications, particularly with respect to alignment and depth. The minimum depth of all force mains shall be 36 inches unless otherwise specified.

2. All newly constructed sanitary sewer force main and valved sections shall be subjected to a hydrostatic pressure-leakage test. Hydrostatic testing shall be conducted only after thrust blocks, supports, and anchors have fully hardened. Force mains shall be tested in sections not to exceed 4,000 lineal feet per test section. The Contractor shall install sufficient additional valves if not shown on the drawings to allow for testing.

3. HDPE pipe shall be hydrostatically tested after joining into continuous lengths prior to installation and again after installation. Pressure and temperature shall be monitored with certified instruments during the test. After this test, the water will be removed with pigs. Erosion prevention procedures shall be used during removal and discharge of the water. Hydrostatic testing shall be performed in accordance with these specifications.

4. Each completed section of the pipeline shall be plugged at both ends and slowly filled with water. As the main is being filled with water in preparation of the test, all air shall be expelled from the pipe. The main shall be subjected to a hydrostatic pressure not less than 1-1/2 times the maximum system operating pressure or 100 pounds per square inch, whichever is greater, for a period of two hours unless otherwise specified. Pressure shall be applied to the main by means of a hand pump for small lines or by use of a gasoline pump or fire engine for larger lines.

5. The rate of leakage shall be determined at 15 minute intervals by means of volumetric measure of the water added during the test until the rate has stabilized at the constant value for three consecutive 15 minute periods.

6. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than ten (10) gallons per inch of pipe diameter per mile of pipe per 24 hours.

7. Cracked or defective pipe, joints, fittings, or valves discovered in consequence of this test shall be removed and replaced with sound materials, and the test shall be repeated until the test results are satisfactory. Precautions shall be taken to remove or otherwise protect equipment in, or attached to, pipe to prevent damage or injury thereto.

8. Tests of insulated and concealed piping shall be made before the piping is covered or concealed. No leakage will be allowed under the above tests for piping in buildings, structures or on bridges.

9. Ductile iron force main piping shall be tested in accordance with AWWA C600, while all PVC force main piping shall be tested in accordance with AWWA M23. HDPE force main piping shall be tested in accordance with ASTM F2164.

F. Inspection and Testing of Manholes:

1. Manholes shall be constructed to provide a true circular inside diameter with properly corbeled tops, satisfactory inverts and properly placed steps and castings. Any visible leaks in the manholes shall be completely stopped to the satisfaction of the Engineer.

2. All sanitary sewer manholes constructed by the Contractor shall be vacuum tested for leakage in the presence of the Engineer. Vacuum testing shall be performed in accordance with ASTM C1244. The vacuum test requirement will not apply to any existing manhole, or any existing manhole that has been converted to a drop manhole by the Contractor.

3. The Contractor shall furnish all labor, equipment, and any appurtenant items necessary to satisfactorily perform the vacuum test. All testing equipment shall be approved for vacuum testing manholes.

4. Vacuum Testing Procedure:

a. Vacuum test the assembled manhole after completing pipe connections, sealing and allowing mortar or cement proper curing time. Plug pipes with suitably sized and rated pneumatic or mechanical pipe line plugs. Place plugs a minimum of 6 inches beyond the manhole wall and brace to prevent displacement of the plugs or pipes during testing.

b. All lifting holes shall be plugged with an approved non-shrink grout inside and out. Manhole joints shall be grouted from the outside only. All pipes entering the manhole shall be plugged. The Contractor shall securely brace the plugs in order to keep them from being drawn into the manhole. The test head shall be placed at the inside of the top of the cone section of the manhole and the seal inflated in accordance with the manufacturer's recommendations.

c. Position the vacuum tester head assembly according to the manufacturer's recommendations. Draw a vacuum of 10 inches of mercury, close the valve on the vacuum line and shut off the vacuum pump and measure the time for the vacuum to drop to 9 inches of mercury. The manhole shall pass when the time to drop to 9 inches of mercury meets or exceeds the table below:

Manhole Vacuum Testing Time (Seconds)

Manhole depth(feet)	Manhole diameter (inches)	Manhole diameter	Manhole diameter

		(inches)	(inches)
	48	**60**	**72**
0-8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	87
26	64	85	105
28	69	91	113
30	74	98	121

d. If the manhole fails the test, remove the head assembly and coat the manhole interior with a soap and water solution and repeat the vacuum test for approximately 30 seconds. Leaking areas will have soapy bubbles. Make the necessary repairs and repeat the test until the manhole passes.

5. Vacuum testing is not required on manholes with pipe connections in excess of 30 inches in diameter.

G. Final Acceptance:

1. The Engineer will notify the Contractor, in writing, as to the satisfactory completion of the work in any or all sections of gravity sanitary sewer pipe, force main and manholes, included in the project.

2. Upon such notification, the Contractor shall immediately remove all construction equipment, excess materials, tools, debris, etc. from the site(s) and leave the same in a neat, orderly condition acceptable to the Engineer.

3. Final landscaping requirements and restoration of surfaces shall then be completed by the Contractor in accordance with their respective specification sections and as shown on the drawings.

END OF SECTION 332700

SECTION 333413.33 - POLYETHYLENE SEPTIC TANKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Polyethylene (HDPE) septic tanks.

B. Related Requirements:

1. Section 310001 - Earthwork Materials: Bedding materials.
2. Section 310000 - Earthwork: Excavation requirements for septic tanks.
3. Section 333451 - Drainage Field System: Materials and installation requirements for drainage fields (also called leach fields) used to further treat effluent from septic tanks.
4. Section 333453 - Distribution Chambers: Materials and installation requirements for distribution chambers used to divert septic tank effluent to drainage fields.

1.2 DEFINITIONS

A. HDPE: High-density polyethylene.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO HB-17 - Standard Specifications for Highway Bridges.
2. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop.

B. ASTM International:

1. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).
3. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
4. ASTM D1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
5. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.
6. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).

7. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
8. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
9. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
10. ASTM F1473 - Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins.

1.4 SUBMITTALS

A. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.

B. Manufacturer’s installation instructions shall be provided along with product data.

C. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).

D. Product Data: Submit manufacturer information on tank.

E. Shop Drawings: Indicate plan, location, and inverts of connecting piping.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer Instructions: Submit special procedures for septic tank installation.

H. Source Quality-Control Submittals: Indicate results of shop and/or factory tests and inspections.

I. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

J. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.

1.5 CLOSEOUT SUBMITTALS

A. Section 017716 - Contract Closeout: Requirements for submittals.

B. Project Record Documents: Record actual locations and invert of buried pipe, components, and connections.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Maintain 1 copy of each standard affecting Work of this Section on Site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016500 - Materials and Equipment: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Transport and handle septic tanks with equipment designed to protect units from damage.

D. Store materials according to manufacturer instructions.

E. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Do not place septic tanks in position that causes them to overstress, warp, or twist.
3. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 HDPE SEPTIC TANKS

A. Manufacturers:

1. Norwesco, LLC, (952) 446-1945, PO Box 439, 4365 Steiner St., St. Bonifacius, MN 55375.
2. Infiltrator Water Technologies, (800) 221-4436, 4 Business Park Rd., PO Box 768, Old Saybrook, CT 06475.
3. Approved equivalent.

B. Description:

1. Capacity: 1000 gal as indicated on Drawings.
2. Maximum Burial Depth: 36 inches.
3. Inlets and Outlets:

    a. Extrusion welded on inside and outside of manhole.
    b. Furnish gussets at quarter points around inlets and outlets.

4. Connections:
    a. 4-Inch and Smaller Pipe: Butt-fusion welded, Electrofusion welded, Flanged, Threaded.

C. Materials:

1. HDPE.
2. Type: 3408.
3. Comply with ASTM D3350.
4. Minimum Cell Classification: 345464 C.

D. Performance and Design Criteria:

1. Loading: Non-traffic.
2. Density:
    a. Comply with ASTM D1505.

3. Melt Index:
    a. Comply with ASTM D1238.

4. Flex Modulus:
    a. Comply with ASTM D790.

5. Tensile Strength at Yield:
    a. Comply with ASTM D638.

6. Slow Crack Growth Resistance:
    a. Comply with ASTM F1473.

7. Hydrostatic Design Basis:
    a. Comply with ASTM D2837.

2.2 MATERIALS

A. Septic Tanks:

1. Crosslinked PE.
2. No fillers will be accepted.

2.3 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly, including hydrostatic testing for leakage.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that building sanitary sewer connection, size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Conduct operations as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures, utilities, and landscape in immediate or adjacent areas.

B. Ream pipe ends and remove burrs.

C. Remove scale and dirt from components before assembly.

D. Establish invert elevations for each component in system.

E. Remove stones, roots, and other obstructions.

3.3 INSTALLATION

A. Tank and Bedding:

1. Excavate as specified in Section 310000 – Earthwork.
2. Hand trim excavation for accurate placement of tank to indicated elevations.
3. Place bedding material level and in continuous layers not exceeding 6 inches of compacted depth.
4. Compact to 95 percent maximum density.
5. Backfill around sides of tank, tamp in place, and compact to 95 percent maximum density.

6. Maintain optimum moisture content of bedding material to attain required compaction density.
7. Install septic tank, distribution chamber, and related components on bedding.

B. Interconnecting Piping: Connect inlet and outlet sanitary piping.

3.4 FIELD QUALITY CONTROL

A. Request inspection prior to placing cover over tank and piping.

B. Compaction Testing:

1. Comply with [ASTM D1557] [ASTM D698] [AASHTO T 180] [ASTM D6938].
2. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 333413.33

SECTION 333451 - DRAINAGE FIELD SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Drainage fields connected to septic tanks.

B. Related Requirements:

1. Section 310001 - Earthwork Materials: Bedding materials.
2. Section 310000 - Earthwork: Excavation and cover for filter piping.
3. Section 333413.33 - Polyethylene Septic Tanks: Materials and installation requirements for septic tanks constructed of HDPE.
4. Section 333453 - Distribution Chambers: Materials and installation requirements for distribution chambers used to divert septic tank effluent to drainage fields.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
2. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop.

B. ASTM International:

1. ASTM C4 - Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile.
2. ASTM C12 - Standard Practice for Installing Vitrified Clay Pipe Lines.
3. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).
5. ASTM D2729- Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
6. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 PREINSTALLATION MEETINGS

A. Convene minimum **one week** prior to commencing Work of this Section.

1.4 SUBMITTALS

A. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.

B. Manufacturer’s installation instructions shall be provided along with product data.

C. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).

D. Product Data: Submit manufacturer information on piping.

E. Shop Drawings: Indicate plan, location, and inverts of filter field, and inverts of connecting piping.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer Instructions: Submit special procedures for drainage field installation.

H. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

I. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.

1.5 CLOSEOUT SUBMITTALS

A. Section 017716 - Contract Closeout: Requirements for submittals.

B. Project Record Documents: Record actual locations and **inverts** of buried pipe, components, and connections.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Maintain **a copy** of each standard affecting Work of this Section on Site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years of documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years of documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016500 - Materials and Equipment: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 DRAINAGE FIELD PIPING

A. Provide **perforated** pipe at filter field system and unperforated pipe through sleeves and at junction with distribution chamber.

B. PVC Pipe, Schedule 40:

1. Comply with ASTM D2729.
2. Nominal Inside Diameter: 4 inches.
3. End Connections: Plain.

2.2 ACCESSORIES

A. Geotextile Filter Fabric: As specified in Section 310001 - Earthwork Materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that septic tank connection, size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Ream pipe ends and remove burrs.

B. Remove scale and dirt from components before assembly.

C. Establish invert elevations for each component in system.

D. Remove stones, roots, and other obstructions.

3.3 INSTALLATION

A. Drainage Field Piping:

1. Bedding:

    a. Place as required in Section 310000 - Earthwork.
    b. As shown on Contract Drawings.
    c. Establish slope of bed to accommodate established invert elevations.

2. Place pipe sloping away from header at minimum of 1/16 in./ft. with perforations facing down.
3. Wrap pipe joints with geotextile fabric and cover sides and top with aggregate.
4. Place geotextile fabric over cover prior to backfilling.
5. Cover entire field with aggregate to depth of 12 inches, lightly compact, and level.
6. Place subsoil cover as specified in Section [310000 - Earthwork].

3.4 FIELD QUALITY CONTROL

A. Request inspection by Engineer prior to placing cover over piping.

B. Do not permit vehicular traffic over drainage field. Provide signage identifying vehicle traffic is not permitted.

END OF SECTION 333451

SECTION 333453 - DISTRIBUTION CHAMBERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Drainage fields connected to septic tanks.

B. Related Requirements:

1. Section 310001 - Earthwork Materials: Bedding materials.
2. Section 310000 - Earthwork: Excavation and cover for filter piping.
3. Section 333413.33 - Polyethylene Septic Tanks: Materials and installation requirements for septic tanks constructed of HDPE.
4. Section 333451 - Drainage Field System: Materials and installation requirements for drainage fields (also called leach fields) used to further treat effluent from septic tanks.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop.

B. American Water Works Association:

1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

C. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
3. ASTM C1227 - Standard Specification for Precast Concrete Septic Tanks.
4. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
5. ASTM D3034 -Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
6. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
7. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

D. Cast Iron Soil Pipe Institute:

1. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

1.3 SUBMITTALS

A. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.

B. Manufacturer's installation instructions shall be provided along with product data.

C. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).

D. Product Data: Submit manufacturer information on distribution chamber and piping.

E. Submit an Environmental Product Declaration (EPD) from the manufacturer for each type of precast structure within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not available.

1. Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

F. Shop Drawings: Indicate plan, location, and inverts of connecting piping.

G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

H. Manufacturer Instructions: Submit special procedures for distribution chamber installation.

I. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

J. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.

1.4 CLOSEOUT SUBMITTALS

A. Section 017716 - Contract Closeout: Requirements for submittals.

B. Project Record Documents: Record actual locations and inverts of buried pipe, components, and connections.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Maintain 1 copy of each standard affecting Work of this Section on Site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016500 - Materials and Equipment: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Transport and handle precast concrete units with equipment designed to protect units from damage.

D. Store materials according to manufacturer instructions.

E. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Do not place concrete units in position that causes them to overstress, warp, or twist.
3. Provide additional protection according to manufacturer instructions.

1.8 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 DISTRIBUTION CHAMBERS

A. Manufacturers:

1. Fort Miller Co., Inc., (518) 695-5000, PO Box 98, Schuylerville, NY 12871
2. Monarch Products, (717) 938-8303, 385 Sipe Road, York Haven, PA 17370.
3. Oldcastle Infrastructure, (888) 965-3227, 8392 Riverview Parkway, Littleton, CO 80125
4. Approved equivalent.

B. Description:

1. Material: Reinforced concrete
2. Provide single inlet, two outlets, gate, and removable cover with lift ring.
3. Accessories: As indicated on Drawings.

2.2 INTERCONNECTING PIPING

A. PVC Pipe, Schedule 40:

1. Comply with ASTM D2729.
2. Nominal Inside Diameter: 4 inches.
3. End Connections: Bell and spigot, solvent sealed.
4. Fittings:

    a. Same material as pipe.
    b. Tee Bends, Elbows, Cleanouts, Reducers, and Ends: To suit pipe joint.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that septic tank connection and drainage field configuration are as indicated on Drawings.

3.2 PREPARATION

A. Ream pipe ends and remove burrs.

B. Remove scale and dirt from components before assembly.

C. Establish invert elevations for each component in system.

D. Remove stones, roots, and other obstructions.

3.3 INSTALLATION

A. Distribution Chamber: As specified in Section [333413.33 - Polyethylene Septic Tanks].

B. Interconnecting Piping:

1. Connect outlets between septic tank and distribution box, and between distribution box and filter field header PVC schedule 40 pipe and fittings
2. Place pipe and fittings on 6-inch bed of aggregate, and compact to 95 percent maximum density.
3. Slope piping to each successive component at minimum slope of 1/4 in./ft.
4.

3.4 FIELD QUALITY CONTROL

A. Request inspection prior to placing cover over distribution chamber and piping.

B. Hydrostatic Testing: Test tanks for watertightness using hydrostatic method according to ASTM C1227.

C. Compaction Testing:

1. Comply with Section 310000 - Earthwork.
2. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 333453

SECTION 334100

STORM DRAINAGE MATERIALS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure transition couplings.
3. Pressure pipe couplings.
4. Expansion joints and deflection fittings.
5. Drains.
6. Encasement for piping.
7. Manholes.
8. Channel drainage systems.
9. Catch basins.
10. Stormwater inlets.
11. Stormwater detention structures.
12. Pipe outlets.
13. Stormwater disposal systems.

1.3 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. CMP: Corrugated Metal Pipe.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High Density Polyethylene.

E. NCDOT: North Carolina Department of Transportation.

F. RCP: Reinforced Concrete Pipe.

1.4 SUBMITTALS

A. Shop Drawings: The Contractor shall submit at least six (6) copies of shop drawings to the Engineer, including dimensional drawings, materials of construction, catalogue cut sheets, and other pertinent information.

1.5 QUALITY ASSURANCE

A. All materials shall be manufactured by suppliers with at least five (5) years of experience in the manufacture of similar materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered, stored and handled in strict accordance with the manufacturer's recommendations, and in a manner which preserves the structural integrity of the materials.

B. Do not store plastic materials in direct sunlight.

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

D. Handle concrete drainage structures according to manufacturer's written rigging instructions.

1.7 WARRANTY

A. All materials and equipment shall be warranted to be free from defects in workmanship and materials for one (1) year after Owner's acceptance.

1.8 PROJECT CONDITIONS

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

1. Notify Engineer no fewer than three days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without Engineer's written permission.

PART 2 – PRODUCTS

2.1 CORRUGATED STEEL PIPE AND FITTINGS

A. Corrugated-Steel Pipe and Fittings: AASHTO M-36, Type 2, except as modified by NCDOT 1032-3 corrugated steel with rerolled ends.

B. Pipe shall be furnished with manufacturer's "hugger type" coupling bands. The use of dimple bands will not be allowed.

C. All corrugated metal pipe shall have 2-2/3-inches by ½ inch corrugations.

D. Pipe 18-inches and smaller in diameter shall be 16 gauge.

E. Pipes 21-inches through 30-inches in diameter shall be 14 gauge.

F. Pipes 36-inches through 48-inches in diameter shall be 12 gauge.

G. Pipes 48-inches and larger in diameter shall be 10 gauge.

H. When shown on the drawings, pipes shall be furnished with full or partial bituminous coatings and/or paved in accordance with NCDOT 1032-4. Bituminous coatings, where required by the drawings, shall consist of asphalt cement having a minimum thickness of 0.04-inches measured at the crest of the corrugations. Paved inverts in corrugated metal pipe, where required by the drawings, shall consist of asphalt cement applied on the inside of the pipe for one quarter of its circumference (bottom of pipe when installed). The pavement shall have a minimum thickness of 0.50 inches tapering to 0.1 inches at the sides.

2.2 CORRUGATED ALUMIUM ALLOY PIPE AND FITTINGS

A. Corrugated-Steel Pipe and Fittings: AASHTO M196, Type 2,and NCDOT 1032- 2 aluminized corrugated steel with rerolled ends.

B. Pipe shall be furnished with manufacturer's "hugger type" coupling bands. The use of dimple bands will not be allowed.

C. Pipes 24-inches and smaller in diameter shall be 16 gauge.

D. Pipes 30 inches through 42-inches in diameter shall be 14 gauge.

E. Pipes larger than 42-inches in diameter shall be 12 gauge.

2.3 HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

A. Corrugated HDPE Pipe and Fittings (12-inch to 60-inch): AASHTO M294, Type S, with smooth interior wall, with watertight joints.

B. Pipe and fittings shall be made of virgin polyethylene compounds that comply with the cell classification 435400C, as defined and described in ASTM D3350, except that carbon black content should not exceed 4%. The 12-inch through 24-inch virgin pipe material shall comply with the notched constant ligamentstress (NCLS) test as specified in Sections 9.5 of AASHTO M294.

2.4 CONCRETE PIPE AND FITTINGS

A. Reinforced Concrete Pipe: ASTM C-76, Class III, with Wall Type B, and AASHTO M170, except as modified by NCDOT 1032-9.

B. All pipe shall have interior surfaces free from roughness, projection, indentations, offset or irregularities of any kind.

C. Joint material for reinforced concrete pipe shall be either "O" ring type joints utilizing a rubber "O" ring, or bell and spigot type utilizing a mastic joint material as provided by the pipe manufacturer.

2.5 MANHOLES

A. Standard precast concrete manholes sections shall conform to the latest revision of ASTM C 478. Tapered section and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections. Flat slab tops shall be required for very shallow manholes where shown or specified. Flat slab tops shall ONLY be utilized when/where approved for use by the Engineer. All manholes shall be constructed to the sizes, shapes and dimensions and at the locations shown on the plans. Unless otherwise shown on the plans, manhole diameters, wall thicknesses and bottom thicknesses shall be as follows: Pipe Size (inches) Diameter (feet) Wall Thickness (inches) Bottom Thickness (inches) 8 through 18 4 5 6 21 through 36 5 5 8 39 through 54 6 6 8 Larger than 54 8 8 8

B. The minimum wall thickness of all manhole riser sections shall be as shown in the table above. Cone sections shall have a minimum wall thickness of 8 inches at their top. Suitable openings for inlet and outlet pipes shall be cast into the base section for standard connections and into the riser section for drop connections. These openings shall be circular, accurately located and appropriately sized for each manhole.

C. When indicated on the drawings, precast concrete base sections shall be provided with extended base sections or increased bottom thickness to provide ballast to prevent flotation. When necessary, this ballast shall be provided as shown on the drawings and incorporated into the manhole base section as a monolithic pour.

D. Minimum compressive strength of concrete shall be 4,000 psi at 28 days and shall comply with ACI 318, and ACI 350. The maximum permissible absorption shall be 6.0 percent. All cement used in the mixture shall be in accordance with ASTM C 150, Type II. Fine aggregate shall be sand, while coarse aggregate shall be crushed gravel, both in accordance with ASTM C 33. All water utilized in the concrete mix shall be potable water. Risers shall be reinforced with a single cage of steel placed within the center third of the wall. Welded wire fabric shall be in accordance with ASTM A 185. Steel reinforcing bars shall be grade 60 deformed steel in accordance with ASTM A 615. The tongue or the groove of the joint shall contain one (1) line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross sectional area of steel per linear foot shall be 0.12 square inches. Precast manhole sections shall fit together readily.

E. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the Engineer and his Construction Field Representative. The manhole sections shall be perpendicular to their longitudinal axis within the limits listed in ASTM C 478. F. Joint Sealing Materials: Joints shall be sealed by two (2) butyl rubber seals. Each seal shall be as described below:

1. Butyl Seals shall consist of a plastic or paper-backed butyl rubber rope no less than 1 inch cross section. When manholes are larger than 4 feet diameter or have a larger than normal space between the joints, the length and or diameter of the rope shall be increased as required to achieve a seal. Butyl rubber material shall conform to Federal Specification SSS210A, AASHTO M-198, Type B - Butyl Rubber and as follows: maximum of 1 percent volatile matter and suitable for application temperatures between 10 and 100 degrees

F. Butyl rubber shall be applied to clean, dry surfaces only. Use of 2 independent wraps of Butyl Rubber qualifies for the requirement of two seals. 2. Internal O-Ring Gaskets and Internal Rubber Gaskets shall not be used. September 2022 Project #22.00705 334100 – Page 6

G. Manhole Steps

1. Steps shall be a copolymer polypropylene plastic reinforced with a ½ inch diameter, grade 60 bar and have serrated tread and tall end lugs. Step pull out strength shall be a minimum of 2,000 pounds when tested according to ASTM C-497.

2. Steps shall be required in all structures with a depth greater than four (4) feet. Steps shall be vertically aligned and uniformly spaced for the entire depth of the structure. Steps shall be located in the structures along the vertical face of the eccentric cone and so as to land upon a bench.

3. Steps shall be vertically spaced between twelve (12) and sixteen (16) inches on center. Step width shall be a minimum of twelve (12) inches. Steps shall protrude from the wall of the structure a minimum of five (5) inches and a maximum of seven (7).

4. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place.

H. Precast Grade Rings and Brick

1. Precast reinforced concrete grade rings or brick shall be used to adjust ring and covers to finished grade. No more than 12 vertical inches of grade rings or brick will be allowed per manhole. Grade rings shall conform to ASTM C478 and shall be no less than 6 inches and no more than 9 inches in height with a diameter matching that of the frame and cover.

2. All brick used shall be solid and shall be made from Concrete, Clay, or Shale, and shall be of standard building size.

2.6 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable. B. Portland Cement Design Mix: 4,000 psi minimum, with 0.45 maximum water/cementitious materials ratio

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3,000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel. 2.7 PRECAST CONCRETE BOXES

A. All rectangular drainage structures shall meet the requirements of NCDOT Standard Specifications for Roads and Structures (latest edition) articles 840-1 through 840-3 as well as NCDOT Standard Detail 840.45. No waffle boxes shall be allowed. All pipe openings in precast structures must be cast or cored.

B. Curb inlet catch basins shall conform to NCDOT Standard Details 840.02 and 840.04.

C. Drop inlets shall conform to NCDOT Standard Detail 840.14.

D. Junction boxes shall conform to NCDOT Standard Detail 840.31 E. Manhole Steps

1. Steps shall be a copolymer polypropylene plastic reinforced with a ½ inch diameter, grade 60 bar and have serrated tread and tall end lugs. Step pull out strength shall be a minimum of 2,000 pounds when tested according to ASTM C-497.

2. Steps shall be required in all structures with a depth greater than four (4) feet. Steps shall be vertically aligned and uniformly spaced for the entire depth of the structure. Steps shall be located in the structures along the vertical face of the structure.

3. Steps shall be vertically spaced between twelve (12) and sixteen (16) inches on center. Step width shall be a minimum of twelve (12) inches. Steps shall protrude from the wall of the structure a minimum of five (5) inches and a maximum of seven (7).

4. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place.

F. Precast Grade Rings and Brick

1. Precast reinforced concrete grade rings or brick shall be used to adjust frames and covers to finished grade. No more than 12 vertical inches of grade rings or brick will be allowed per structure. Grade rings shall conform to ASTM C478 and shall be no less than 6 inches and no more than 9 inches in height with a diameter matching that of the frame and cover.

2. All brick used shall be solid and shall be made from Concrete, Clay, or Shale, and shall be of standard building size.

2.8 FRAMES, GRATES AND HOODS

A. All metal castings and grating shall meet the requirements of NCDOT Standard Specifications for Roads and Structures (latest edition) articles 1074-7 and 1074-9.

B. All metal castings shall be sound and free from warp, holes and other defects that impair their strength or appearance. Exposed surfaces shall have a smooth finish and sharp, well defined lines and arises. Machined joints, where required, shall be milled to a close fit. Provide all necessary lugs and brackets so that work can be assembled in a neat, substantial manner.

C. Frames, grates and hoods for curb inlets shall conform to NCDOT Standard Detail 840.03.

D. Frames and grates for drop inlets shall conform to NCDOT Standard Detail 840.16.

E. Frames and covers for junction boxes shall conform to NCDOT Standard Detail 840.54. Include indented top design with lettering cast into cover, using wording "STORM SEWER."

2.9 AGGREGATE FOR UNDERDRAINS

A. Aggregate for underdrains shall be washed stone, standard size number 67 per North Carolina Department of Transportation specifications, Section 1005.

PART 3 - EXECUTION 3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PREPARATION OF PIPE FOUNDATION

A. Lines and Grades: The pipe foundation shall be prepared to be uniformly firm and shall be true to the lines and grades as shown on the plans. Any deviation or field adjustments will require the approval of the Engineer. When a Construction Field Representative is present on the site and is so requested by the Contractor, he shall check the position of grades and lines; but the Contractor shall be responsible for the finished drain line being laid to exact and proper line and grade.

B. Pipe Foundation:

1. Whenever the nature of the ground will permit, the excavation at the bottom of the trench shall have the shape and dimensions of the outside lower third of the circumference of the pipe, care being taken to secure a firm bearing support uniformly throughout the length of the pipe. A space shall be excavated under and around each bell to sufficient depth to relieve it of any load and to allow ample space for filling and finishing the joint. The pipe, when thus bedded firmly, shall be on the exact grade. In case the bed shaped in the bottom of the trench is too low, the pipe shall be completely removed from position, and earth of suitable quality shall be placed and thoroughly tamped to prepare a new foundation for the pipe.

2. In no case shall the pipe be brought to grade by blocking up under the barrel or bell of same, but a new and uniform support must be provided for the full

length of the pipe. Where rock or boulders are encountered in the bottom of the trench, the same shall be removed to such depth that no part of the pipe, when laid to grade, will be closer to the rock or boulders than 6”. A suitably tamped and shaped foundation of suitable earth shall be placed to bring the bottom of the trench to proper subgrade over rock or boulders.

3. Where the foundation material is found to be of poor supporting value, the Engineer may make minor adjustment in the location of the pipe to provide a more suitable foundation. Where this is not practical, the foundation shall be conditioned by removing the existing foundation material by undercutting to the depth as directed by the Engineer, within the limits established on the plans, and backfilling with either a suitable local material secured from unclassified excavation or borrow excavation at the nearest accessible location along the project, or foundation conditioning material consisting of crushed stone or gravel or a combination of sand and crushed stone or gravel approved by the Engineer as being suitable for the purpose intended. The selection of the type of backfill material to be used for foundation conditioning will be made by the Engineer.

C. Water in Trenches: The Contractor shall remove all water which may be encountered or which may accumulate in the trenches by pumping or bailing and no pipes shall be laid until the water has been removed from the trench. The Contractor will not be permitted to drain water through the storm drain within a period of 24 hours after the pipe has been laid, and the open end of the pipe in the trench shall be kept closed with a tight fitting plug to prevent washing of dirt or debris into the line. Water so removed from the trench must be disposed of in such manner as not to cause injury to work completed or in progress.

D. Special Foundations: Whenever the bottom of the trench shall be of such nature as to provide unsatisfactory foundation for the pipe, the Engineer will require the pipe to be laid on timber or concrete cradle foundations. Such foundations whether of single plank, plank cradle, plank cradle supported on piles, or poured concrete cradle, shall be placed by the Contractor and compensation will be allowed the Contractor for the materials so used.

3.3 PIPING INSTALLATION

A. General: All piping is to be installed in strict accordance with the manufacturer's recommendations. Installation manuals from various material suppliers shall be furnished to the Engineer for his review and approval prior to installation of any material. The Engineer may augment any manufacturer's installation recommendations, if in his opinion it will best serve the interest of the Owner.

B. Laying Pipe:

1. No pipe shall be laid except in the presence of the Engineer or his Construction Field Representative or without special permission from the Engineer. Proper tools, implements, and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe, fittings, valves, and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in

such a manner to prevent damage to the pipe materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be carefully given a final inspection to see that it is clean, sound and free of defects. It shall be laid on the prepared foundation to produce a straight line on a uniform grade, each pipe being laid as to form a close abutted joint with a preceding pipe, so as to form a smooth and straight inside flow line. Each pipe will be tested for its exact position after it is in its final position. The pipes shall be fitted together in order to insure sufficient space for joint gaskets, and other jointing material. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.

2. When cutting short lengths of pipe, a pipe cutter as approved by the Engineer will be used, and care will be taken to make the cut at right angles to the center line of the pipe, or on the exact skew as shown on the plans. In the case of push on pipe, the cut ends shall be tapered with a portable grinder of coarse file to match the manufactured taper.

3. When coupling bands for annular or helical corrugated metal pipe are used, the pipe sections shall be joined and fully bolted so that the circumferential and longitudinal strength will be sufficient to preserve the alignment, prevent separation of the sections, and to prevent infiltration of backfill material.

3.4 CONCRETE STRUCTURE INSTALLATION

A. Drainage structures shall be built to the lines, grades and dimensions as shown on the plans. The Contractor shall adjust the final grades in the field as necessary to provide positive drainage to the structures or to match final pavement or grade elevation.

B. Excavations for drainage structures shall be made with care so as not to disturb the surrounding areas more than necessary. All excavations shall be maintained water free until completion of the drainage structure, including backfilling. The Contractor shall provide adequate pumping capacity as required.

C. Where the foundation material is found to be of poor supporting value, the existing foundation material shall be removed by undercutting to the depth directed by the Engineer and backfilled with suitable material secured from locations along the project or from a borrow pit. The backfill placed in the undercut area shall be compacted to a degree satisfactory to the Engineer.

D. Precast concrete sections shall be lifted from the side of the excavation to the bottom of the trench with equipment and support slings capable of safely handling the weight of the concrete pieces. The structure shall be set plumb and adjusted to the final finished surface grade with brick and mortar.

E. For cast-in-place structures the Contractor shall use care in placing rebar and concrete. Unless otherwise approved, the bottom slabs shall be poured separate from the walls. A minimum of seven (7) days cure time shall be provided between completion of pouring the bottom and the walls.

F. Pipe openings shall be exactly aligned to that of the pipe(s) entering and/or leaving the structure. The pipe lines shall be placed in the structure openings, properly aligned, and set to grade.

G. When existing drainage structures are constructed of concrete brick, only new, sound brick shall be used to modify those structures. Mortar mix shall be mixed on site using an approved mortar mix consisting of Portland Cement (Type S), and clean sand. Following the modification of existing drainage boxes, both the interior and exterior shall be plastered with a minimum ½-inch thick coat of Portland Cement and sand mixture.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318. 3.6 FITTINGS AND CONNECTIONS

A. Where fittings enter masonry, they shall be placed as the work is built up, thoroughly bonded, and accurately spaced and aligned.

B. Pipe connections shall be cut off flush with the inside wall of the drainage structure and grouted as necessary to make smooth and uniform surfaces on the inside of the structure.

C. Metal frames for grates and covers shall be set in full mortar beds or secured by methods approved by the Engineer.

D. Pipe collars and pipe plugs shall be constructed in accordance with the details shown on the plans or as directed by the Engineer.

3.7 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

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

1. Close open ends of piping with at least 8-inch thick, concrete bulkheads.

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

1. Remove manhole or structure and close open ends of remaining piping.

2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 36 inches of top with CABC. Fill to top with compacted earth fill.

C. Backfill to grade according to Division 31 Section "Earth Moving."

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Upon completion, installed lines shall show a full circle of light when "Lamped" between drainage structures. This test shall be performed by the Engineer.

B. Other tests may be required by the Engineer, such as exfiltration. In this event the results shall meet the minimum standards that the manufacturer states are obtainable.

C. The Contractor shall demonstrate to the Owner and Engineer that all drainage structures operate as intended and designed. All drainage structures shall be field tested by the Contractor in the presence of the Engineer prior to final acceptance.

D. Replace defective piping and structures using new materials, and repeat inspections until defects are within allowances specified.

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

3.9 CLEANING

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

END OF SECTION 334100