Contract Documents
&
Technical Specifications
For

CITY OF DARLINGTON
East Broad Street Sewer Main Replacement

June 2020

DB.2020-304

RIA #R-20-1244

Prepared by:

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INFORMATION FOR BIDDERS

BIDS will be received by City of Darlington, SC , herein called the Owner, at 400 Pearl Street, Darlington, SC 29540 until **2:00 PM on AUGUST 11, 2020**, then and there at said office to be publicly opened and read aloud.

Each BID must be submitted in a sealed envelope, addressed to: Howard Garland, Manager, City of Darlington, SC.

Each sealed envelope containing a BID must be plainly marked on the outside as BID for the **E. Broad Street Sewer Main Replacement** and the envelope should bear on the outside, the name of the BIDDER, his address, his license number if applicable, and the name of the project for which the BID is submitted. If forwarded by mail, the sealed envelope containing the BID must be enclosed in another envelope addressed to the OWNER at same address as above marked as indicated.

All BIDS must be made on the required BID form, stapled together. All blank spaces for BID prices must be filled in, in ink or on a typewriter and the BID form must be fully completed and executed when submitted. Only one copy of the BID form is required.

The OWNER may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified shall not be considered. No BIDDER may withdraw a BID within ninety (90) days after the actual date of the opening thereof. Should there be reasons why the contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the OWNER and the BIDDER.

BIDDERS must satisfy themselves of the accuracy of the estimated quantities in the BID Schedule by examination of the site and a review of the drawings and specifications including ADDENDA. After BIDS have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of work or of the nature of the work to be done.

The OWNER shall provide to BIDDERS prior to bidding, all information which is pertinent to, and delineates and describes, the land owned and rights-of-way acquired or to be acquired.

The CONTRACT DOCUMENTS contain the provisions required for the construction of the project. Information obtained from an officer, agent, or employee of the OWNER, or any other person, shall not affect the risks or obligations assumed by the contractor or relieve him from fulfilling any of the conditions of the contract.

Each BID must be accompanied by a BID BOND payable to the OWNER for five percent (5%) of the total amount of the BID. As soon as the BID prices have been compared, the OWNER will return the bonds of all except the three lowest responsible bidders. When the Agreement is executed, the bonds of the two remaining unsuccessful bidders will be returned. The BID BOND of the successful bidder will be retained until the PAYMENT BOND and PERFORMANCE BOND have been executed and approved, after which it will be returned. A certified check may be used in lieu of a BID BOND.

A PERFORMANCE BOND and a PAYMENT BOND, each in the amount of one hundred percent (100%) of the contract price, with a corporate surety approved by the OWNER. will be required for the faithful performance of the contract.

Attorneys-in-fact who sign bid bonds or payment bonds and performance bonds must file with each bond a certified and effective dated copy of their Power of Attorney.

The party to whom the contract is awarded will be required to execute the Agreement and obtain the performance bond and payment bond within ten (10) calendar days from the date when the Notice of Award is delivered to the BIDDER. The Notice of Award shall be accompanied by the necessary Agreement and bond forms. In case of failure of the BIDDER to execute the Agreement, the OWNER may, at his option, consider the BIDDER in default, in which case the Bid Bond accompanying the proposal shall become the property of the OWNER.

The OWNER, within ten (10) days of receipt of an acceptable Performance Bond, Payment Bond, and Agreement signed by the party to whom the Agreement was awarded, shall sign the Agreement. If the OWNER does not execute the Agreement within such period, the BIDDER may, by WRITTEN NOTICE, withdraw his signed Agreement. Such Notice of Withdrawal shall be effective upon receipt of the notice by the OWNER.

The NOTICE TO PROCEED shall be issued within ten (10) days of the execution of the Agreement by the OWNER. Should there be reasons why the NOTICE TO PROCEED cannot be issued within such period, the time may be extended by mutual agreement between the OWNER and CONTRACTOR. If the NOTICE TO PROCEED has not been issued within the ten-day period or within the period mutually agreed upon, the CONTRACTOR may terminate the Agreement without further liability on the part of either party.

The OWNER may make such investigations as he deems necessary to determine the ability of the BIDDER to perform the work, and the BIDDER shall furnish to the OWNER all such information and data for this purpose as the OWNER may request. The OWNER reserves the right to reject any BID if the evidence submitted by, or investigation of such BIDDER fails to satisfy the OWNER that such BIDDER is properly qualified to carry out the obligations of the

Agreement and to complete the work contemplated therein. A conditional or qualified BID will not be accepted. Award will be made to the lowest responsive, responsible, BIDDER.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout.

Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the contract documents. The failure or omission of any BIDDER to do any of the foregoing shall in no way relieve any BIDDER from any obligation in respect to his BID.

The low BIDDER shall supply the names and addresses of major material suppliers and subcontractors when requested to do so by the OWNER.

The ENGINEER is Glenn T. Kirven, P.E. Davis & Brown, 124 W. McIver Road, Florence, South Carolina 29501.

BID FORM

Proposal of _____, hereinafter called "BIDDER", organized and existing under the Laws of the State of _____, doing business as

_____ _,

To_____, hereinafter called "OWNER". In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all work for the construction of:

_____

In strict accordance with the Contract Documents within the time set forth therein and at the prices stated below.

By permission of this Bid, each BIDDER certifies, and in the case of a joint Bid, each party thereto certifies as to his own organization, that this Bid has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this Bid with any other BIDDER or with any competitor.

BIDDER here agrees to commence work under this Contract on or before a date to be specified in the Notice to Proceed and to fully complete the Project within **90** consecutive calendar days thereafter. BIDDER further agrees to pay as liquidated damages sustained by the Owner, if the Project is not completed within the stipulated time, $400.00 per day for each consecutive calendar day thereafter as provided in Section 15 of the General Conditions.

*Insert: "a corporation", "a partnership", or "an individual", as applicable.

BIDDER acknowledges receipt of the following **ADDENDUM:** _____

_____ BIDDER hereby agrees that preference will be given to domestic construction material and further agrees to require subcontractors, material men and suppliers to also give preference to domestic construction material.

BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the following unit prices**:**

BID SCHEDULE

Item	Description	Quantity	Units	Unit Cost	Total
1	Gravity Sewer 18” PVC (12-14’ Depth)	LF	60	$	$
2	Gravity Sewer 18” PVC (14-16’ Depth)	LF	100	$	$
3	Gravity Sewer 18” PVC (16-18’ Depth)	LF	540	$	$
4	Gravity Sewer 18” PVC (18-20’ Depth)	LF	50	$	$
5	Gravity Sewer 8” PVC (4-6’ Depth)	LF	120	$	$
6	Gravity Sewer 8” PVC (6-8’ Depth)	LF	726	$	$
7	Sewer Manhole 5’ Dia. (12-14’ Depth)	EA	1	$	$
8	Sewer Manhole 5’ Dia. (16-18’ Depth)	EA	2	$	$
9	Sewer Manhole 4’ Dia. (4-6’ Depth)	EA	3	$	$
10	Sewer Services 4” PVC	EA	20	$	$
11	Asphalt Driveway Patch	LF	360	$	$
12	Concrete Sidewalk	SF	500	$	$
13	Stormwater Junction Box (SW and 8” DI Sewer)	EA	1	$	$
14	Select Fill Material	CY	5,700	$	$
15	Road Asphalt Cut and Repair (6” Binder) including markings	SY	1,920	$	$
16	Asphalt Overlay (2” Overlay)	SY	2,950	$	$
17	Bypass Pumping	LS	1	$	$
18	Signage	LS	1	$	$
19	Grassing and Erosion Control	LS	1	$	$

TOTAL AMOUNT $_____

NOTE: QUANTITIES GIVEN IN BID SCHEDULE ARE ESTIMATES ONLY. PRICES TO INCLUDE ALL TAXES & FEES.

WRITTEN (IN WORDS) TOTAL AMOUNT _____

_____**DOLLARS**

Respectfully submitted:

_____	_____
Company	Signature/ Title
_____	_____
Address	License Number (If Applicable)
_____	_____
	Date

SEAL - if BID is by a corporation.

ATTEST: _____

BID BOND

KNOW ALL MEN BY THESE PRESENTS, THAT WE_____

_____

as Principal, hereinafter called the Principal, and _____

_____

a corporation duly organized under the laws of the State of _____

_____ as Surety, hereinafter called the Surety, are held and firmly bound unto_____as Obligee, hereinafter called the Obligee, in the sum

of_____

_____ Dollars ($),

for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for_____

_____

_____

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this_____ day of _____, 20___.

_____ _____

Witness Principal's Name & Title (Seal)

_____ _____

Witness Surety's Name & Title (Seal)

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that _____
(Name & Address)
_____

as Principal, hereinafter called Contractor, and _____
(Name & Address)
_____

as Surety, hereinafter called Surety, are held and firmly bound

unto _____
(Name and Address of Owner)

as Obligee, hereinafter called Owner, in the amount of - _____

_____Dollars ($_____)

for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,_____,

Contractor has by written agreement dated _____, 20__,

entered into a contract with Owner for _____

_____

_____

_____

in accordance with Drawings and Specifications prepared by _____

_____
(Name & Address of Engineer)

which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if

Contractor shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

The Surety hereby waives notice of any alteration or extension of time made by the Owner.

Whenever Contractor shall be, and is declared by Owner to be in default under the Contract, the Owner having performed Owner's obligations thereunder, the Surety may promptly remedy the default, or shall promptly --

1. Complete the Contract in accordance with its terms and conditions, or

2. Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, or, if the Owner elects, upon determination by the Owner and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and Owner, and make available as Work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by Owner to Contractor under the Contract and any amendments thereto less the amount properly paid by Owner to Contractor.

Any suit under this bond must be instituted before the expiration of two (2) years from the date on which final payment under the Contract falls due.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the Owner named herein or the heirs, executors, administrators or successors of the Owner.

Signed and sealed this _____ day of _____, 20___.

_____ _____
Witness Principal & Title (Seal)

_____ _____
Witness

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS:

that_____

_____
(Name & Address of Contractor)

as Principal, hereinafter called Principal, and

_____

_____
(Name & Address of Surety)

as Surety, hereinafter called Surety, are held and firmly bound

unto_____
(Name and Address of Owner)

as Obligee, hereinafter called Owner, for the use and benefit of claimants as herein below defined, in the amount of _____

_____ Dollars ($_____),

for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,_____ Principal has by written agreement dated _____, 20___, entered into a contract with Owner for_____

in accordance with Drawings and Specifications prepared by

_____
(Name & Address of Engineer)

which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1. A claimant is defined as one having a direct contract with the Principal or with a Subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the Contract, labor, and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

2. The above named Principal and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.

3. No suit or action shall be commenced hereunder by any claimant:

   a. Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: the Principal, the Owner, or the Surety above named, within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be severed by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, Owner or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.

b. After the expiration of one (1) year following the date on which Principal ceased Work on said Contract, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

c. Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the Project, or any part thereof, is situated, or in the United States District Court for the district in which the Project or any part thereof is situated, or in the United States District Court for the district in which the Project, or any part thereof, is situated, and not elsewhere.

4. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens which may be filed of record against said improvement, whether or not claim for the Amount of such lien be presented under and against this bond.

Signed and sealed this _____ day of _____, 20_____.

_____ _____
Witness Principal & Title (Seal)

_____ _____
Witness Surety & Title (Seal)

NOTICE OF AWARD

TO: _____ Date: _____

_____

_____

PROJECT NO.: _____

PROJECT DESCRIPTION: _____

You are notified that your Bid dated _____for the above Contract has been considered. You are the apparent successful bidder and have been awarded a contract for_____.

The Contract Price of your contract is _____Dollars ($_____).

Three copies of each of the proposed Contract Documents (except Drawings) accompany this Notice of Award. Three sets of the Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within thirty days of the date of this Notice of Award, that is, by _____.

1. You must deliver to the OWNER three fully executed counterparts of the Agreement including all the Contract Documents. Each of the Contract Documents must bear your signature.

2. You must deliver with the executed Agreement the Contract Security (Bonds) as specified in the Instructions to Bidders, General Conditions and Supplementary Conditions.

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

Within ten (10) days after you comply with those conditions, the OWNER will return to you one fully signed counterpart of the Agreement with the Contract Documents attached.

OWNER _____

BY: _____

TITLE: _____

AGREEMENT

AGREEMENT made as of the ___ day of _____ in the year Two Thousand and ____,

BETWEEN the Owner: _____
_____
_____

and the Contractor: _____
_____
_____

The Project: _____

The Engineer: Davis & Brown
Post Office Box 15038
Quinby, SC 29506

The Owner and Contractor agree as set forth below.

ARTICLE 1

THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, the Conditions of the Contract (General, Supplementary and other Conditions), the Drawings, the Specifications, all Addenda issued prior to and all Modifications issued after execution of this Agreement. These form the Contract, and all are as fully a part of the Contract as if attached to this Agreement or repeated herein.

ARTICLE 2

THE WORK

The scope of work to include the installation of 750 lf of 18” gravity sewer, 846 lf of 8” gravity sewer, 6 manholes, services, asphalt repair and replacement and appurtenances.

ARTICLE 3

TIME OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

The Work to be performed under this Contract shall be commenced Within (30) days of Notice to Proceed and, subject to authorized adjustments, Substantial Completion shall be achieved not later than **90** Consecutive Calendar Days from the date of Notice to Award/Proceed.

BIDDER further agrees to pay as liquidated damages sustained by the Owner, if the Project is not completed within the stipulated time, **$400.00** per day for each consecutive calendar day thereafter as provided in the General Conditions.

ARTICLE 4

CONTRACT SUM

The Owner shall pay the Contractor in current funds for the performance of the work, subject to additions and deductions by Change Order as provided in the Contract Documents, the Contract Sum of _____
_____Dollars ($_____).

The Contract Sum is determined as follows:

Unit Prices Within the Bid Schedule_____
_____

ARTICLE 5

PROGRESS PAYMENTS

Based upon Applications for Payment submitted to the Engineer by the Contractor and Certificates for Payment issued by the Engineer, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided in the Contract Documents for the period ending the __15th_ day of the month as follows:

Not later than __thirty__days following the end of the period covered by the Application for Payment __ninety__percent (_90_%) of the portion of the Contract Sum properly allocable to labor, materials and equipment incorporated in the work and__ninety__percent (_90_%) of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing, for the period covered by the Application for Payment, less the aggregate of previous payments made by the Owner; and upon Substantial Completion of the entire work, a sum sufficient to increase the total payments to __ ninety-five_____ percent (_95_%) of the Contract Sum, less such amounts as the Engineer shall determine for all incomplete Work and unsettled claims as provided in the Contract Documents.

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate entered below, or in the absence thereof, at the legal rate prevailing at the place of the Project. The rate of interest agreed upon is ____N/A_____.

ARTICLE 6

FINAL PAYMENT

Final payment, constituting the entire unpaid balance of the Contract Sum, shall be paid by the Owner to the Contractor when the work has been completed, the Contract fully performed, and a final Certificate for Payment has been issued by the Engineer.

ARTICLE 7

MISCELLANEOUS PROVISIONS

Terms used in this Agreement which are defined in the Conditions of the Contract shall have the meanings designated in those Conditions.

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

OWNER	CONTRACTOR
_____	_____
_____	_____
By:_____	By:_____

NOTICE TO PROCEED

TO: (Contractor's name/address) DATE: _____

PROJECT: _____ _____
(Number) (Name)

You are hereby notified to commence WORK in accordance with the Agreement executed _____, on or before _____, and you are to complete the WORK within _____ consecutive calendar days thereafter. The date of completion of all WORK is therefore _____ .

_____
Owner

By: _____

Title: _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by _____
Contractor

this the _____ day of _____, 20____.

By: _____

Title: _____

CHANGE ORDER

Order No. _____

Date: _____

Agreement Date: _____

NAME OF PROJECT: _____

_____

OWNER: _____

CONTRACTOR: _____

The following changes are hereby made to the *Contract Documents:*

Justification:

Change to *Contract Price:* *$* _____

Original *Contract Price:* *$* _____

Current *Contract Price* adjusted by previous *Change Order:* *$* _____

The *Contract Price* due to this *Change Order* will be (increased) (decreased) by:

$ _____

The new *Contract Price* including this *Change Order* will be: *$*_____

Change to *Contract Time:*

The *Contract Time* will be (increased) (decreased) by _____ calendar days.

The date for completion of all work will be _____ (Date).

Approvals Required:

To be effective this Order must be approved by the Federal agency if it changes the scope of objective of the PROJECT, or as many otherwise be required by the SUPPLEMENT GENERAL CONDITIONS.

Requested by: _____

Recommended by: _____

Ordered by: _____

Accepted by: _____

SECTION 01 30 00 – GENERAL CONDITIONS

PART 1 GENERAL

1.1 SUMMARY

A. SECTION INCLUDES

1. Definitions.
2. Schedules, Reports and Records.
3. Drawings and Specifications.
4. Shop Drawings.
5. Materials, Services and Facilities.
6. Inspection and Testing.
7. Substitutions.
8. Patents.
9. Surveys, Permits, Regulations.
10. Protection of Work, Property, and Persons.
11. Supervision by Contractor.
12. Changes in the Work.
13. Changes in Contract Price.
14. Time for Completion and Liquidated Damages.
15. Correction of Work.
16. Subsurface Conditions.
17. Suspension of Work, Determination, and Delay.
18. Payments to Contractor.
19. Acceptance of Final Payment As Release.
20. Insurance.
21. Contract Security.
22. Assignments.
23. Indemnification.
24. Separate Contracts.
25. Subcontracting.
26. Engineer’s Authority.
27. Land and Rights-of-way.
28. Guaranty.
29. Arbitration.
30. Taxes.

1.2 DEFINITIONS

A. Wherever used in the CONTRACT DOCUMENTS, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

Addenda -- Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Documents, drawings and Specifications, by additions, deletions, clarifications or corrections.

Bid --The offer or proposal of the Bidder submitted on the prescribed form, setting forth the prices for the work to be performed.

Bidder -- Any person, firm or corporation submitting a Bid for the work.

Bonds -- Bid, Performance, and Payment Bonds are instruments of security, furnished by the Contractor and his surety in accordance with the Contract Documents.

Change Order -- A written order to the Contractor authorizing an addition, deletion or revision in the work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Price or Contract Time.

Contract Documents -- The contract, including Advertisement for Bids, Information for Bidders, Bid, Bid Bond, Agreement, Payment Bond, Performance Bond, Notice of Award, Notice to Proceed, Change Order, Drawings, Specifications, and Addenda.

Contract Price – The total monies payable to the Contractor under the terms and conditions of the Contract Documents.

Contract Time -- The number of calendar days stated in the Contract Documents for the completion of the work.

Contractor -- The person, firm, or corporation with whom the Owner has executed the Agreement.

Drawings -- The part of the Contract Documents which show the characteristics and scope of the Work to be performed and which have been prepared or approved by the Engineer.

Engineer -- The person, firm or corporation named as such in the Contract Documents.

Field Order -- A written order effecting a change in the Work not involving an adjustment in the Contract Price or an extension of the Contract Time, issued by the Engineer to the Contractor during construction.

Notice of Award -- The written notice of the acceptance of the Bid from the Owner to the successful Bidder.

Notice to Proceed -- Written communication issued by the Owner to the Contractor authorizing him to proceed with the Work and establishing the date of commencement of the Work.

Owner -- A public or quasi-public body or authority, corporation, association, partnership, or individual for whom the Work is to be performed.

Project -- The under taking to be performed as provided in the Contract Documents.

Resident Project Representative -- The authorized representative of the Owner who is assigned to the Project site or any part thereof.

Shop Drawings -- All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a subcontractor, manufacturer, supplier or distributor, which illustrate how specific portions of the Work shall be fabricated or installed.

Specifications -- A part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

Subcontractor -- An individual, firm or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the site.

Substantial Completion -- That date, as certified by the Engineer when the construction of the Project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the Project or specified part can be utilized for the purposes for which it is intended.

Supplemental General Conditions -- Modifications to General Conditions required by a Federal agency for participation in the Project and approved by the agency in writing prior to inclusion in the Contract Documents or such requirements that maybe imposed by applicable state laws.

Supplier -- Any person or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

Work -- All labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in the Project.

Written Notice -- Any notice to any party of this Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the Work.

1.3 SCHEDULES, REPORTS AND RECORDS

A. The Contractor shall submit to the owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data where applicable as are required by the Contract Documents for the work to be performed.

B. Prior to the first partial payment estimate, the Contractor shall submit construction progress schedules showing the order in which he proposes to carry on the Work, including dates at which he will start the various parts of the Work, estimated date of completion of each part and, as applicable:
   1. The dates at which special detail drawings will be required, and

2. Respective dates for submission of Shop Drawings, the beginning of manufacturer, the testing and the installation of materials, supplies and equipment.

C. The Contractor shall also submit a schedule of payments that he anticipates he will earn during the course of the Work.

1.4 DRAWINGS AND SPECIFICATIONS

A. The intent of the Drawings and Specifications is that the Contractor shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the work in accordance with the Contract documents and all incidental work necessary to complete the project in an acceptable manner, ready for use, occupancy or operation by the Owner.

B. In case of conflict between the Drawings and Specifications, the Drawings shall govern. Figure dimensions on Drawings shall govern over scale dimensions in detail drawings shall govern over general drawings.

C. Any discrepancies found between the Drawings and Specifications and site conditions or any inconsistencies or ambiguities in the Drawings or Specifications shall be immediately reported in writing to the Engineer, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the Contractor after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor's risk.

1.5 SHOP DRAWINGS

A. The Contractor shall provide Shop Drawings as may be necessary for the prosecution of the work as required by the Contract Documents. The Engineer shall promptly review all Shop Drawings. The Engineer's approval of any Shop Drawing shall not release the Contractor from responsibility for deviations from the Contract Documents. A Change Order shall evidence the approval of any Shop Drawing of which substantially deviates from the requirement of the Contract Documents.

B. When submitted for the Engineers review, Shop Drawings shall bear the Contractor's certification that he has reviewed, checked and approved the Shop Drawings and that they are in conformance with the requirements of the Contract Documents.

C. Portions of the work requiring a Shop Drawing or sample submission shall not begin until the Engineer has approved the Shop Drawing or submission. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.

1.6 MATERIALS, SERVICES AND FACILITIES

A. it is understood that, except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light,

power, transportation, supervision, temporary construction of any nature and all other services and facilities of any nature whatsoever necessary to execute, complete, and delivered the Work within the specified time.

B. Materials and equipment shall be so stored as to ensure the preservation of their quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work shall be located so as to facilitate prompt inspection.

C. Manufactured articles, materials and equipment shall be applied, installed, connected, directed, used, cleaned and conditioned as directed by the manufacturer.

D. Materials, supplies and equipment shall be in accordance with samples submitted by the Contractor and approved by the Engineer.

E. Materials, supplies, or equipment to be incorporated into the Work shall not be purchased by the Contractor or the Subcontractor subject to a chattel mortgage or under a conditional sale contract or other agreement by which interest is retained by the seller.

1.7 INSPECTION AND TESTING

A. All materials and equipment used in the construction of the Project shall be subject to adequate inspection and testing in accordance with generally accepted standards, has required and defined in the Contract Documents.

B. The Owner shall provide all inspection and testing services not required by the Contract Documents.

C. The Contractor shall provide at his expense, the testing and inspection services required by the Contract Documents.

D. If the Contract Documents, laws, ordinances, rules, regulations or order of any public authority having jurisdiction, require any Work to specifically be inspected, tested, or approved by someone other than the Contractor, the Contractor shall give the Engineer timely notice of readiness. The Contractor will then furnish the Engineer the required certificates of inspection, testing or approval.

E. Inspections, tests or approvals by the Engineer or others shall not relieve the Contractor from his obligations to perform the Work in accordance with the requirements of the Contract Documents.

F. The Engineer and his representatives will, at all times have access to the Work. In addition, authorized representatives and agents of any participating Federal or State agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and also for any inspection or testing thereof.

G. If any Work is covered contrary to the written instructions of the Engineer, if requested by the Engineer, it must be uncovered for his observation and replaced at the Contractor's expense.

H. If the Engineer considers it necessary or advisable that covered Work be inspected or tested by others, the Contractor, at the Engineer's request, will uncover, expose or otherwise make available for observation, inspection or testing as the Engineer may require, that portion of the Work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such Work is defective, the Contractor will bear all the expenses of such uncovering, exposure, observation, inspection and testing of satisfactory reconstruction. If, however, such Work is not found to be defective, the Contractor will be allowed in increase in the Contract Price or extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and inappropriate Change Order shall be issued.

I. Any costs associated with location or inspection of utility lines other than those being installed as part of this project will be at the expense of the Contractor, and no separate payment will be made for these expenses.

1.8 SUBSTITUTIONS

A. Whenever a material, article or piece of equipment is identified on the Drawings or Specifications by reference to brand name or catalogue number, it shall be understood that this is reference for the purpose of defining the performance of other salient requirements and that other products of equal capacities, quality and material, article, or piece of equipment of equal substance and function for these referred to in the Contract Documents by reference to brand name or catalogue number and if, in the opinion of the Engineer, such material, article, or piece of equipment is of equal substance and function to that specified, the Engineer may approve its substitution and use by the Contractor. Any cost differential shall be deductible from the Contract price and the Contract documents shall be appropriately modified by Change Order. The Contractor warrants that if substitutes are approved, no major changes in the function or general design of the project will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the Contract price or Contract time.

1.9 PATENTS

A. The Contractor shall pay all applicable royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and save the Owner harmless from loss on account thereof except that the Owner shall be responsible for any such loss when a particular process, design or the product of a particular manufacturer or manufacturers is specified, however, if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Engineer.

1.10 SURVEYS, PERMITS, AND REGULATIONS

A. The Owner shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the Work together with a suitable number of bench marks adjacent to the Work as shown in the Contract Documents. From the information provided by the Owner, unless otherwise specified in the Contract Documents, the Contractor shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stake for pile locations and other working points, lines, elevations and cut sheets.

B. The Contractor shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

C. Permits and licenses of a temporary nature necessary for the prosecution of the Work shall be secured and paid for by the Contractor unless otherwise stated in the Supplemental General Conditions. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Owner, unless otherwise specified. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified. If the Contractor observes that the Contract Documents are at variance therewith, he shall promptly notify the Engineer in writing and any necessary changes shall be adjusted as provided in Section 13, Changes in the Work.

1.11 PROTECTION OF WORK, PROPERTY AND PERSONS

A. The Contractor will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the Work and other persons who may be affected thereby, all the Work and all materials or equipment to be incorporated therein, whether storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

B. The Contractor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. He will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. He will notify owners of adjacent utilities when prosecution of the Work may affect them. The Contractor will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by the Contractor, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them be liable, except damage or loss attributable to the fault of the Contract Documents or to the acts or omissions of the Owner or the Engineer or anyone employed by either of them or anyone for whose acts either of them may be liable, and

not attributable, directly or indirectly, in whole or in part, to the fault of negligence by the Contractor.

C. In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or Owner, shall act to prevent threatened damage, injury or loss. He will give the Engineer prompt WRITTEN NOTICE of any significant changes in the Work or deviations from the Contract Documents caused thereby and a Change Order shall there upon be issued covering the changes and deviations involved.

1.12 SUPERVISION BY CONTRACTOR

A. The Contractor will supervise and direct the Work. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor will employ and maintain on the Work a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The supervisor shall have full authority to act on behalf of the Contractor and all communications given to the Supervisor shall be as binding as if given to the Contractor. The Supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the Work.

1.13 CHANGES IN THE WORK

A. The Owner may, at any time as the need arises, order changes within the scope of the Work without invalidating the Agreement. If such changes increase or decrease the amount due under the Contract Documents, or in the time required for performance of the Work, Change Order shall authorize an equitable adjustment.

B. The Engineer also may, at any time, by issuing a Field Order, make changes in the details of the Work. The Contractor shall proceed with the performance of any changes in the Work so ordered by the Engineer unless the Contractor believes that such Field Order entitles him to a change in the Contract Price or Time or both, in which event he shall give the Engineer WRITTEN NOTICE thereof within seven (7) days after the receipt of the ordered change. Thereafter the Contractor shall document the basis for the change in Contract Price or Time within thirty (30) days. The Contractor shall not execute such changes pending the receipt of any executed Change Order or further instruction from the Owner.

1.14 CHANGES IN CONTRACT PRICE

A. The Contract Price may be changed only by a Change Order. The value of any Work covered by a Change Order or of any claim for increase or decrease in the Contract Price shall be determined by one or more of the following methods in the order of precedence listed below:
   1. Unit prices previously approved
   2. An agreed upon sum
   3. The actual cost for labor, direct overhead, materials, supplies, equipment, and other services necessary to complete the work.

In addition there shall be added an amount to be agreed upon but not to exceed fifteen (15%) percent of the actual cost of the Work to cover the cost of general overhead and profit.

1.15 TIME FOR COMPLETION AND LIQUIDATED DAMAGES

A. The date of beginning and the time for completion of the Work are essential conditions of the Contract Documents and the Work embraced shall be commenced on a date specified in the Notice to Proceed.

B. The Contractor will proceed with the Work at such rate of progress to insure full completion within the Contract Time. It is expressly understood and agreed, by and between the Contractor and the Owner, that the Contract Time for the completion of the Work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Work.

C. If the Contractor shall fail to complete the Work within the Contract Time or extension of time granted by the Owner, then the Contractor will pay to the Owner the amount for liquidated damages as specified in the Bid for each calendar day the Contractor shall be in default after the time stipulated in the Contract Documents.

D. The Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the Work is due to the following, and the Contractor has promptly given WRITTEN NOTICE of such delay to the Owner or Engineer.
   1. To any preference, priority or allocation order duly issued by the Owner.
   2. To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and
   3. To any delays of Subcontractors occasioned by any of the causes specified in paragraphs 15.4.1 and 15.4.2 of this article.

1.16 CORRECTION OF WORK

A. The Contractor shall promptly remove from the premises all Work rejected by the Engineer for failure to comply with the Contract Documents, whether incorporated in the construction or not, and the Contractor shall promptly replace and re-execute the Work in accordance with the Contract Documents and without expense to the Owner and shall bear the expense of making good all Work of other Contractors destroyed or damaged by such removal or replacement.

B. All removal and replacement Work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected Work within ten (10) days after receipt of WRITTEN NOTICE, the Owner may remove such Work and store the materials at the expense of the Contractor.

1.17 SUBSURFACE CONDITIONS

A. Should the contractor encounter subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents; or
   1. Unknown physical conditions at the site of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work of the contractor provided for in the Contract Documents.
   2. The Contractor shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the Owner by WRITTEN NOTICE of:

B. The Owner shall promptly investigate the conditions, and if he finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for performance of the Work, an equitable adjustment shall be made and the Contract Documents shall be modified by a Change Order. Any claim of the Contractor for adjustment hereunder shall not be allowed unless he has given the required WRITTEN NOTICE; provided that the Owner may, if he determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

1.18 SUSPENSION OF WORK, TERMINATION AND DELAY

A. Owner may suspend the Work or any portion thereof for a period of not more than ninety (90) days or such further time as agreed upon by the Contractor, by WRITTEN NOTICE to the Contractor and the Engineer, which notice shall fix the date on which work shall be resumed. The Contractor will resume that work on the date so fixed. The Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension.

B. If the Contractor is adjudged as bankrupt or insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or receiver is appointed for the Contractor or for any of his property, or if he files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or applicable laws, or if he repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment or if he repeatedly fails to make prompt payments to Subcontractors or for labor, materials, or equipment or if he disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the Work or if he disregards the authority of the Engineer, or if he otherwise violates any provision of the Contract Documents, then the Owner may, without prejudice to any other right or remedy, and after giving the Contractor and his surety a minimum of ten (10) days from delivery of the WRITTEN NOTICE, terminate the services of the Contractor and take possession of the Project and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor and finish the Work by whatever method he may deem expedient. In such case, the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the project, including compensation for additional professional services, such excess shall be paid to the Contractor. If such costs exceed such unpaid balance, the Contractor will pay the difference to the Owner. Such costs incurred by the Owner will be determined by the Engineer and incorporated in a Change Order.

C. Where the Contractor's services have been so terminated by the Owner, said termination shall not affect any right of the Owner against the Contractor then existing or which may thereafter accrue. Any retention or payment of monies due the Contractor by the Owner will not release the Contractor from compliance with the Contract Documents.

D. After ten (10) days from delivery of a WRITTEN NOTICE to the Contractor and the Engineer, the Owner may, without cause and without prejudice to any other right or remedy, elect to abandon the Project and terminate the Contract. In such case, the Contractor shall be paid for all work executed and any expense sustained plus reasonable profit.

E. If, through no act or fault of the Contractor, the work is suspended for a period of more than ninety (90) days by the Owner or under an order of court or other public authority, or the Engineer fails to act on any request for payment within thirty (30) days after it is submitted, or the Owner fails to pay the Contractor substantially the sum approved by the Engineer or awarded by arbitrators within thirty (30) days of its approval and presentation, then the Contractor may, after ten (10) days from delivery of a WRITTEN NOTICE to the Owner and the Engineer, terminate the Contract and recover from the Owner payment for all work executed and all expenses sustained. In addition, and in lieu of terminating the Contract, if the Engineer has failed to act on a request for payment, or if the Owner has failed to make any payment as aforesaid, the Contractor may, upon ten (10) days WRITTEN NOTICE to the Owner and the Engineer, stop the work until he has been paid all amounts then due, in which event and upon resumption of the work, Change Orders shall be issued for adjusting the Contract Price or extending the Contract Time, or both to compensate for the costs and delays attributable to the stoppage of the work.

F. If the performance of all or any portion of the Work is suspended, delayed, or interrupted as a result of a failure of the Owner or Engineer to act within the time specified in the Contract Documents, or if no time is specified, within a reasonable time an adjustment in the Contract Price or an extension of the Contract Time, or both, shall be made by Change Order to compensate the Contractor for the costs and delays necessarily caused by the failure of the Owner or Engineer.

1.19 PAYMENTS TO CONTRACTOR

A. At least ten (10) days before each progress payment falls due (but not more often than once a month), the Contractor will submit to the Engineer a Partial Payment Estimate filled out and signed by the Contractor covering the work performed during the period covered by the Partial Payment Estimate and supported by such data as the Engineer may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the Owner, as will establish the Owner's title to the material and equipment and protect his interest therein, including applicable insurance. The Engineer will, within ten (10) days after receipt of each Partial Payment Estimate, either indicate in writing his approval of payment and present the Partial Payment Estimate to the Owner, or return the partial payment estimate to the Contractor indicating in writing his reasons for refusing to approve payment. In the latter case, the Contractor may

make the necessary corrections and resubmit the Partial Payment Estimate. The Owner will, within ten (10) days of presentation to him of an approved Partial Payment Estimate, pay the Contractor a Progress payment on the basis of the approved Partial Payment Estimate. The Owner shall retain ten percent (10%) of the amount of each payment until final completion and acceptance of all work covered by the Contract Documents. The Owner however, at any time after fifty percent (50%) of the work has been completed, if he finds that satisfactory progress is being made, may reduce retainage to five percent (5%) on the current and remaining estimates. When the work is substantially complete (operational or beneficial for occupancy), the retained amount may be further reduced below five percent (5%) to only that amount necessary to assure completion. On completion and acceptance of a part of the work on which the price is stated separately in the Contract Documents, payment may payment may be made in full, including retained percentages, less authorized deductions.

B. The request for payment may also include an allowance for the cost of such major materials and equipment, which are suitably stored either at or near the site.

C. Prior to substantial completion, the Owner, with the approval of the Engineer and with the concurrence of the Contractor, may use any completed or substantially completed portions of the work. Such use shall not constitute an acceptance of such portions of the work.

D. The Owner shall have the right to enter the premises for the purpose of doing work not covered by the Contract Documents. This provision shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the work, or the restoration of any damaged work except such as may be caused by agents or employees of the Owner.

E. Upon completion and acceptance of the Work, the Engineer shall issue a certificate attached to the final payment request that the Work has been accepted by him under the conditions of the Contract Documents. The entire balance found to be due the Contractor, including the retained percentages, but except such sums as may be lawfully retained by the Owner, shall be paid to the Contractor within thirty (30) days of completion and acceptance of the work.

F. The Contractor will indemnify and save the Owner or the Owner's agents harmless from all claims growing out of the lawful demands of subcontractors, laborers, workmen, mechanics, material men, and furnishers of machinery and arts thereof, equipment, tools, and all supplies incurred in the furtherance of the performance of the work. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If the Contractor fails to do so, the Owner may, after having notified the Contractor, either pay unpaid bills or withhold from the Contractor’s unpaid compensation, a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of the Contract Documents, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor, his

Surety, or any third party. In paying any unpaid bills of the Contractor, any payment so made by the Owner shall be considered as a payment made under the Contract Documents by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.

G. If the Owner fails to make payment thirty (30) days after approval by the Engineer, in addition to other remedies available to the Contractor, there shall be added to each such payment, interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by the Contractor.

1.20 ACCEPTANCE OF FINAL PAYMENT AS RELEASE

A. The acceptance by the Contractor of final payment shall be and shall operate a release to the Owner of all claims and all liability to the Contractor other than claims in stated amounts as may be specifically excepted by the Contractor for all things done or furnished in connection with this work and for every act and neglect of the Owner and others relating to or arising out of this work. Any payment, however, final or otherwise, shall not release the Contractor or his sureties from any obligations under the Contract Documents or the Performance Bond and Payment Bonds.

1.21 INSURANCE

A. The Contractor shall purchase and maintain such insurance as will protect him from claims set forth below which may arise out of, or result from the Contractor's execution of the work, whether such execution be by himself or by any subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:
   1. Claims under workmen's compensation, disability benefit and other similar employee benefit acts;
   2. Claims for damages because of bodily injury, occupational sickness or disease, or death of his employees;
   3. Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;
   4. Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person; and
   5. Claims for damages because of injury to or destruction of tangible property, including loss of use resulting there from.
      a. Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the work. The Certificates shall contain a provision that coverages afforded under the policies will not be canceled unless at least fifteen (15) days prior WRITTEN NOTICE has been given to the Owner.

B. The Contractor shall procure and maintain, at his own expense, during the Contract Time, liability insurance as hereinafter specified.

1. Contractor's General Public Liability and Property Damage Insurance, including vehicle coverage, issued to the Contractor and protecting him from all claims for personal injury including death and all claims for destruction of, or damage to property arising out of, or in connection with any operations under the Contract Documents, whether such operations be by himself or by any subcontractor under him or anyone directly or indirectly employed by the Contractor or by a subcontractor under him. Insurance shall be written with a limit of liability of not less than $500,000 for all damages arising out of bodily injury, including death, at any time resulting there from, sustained by anyone person in any one accident; and a limit of liability of not less than $500,000 aggregate for any such damages sustained by two or more persons in any one accident. Insurance shall be written with a limit of liability of not less than $200,000 for all property damage sustained by any one person in any one accident; and a limit of liability of not less than $200,000 aggregate for any such damage sustained by two or more persons in any one accident.
2. The Contractor shall acquire and maintain, if applicable, Fire and Extended Coverage Insurance upon the project to the full insurable value thereof for the benefit of the Owner, the contractor, and subcontractors as their interest may appear. This provision shall in no way release the Contractor or Contractor's surety from obligations under the Contract Documents to fully complete the project.

C. The Contractor shall procure and maintain, at his own expense during the Contract Time, in accordance with the provisions of the laws of the state in which the work is performed, Workmen's Compensation Insurance, including occupational disease provisions, for all of his employees at the site of the project and in case any work is sublet, the Contractor shall require such subcontractor similarly to provide Workmen's Compensation Insurance, including occupational disease provisions for all of the latter's employees unless such employees are covered by the protection afforded by the Contractor. In case any class of employees engaged in hazardous work under this contract at the site of the project is not protected under Workmen's Compensation statute, the Contractor shall provide, and shall cause each subcontractor to provide adequate and suitable insurance for the protection of his employees not otherwise protected.

D. The Contractor shall secure, if applicable, "All Risk" type Builder's Risk Insurance for work to be performed. Unless specifically authorized by the Owner, the amount of such insurance shall not be less than Contract Price totaled in the Bid. The policy shall cover not less than the losses due to fire, explosion, hail, lightening, vandalism, malicious mischief, wind, collapse, riot, aircraft, and smoke during the Contract Time, and until the work is accepted by the Owner. The policy shall name as the insured, the Contractor, the Engineer, and the Owner.

1.22 CONTRACT SECURITY

A. The Contractor shall, within ten (10) days after the receipt of the Notice of Award, furnish the Owner with a Performance Bond and a Payment Bond in penal sums equal to the amount of the Contract Price, conditioned upon the performance by the Contractor of

all undertakings, covenants, terms, conditions and agreements of the Contract Documents, and upon the prompt payment by the Contractor to all persons supplying labor and materials in the prosecution of the Work provided by the Contract Documents. Such bonds shall be executed by the Contractor and a corporate bonding company licensed to transact such business in the state in which the work is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these Bonds shall be borne by the Contractor. If, at any time, a surety on any such bond is declared a bankrupt or loses its right to do business in the state in which the work is to be performed or is removed from the list of Surety Companies accepted on Federal bonds, Contractor shall, within ten (10) days after notice from the Owner to do so, substitute an acceptable bond (or bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable bond to the Owner.

1.23 ASSIGNMENTS

A. Neither the Contractor nor the Owner shall sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of his right, title or interest therein, or his obligations there under, without written consent of the other party.

1.24 INDEMNIFICATION

A. The Contractor will indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the work, provided that any such claims, damage, loss or destruction of tangible property, including the loss of use resulting there from; and is caused in whole or in part by any negligent or willful act or omission of the Contractor, and subcontractor or any one directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

B. In any and all claims against the Owner or the Engineer, or any of their agents or employees, by any employee of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under workmen's compensation acts, disability benefit acts or other employee benefits acts.

C. The obligation of the Contractor under this paragraph shall not extend to the liability of the Engineer, his agents or employees arising out of the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or Specifications.

1.25 SEPARATE CONTRACTS

A. The Owner reserves the right to let other contracts in connection with this project. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate his work with theirs. If the proper execution or results of any part of the Contractor's work depends upon the work of any other contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such work that renders it unsuitable for such proper execution and results.

B. The Owner may perform additional work related to the project by himself or he may let other contracts containing provisions similar to these. The Contractor will afford the other contractors who are parties to such contracts (or the Owner, if he is performing the additional work himself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of work, and shall properly connect and coordinate his work with theirs.

C. If the performance of additional work by other contractors or the owner is not noted in the Contract Documents prior to the execution of the Contract, WRITTEN NOTICE thereof shall be given to the Contractor prior to starting any such additional work. If the Contractor believes that the performance of such additional work by the Owner or others involves him in additional expense or entitles him to an extension of the Contract Time, he may make a claim therefore as provided in Section 14 and 15.

1.26 SUBCONTRACTING

A. The Contractor may utilize the services of specialty subcontractors on those parts of the work which, under normal contracting practices, are performed by specialty subcontractors.

B. The Contractor shall not award the subcontractor(s), in excess of fifty percent (50%) of the Contract Price without prior written approval of the Owner.

C. The Contractor shall be fully responsible to the Owner for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

D. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the work of subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.

E. Nothing contained in this Contract shall create any contractual relation between any subcontractor and the Owner.

1.27 ENGINEER'S AUTHORITY

A. The Engineer shall act as the Owner's representative during the construction period. He shall decide questions, which may arise as to quality and acceptability of materials furnished and work performed. He shall interpret the intent of the Contract Documents in a fair and unbiased manner. The Engineer will make visits to the site and determine if the work is proceeding in accordance with the Contract Documents.

B. The Contractor will be held strictly to the intent of the Contract Documents in regard to the quality of materials, workmanship and execution of the work. Inspections may be made at the factory or fabrication plant of the source of material supply.

C. The Engineer will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.

D. The Engineer shall promptly make decisions relative to interpretation of the Contract Documents.

1.28 LAND AND RIGHTS-OF-WAY

A. Prior to issuance of NOTICE TO PROCEED, the Owner shall obtain all land and rights of way necessary for carrying out and for the completion of the work to be performed pursuant to the Contract Documents unless otherwise mutually agreed.

B. The Owner shall provide to the Contractor information, which delineates and describes the lands owned and rights of way acquired.

C. The Contractor shall provide at his own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

1.29 GUARANTY

A. The Contractor shall guarantee all materials and equipment furnished and work performed for a period of one (1) year from the date of substantial completion. The Contractor warrants and guarantees for a period of one (1) year from the date of substantial completion of the system, that the completed system is free from all defects due to faulty materials or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. The Owner will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments, or other work that may be made necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect through the guarantee period.

1.30 ARBITRATION

A. All claims, disputes and other matters in question and arising out of, or relating to the Contract Documents or the breach thereof, except for claims which have been waived by the making and acceptance of final payment as provided by Section 20, shall be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association. This agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.

B. Notice of the Demand for Arbitration shall be filed in writing with the other party to the Contract Documents and with the American Arbitration Association, and a copy shall be filed with the Engineer. Demand for Arbitration shall in no event be made on any claim, dispute or other matter in question, which would be barred by the applicable statute of limitations.

C. The Contractor will carry on the work and maintain the progress schedule during any arbitration proceedings unless otherwise mutually agreed in writing.

1.31 TAXES

A. The Contractor will pay all sales, consumer, use and other similar taxes required by the law of the place where the work is performed.

END OF SECTION

SECTION 01 30 10 – SPECIAL CONDITIONS

PART 1 GENERAL

1.1 SUMMARY

A. SECTION INCLUDES
1. General.
2. Contract Documents.
3. Completion Time.
4. Liquidated Damages.
5. Classification of Earthwork.
6. Special Provisions.
7. Special Attention for Bidders.
8. Work on Highway Right-of-Way

1.2 GENERAL

A. Work covered by the Contract Documents consists of improvements as described in the BID Schedule, and as specified herein.

B. All Bids shall include labor, materials, transportation, equipment, services, applicable taxes and other items necessary for a complete and acceptable job in compliance with the Drawings and Specifications.

1.3 CONTRACT DOCUMENTS

A. Documents covering the work under this project consist of the following items:
1. Contract Documents containing:
a. Invitation to Bid
b. Bid
c. Bid Bond
d. Performance and Payment Bond
e. Construction Contract
f. Standard General Conditions of the Construction Contract
g. Specifications
2. Drawings, Sheets **1 through 9**

B. All Documents are a part of this Contract and the requirements of each part shall apply to the entire project as may be applicable.

1.4 COMPLETION TIME

A. Work on the project shall be commenced with adequate forces, within the time stipulated in the “Bid” and shall be fully completed within **90 days** which shall include Sundays and holidays.

1.5 LIQUIDATED DAMAGES

A. Liquidated damages sustained by the Owner, the Project not being completed within the stipulated time, shall be **$400.00 per day**.

1.6 CLASSIFICATION OF EARTHWORK

A. All excavation and grading shall be unclassified.

1.7 SPECIAL PROVISIONS

A. The following Special Provisions shall be part of this Contract.

B. Any areas on or adjacent to the work site disturbed during the course of construction shall be restored to present or better condition.

C. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymers, reactant or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in conformance with instructions and these specifications.

D. Safety and Health Regulations: The Contractor shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54).

E. Protection of Property: The operations of the Contractor shall be conducted with full consideration of all the proper and legal rights of the Owner, and of adjacent property owners and the public, and with the least possible amount of inconvenience to them. Contractor shall coordinate all construction activities and schedules with Owner.

F. Construction Staking: Contractor shall perform or provide all construction layout survey and grade staking. Survey control points if required are in place and identified on the plans.

G. Siltation and Erosion Control: Erosion of soil shall be minimized during construction and any areas on or adjacent to the work site disturbed during construction operations shall be restored to present or better condition. Contractor shall erect silt fences of sufficient strength to prevent silt erosion into main drainage channels and storm drainage structures.

H. Underground Utilities: Sewer and water mains/services, telephone lines, power lines and cables may be encountered and should be anticipated along roadways and rights-of-ways. The Contractor shall contact representatives of all utilities to determine the exact locations of all existing facilities and underground utilities and shall make every effort to avoid damage to such. Any overhead utility lines and power poles, guys, etc., obstructing construction shall be protected from damage or moved by utility company, as necessary.

I. Codes and Standards: Wherever reference is made to codes, standard specifications and regulations, on the Drawings or in these specifications, included but not limited to National Electric codes, Federal Specifications, ASTM, AWWA, ANSI specifications, various institute specifications, etc., it shall be understood that such reference is to the latest edition including addenda and revisions in effect on the date of these Contract Documents.

J. Work Schedule: The Contractor shall submit to the Owner a construction schedule of proposed work sequence, target dates and activities, completely coordinated with the State Department of Transportation officials prior to submittal.

1.8 SPECIAL ATTENTION FOR BIDDERS

A. Submittal of Bids:
   1. Comply exactly with all requirements and especially:
      a. Show license numbers on outside of envelope.
      b. All bids are to be submitted on the extra copy of the Bid Form, included herewith.
      c. Be sure the Bid is signed by a responsible Agent of the Bidder.
      d. Show the receipt of all Addenda.
      e. Include a 5% Certified Check, Bid Bond if required.

B. Taxes: It is to be noted that all applicable taxes are to be included in the Contract prices for all work and equipment.

C. Intent of Specifications: These Specifications specify and show materials deemed most suitable for the service anticipated. However, this is not done to eliminate other products equally as good and efficient. The Contractor shall prepare his bid on the basis of the particular materials specified. The awarding of the contract shall constitute a contractual obligation to furnish the specified materials or approved equal materials.

1.9 WORK ON HIGHWAY RIGHT-OF-WAY

A. The Contractor shall not begin work on any property of the State Department of Transportation until he has secured necessary permits. He shall conform to all requirements of the Highway Department, or its authorized representatives in the prosecution of this portion of the work. It shall be the responsibility of each Bidder to contact the local highway representative and to determine the requirements for work to be done. Requirements shall include, but are not limited to the following:
   1. The Contractor shall erect adequate warning signs and where necessary, place flagmen with appropriate red flags, to control traffic at construction site. The Contractor for each part of the work and all subcontractors will provide adequate barricades to properly protect the work and to warn all pedestrians and drivers as to the construction. From sundown to sun-up, adequate lighting will be provided to mark all construction and hazards at night. The Engineer and his construction observer shall have the right to require such barricades and lighting as they feel is required if the Contractor

fails to provide same. Signs and flagman shall be placed at sufficient distances from the work site so that ample warning is given to approaching traffic.

2. Construction equipment such a loaders, tractors, cranes and trucks shall be operated in a manner to provide a safe condition and usable area for two-way traffic.

1.10 CUTTING AND PATCHING OF EXISTING DRIVEWAYS

A. Existing Asphalt Driveways: Full Depth HMA Patching per SC DOT Standard Specifications for Highway Construction, Division 401.4.14.

B. Existing Concrete Driveways: Full Depth Concrete Pavement Patching per SC DOT Standard Specifications For Highway Construction, Division 502.

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes
   1. Submittal procedures.
   2. Proposed product list.
   3. Product data.
   4. Shop Drawings.
   5. Other submittals.
   6. Design data.
   7. Test reports.
   8. Certificates.
   9. Manufacturer's instructions.
   10. Manufacturer's field reports.
   11. Contractor review.
   12. Engineer review.

1.2 SUBMITTAL PROCEDURES

A. Transmit each submittal with cover sheet. Identify: Project, Contractor, Subcontractor and supplier. If necessary, include pertinent Drawing and detail number and/or Specification Section number appropriate to submittal.

B. Apply Contractor's stamp, signed or initialed, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is according to requirements of the Work and Contract Documents.

C. Coordinate submission of related items.

D. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.

E. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.

F. Allow space on submittals for Contractor and Engineer review stamps.

G. When revised for resubmission, identify changes made since previous submission.

H. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

I. Incomplete Submittals: Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Engineer.

1.3 PROPOSED PRODUCT LIST

A. Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, indicate manufacturer, trade name, model or catalog designation, and reference standards.

1.4 PRODUCT DATA

A. Submit number of copies Contractor requires, plus two copies Engineer will retain.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.5 SHOP DRAWINGS

A. Shop Drawings: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional Engineer responsible for designing components shown on Shop Drawings.
   1. Include signed and sealed calculations to support design.
   2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
   3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. Submit number of opaque reproductions Contractor requires, plus two copies Engineer will retain.

1.6 OTHER SUBMITTALS

A. Closeout Submittals: Comply with Section 01 70 00 - Execution and Closeout Requirements.

B. Informational Submittal: Submit data for Engineer's knowledge as Contract administrator or for Owner.

C. Submit information for assessing conformance with information given and design concept expressed in Contract Documents.

1.7 TEST REPORTS

A. Informational Submittal: Submit reports for Engineer's knowledge as Contract administrator or for Owner.

B. Submit test reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.8 CERTIFICATES

A. Informational Submittal: Submit certification by manufacturer, installation/application Subcontractor, or Contractor to Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

1.9 MANUFACTURER'S INSTRUCTIONS

A. Informational Submittal: Submit manufacturer's installation instructions for Engineer's knowledge as Contract administrator or for Owner only if requested.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Engineer in quantities specified for Product Data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.10 MANUFACTURER'S FIELD REPORTS

A. Informational Submittal: Submit reports for Engineer's knowledge as Contract administrator or for Owner.

B. Submit report within 5 days of observation to Engineer for information.

C. Submit reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.11 CONTRACTOR REVIEW

A. Review for compliance with Contract Documents and approve submittals before transmitting to Engineer.

B. Contractor: Responsible for:
   1. Determination and verification of materials including manufacturer's catalog numbers.
   2. Determination and verification of field measurements and field construction criteria.
   3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.
   4. Determination of accuracy and completeness of dimensions and quantities.
   5. Confirmation and coordination of dimensions and field conditions at Site.
   6. Construction means, techniques, sequences, and procedures.
   7. Safety precautions.
   8. Coordination and performance of Work of all trades.

C. Stamp, sign or initial, and date each submittal to certify compliance with requirements of Contract Documents.

D. Do not fabricate products or begin Work for which submittals are required until approved submittals have been received from Engineer.

1.12 ENGINEER REVIEW

A. If "mass submittals" are received, Engineer's review time stated above will be extended as necessary to perform proper review. "Mass submittals" are defined as six or more submittals or items in one day or 20 or more submittals or items in one week. Engineer will review "mass submittals" based on priority determined by Engineer after consultation with Owner and Contractor.

B. Informational submittals and other similar data are for Engineer's information, do not require Engineer's responsive action, and will not be reviewed or returned with comment.

C. Submittals made by Contractor that are not required by Contract Documents may be returned without action.

D. Submittal approval does not authorize changes to Contract requirements unless accompanied by Change Order, or a Construction Change Directive by either the Owner or Engineer.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete for the following:
   1. Slabs on grade.
   2. Manholes.

B. Related Sections:
   1. Section 33 05 13 – Manholes and Structures
   2. Section 33 05 16.13 – Precast Concrete Utility Structures

C. Site Conditions:
   1. The Contractor shall, prior to beginning work on any cast-in-place concrete structure, consult with the Owner and determine that all rights-of-way and necessary permits have been obtained. He shall familiarize himself with all conditions and/or limitations of such rights-of-way and permits and shall fully comply with all requirements. All work and any encroachment beyond these limits shall be the Contractor's liability.
   2. The Contractor shall be responsible for all survey work for lines and grades.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Concrete - Slab-on-fill or grade:
   1. Basis of Measurement: By the square yard.
   2. Basis of Payment: Includes concrete, placement accessories, consolidating and leveling, troweling, curing and testing.

B. Concrete – Structural:
   1. Basis of Measurement: By Lump Sum.
   2. Basis of Payment: Includes concrete, placement accessories, consolidating and leveling, troweling, curing and testing.

C. Concrete – Repairs:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes debris removal, preparation of substrate, placement, troweling and curing.

1.3 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 305 - Hot Weather Concreting.
   3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
   4. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:

2. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
3. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
4. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
5. A185/A185M-07 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
6. STM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
7. ASTM C33 - Standard Specification for Concrete Aggregates.
8. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
9. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
10. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
11. ASTM C150 - Standard Specification for Portland Cement.
12. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
13. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
14. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
15. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
16. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
17. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
18. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
19. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
20. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
21. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
22. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
23. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

C. Concrete Reinforcing Steel Institute:

1. CRSI – Manual of Standard Practice.
2. CRSI – Placing Reinforcing Bars.

1.4 SUBMITTALS

A. Product Data: Submit data on joint devices, attachment accessories and admixtures.

B. Design Data:
   1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
      a. Hot and cold weather concrete work.
      b. Air entrained concrete work.
   2. Identify mix ingredients and proportions, including admixtures.
   3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.
   4. Identify concrete curing method and any required backup data such as compounds, surface additives, etc.

C. Shop Drawings in accordance with CRSI shall be submitted to the Engineer for all reinforcing steel. Written approval of these shop drawings shall be obtained from the Engineer before fabrication.

D. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction. Contractor is responsible for any survey work entailed in the as-builts.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 for outdoor equipment slabs, curbs, flagpole bases, and underground non-habitable structures. Perform work in accordance with ACI 318 for retaining walls.

B. Conform to ACI 305 when concreting during hot weather.

C. Conform to ACI 306.1 when concreting during cold weather.

D. Acquire cement and aggregate from one source for Work.

E. Perform Work in accordance with applicable State or County standards.

1.7 COORDINATION

A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. All poured in place concrete shall be plant mixed in accordance with ASTM C94 unless otherwise approved in writing by the Engineer.

B. Cement: ASTM C150, Type I - American Portland Cement.

C. Concrete strength rating = 3000 psi at 28 days, or as specified in the construction plans.

D. Air entraining concrete shall conform to ASTM C173/C173M.

E. Normal Weight Aggregates: ASTM C33.
   1. Coarse Aggregate: well-graded crushed stone or washed gravel.
      a. Maximum Size: In accordance with ACI 318.
   2. Fine Aggregate: washed inert natural sand.

F. Water: ACI 318; potable water free of oil, acid, alkali, salts, chlorides (except for those attributable to drinking water), organic matter or other deleterious substances.

2.2 ADMIXTURES

A. Furnish materials according to Florence County, SC, standards.

B. Air Entrainment: ASTM C260.

C. Water Reducing and Retarding admixtures: ASTM C494/C494M, Type D.

D. Other chemical admixtures: ASTM C494/C494M.

E. Fly Ash: per ASTM C618.

2.3 ACCESSORIES

A. Cement Grout: Portland cement, sand and water mixture with stiff consistency to suit intended purpose.

B. Non-Shrink Grout: ASTM C1107/C1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler Type A: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/4 inch thick; tongue and groove profile.

B. Premolded Joint Filler: Self-expanding cork, ASTM D1752 type III; 1 inch thick.

C. Sealant: ASTM D6690, Type I.

2.5 CONCRETE MIX

A. Select proportions for concrete in accordance with ACI 318 field experience.

B. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94/C94M.

C. Site Mixed Concrete: Mix concrete in accordance with ACI 318.

2.6 REINFORCEMENT

A. Concrete Reinforcing Fibers: ASTM C1116, high strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete. 1/2 or 3/4 inch long monofilament polymer fibers.

B. All reinforcing steel shall be shop fabricated in accordance with approved shop drawings.

C. Reinforcing Steel (bent or welded): ASTM A706/A706M; 60 ksi yield strength (Grade 60), galvanized steel bars.

D. Prefabricated Deformed Bar Mats: ASTM A184/A184M; fabricated from ASTM A615/A615M; 60 ksi yield strength, steel bars, galvanized finish.

E. Use zinc-coated galvanized deformed steel reinforcing bars in structural concrete where shown on the plans and extended to the limits shown. Provide zinc-coated reinforcing steel in structures that is hot-dip galvanized in accordance with ASTM A767, Class II, 2 ounces per square foot with a minimum thickness of 3.5 mils. Galvanize the steel bars after fabrication.

F. Install reinforcing by tying or welding to form rigid assemblies. Secure reinforcement to prevent displacement when placing concrete. Maintain concrete cover around reinforcement based on exposure to the environment:
   1. Concrete permanently exposed to earth: 3 inches.
   2. Concrete exposed to soil, water, sewage, sludge or weather: 2 inches.
   3. Concrete not exposed to soil, water, sewage, sludge or weather: 1 inch.

G. Position and secure embedded items to prevent displacement when placing concrete.

H. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on Drawings.

I. Tension reinforcement tendons as required to achieve design load criteria.

J. Fabricate required openings with dimension larger than 10 inches and embed accessories provided by other Sections, at indicated locations.

K. Weld steel fabrications in accordance with AWS D1.1. Weld reinforcing steel in accordance with AWS D1.4. Do not tack weld reinforcing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Preparation of subgrade:
   1. Thoroughly compact the subgrade and finish to a smooth, firmly compacted surface, which is moist at the time the concrete is placed.
   2. In areas where it is impractical to use standard type rollers, accomplish compaction by vibratory hand compactors.

B. Use wood or metal forms of a depth equal to the thickness of the concrete course. Make certain they are free from warp and are of sufficient strength when staked, to hold the alignment during the concrete placing and finishing operations.

C. Verify requirements for concrete cover over reinforcement.

D. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates. Clean and oil the forms.

D. Remove water from areas receiving concrete before concrete is placed.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 318.

B. Notify testing laboratory and Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, and formed expansion and contraction joints are not disturbed during concrete placement.

D. The contractor shall use conveyor, chutes, tremies, buckets, etc., for the efficient placement of the concrete but in no case will a placement system be allowed that causes undue segregation of aggregate. All concrete shall be consolidated by vibrating or rodding. The Contractor will be responsible for having adequate back up vibrators, screeds, etc., to prevent interruption during a pour.

E. No concrete will be placed during periods of rain, sleet, or other precipitation.

F. Cold weather placement:
   1. No concrete shall be placed when the atmospheric temperature is below 35 degrees F or when the temperature threatens to drop below 25 degrees F within 48 hours, except upon written permission of the Engineer, and such permission will not be granted until satisfactory provisions have been made to protect the work.
   2. Should the temperature drop below 30 degrees F while concrete is being placed or before it has hardened sufficiently to prevent injury from cold, the Contractor shall provide sufficient housing and heating apparatus to enclose and protect the structure in such a way that the air surrounding the fresh concrete can be kept at a temperature above 50 degrees F for a period of three days after the concrete is placed.

G. During hot weather adequate means shall be taken to protect fresh concrete form heating to temperatures exceeding 90 degrees F.

H. Place concrete in continuous operation for each panel or section determined by predetermined joints.

I. Consolidate concrete.

J. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

K. Place concrete continuously between predetermined expansion, control, and construction joints.

L. Place floor slabs in checkerboard or saw cut pattern as indicated on the construction drawings. If no pattern is shown, an expansion joint (saw cut unless otherwise specified) must be placed at 15-foot maximum intervals.

M. Saw cut joints within 12 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.

N. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft, or as shown on the construction plans.

O. All freshly poured concrete must be kept moist for a minimum of four days to allow for thorough curing. An acceptable curing compound may be used in lieu of wet curing with the Engineer's permission.

3.4 CONCRETE FINISHING

A. As soon as the concrete has set sufficiently, remove the forms from the exposed surfaces. Float and trowel the concrete on the face and top as necessary to provide a smooth uniform finish. Leave joint templates in place a minimal length of time to prevent bonding or distortion at the joint.

B. Ordinary Finish: An ordinary finish shall be given to all exposed concrete as follows:
   1. After the forms are removed, all depressions resulting from the removal of metal ties and all other holes and rough places shall be carefully pointed with a mortar of sand and cement. The surface of all such pointed surfaces shall be made flush with the adjacent surface by means of a wooden float before settling occurs.

3.5 BACKFILLING

A. After the concrete has set sufficiently and the forms had been removed, backfill the spaces on both sides to the required elevation with suitable material that is firmly compacted and neatly graded.

3.6 FIELD QUALITY CONTROL

A. Field testing of concrete will be performed by a testing laboratory approved by the Engineer.
   1. Field testing shall be in accordance with ACI 318.

B. Provide free access to Work and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to testing firm for review prior to commencement of Work.

D. Concrete Inspections:
   1. Continuous Placement Inspection: Inspect for proper installation procedures.
   2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

E. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. The Contractor will be responsible for sampling, making and curing test cylinders for each pour. He will also be responsible for timely delivery to the approved laboratory.

3. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cure.
4. Sample concrete and make one set of four cylinders for every 100 cu yds of each class of concrete placed each day and for every 5,000 sf of surface area for slabs and walls. There shall be not less than one test sample for each day's concreting.
5. Two cylinders shall be tested at 7 days and the remaining two at 28 days.
6. When volume of concrete for any class of concrete would provide less than 5 sets of cylinders, take samples from five randomly selected batches, or from every batch when less than 5 batches are used.
7. Make one additional cylinder during cold weather concreting, and field cure.
8. Additional cylinders may be required for field curing in order to justify removal of form work.

F. Field Testing:
1. Slump Test Method: ASTM C143/C143M.
2. Air Content Test Method: ASTM C173/C173M.
3. Temperature Test Method: ASTM C1064/C1064M.
4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

G. Cylinder Compressive Strength Testing:
1. Test Method: ASTM C39/C39M.
2. Test Acceptance: In accordance with ACI 318.
3. Test two cylinders at 7 days.
4. Test two cylinders at 28 days.
5. Dispose remaining cylinders when testing is not required.

H. Core Compressive Strength Testing:
1. Sampling and Testing Procedures: ASTM C42/C42M.
2. Test Acceptance: In accordance with ACI 318.
3. Drill three cores for each failed strength test from concrete represented by failed strength test.

3.7 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections in accordance with ACI 318.

3.8 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. As soon as the forms are removed from all concrete shapes, fill honeycombed spaces and other minor defects with a mortar composed of one part Portland cement into parts sand. Plastering is not allowed.

C. Replace sections with visible cracks at no expense to the owner.

D. Repair or replacement of major defects will be determined by Engineer.

END OF SECTION

SECTION 31 22 13 - GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, grading, filling, rough contouring, and compacting site for site structures, building pads, drainage structures, roads, infrastructure and slopes.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 05 16 - Aggregates for Earthwork.
3. Section 31 10 00 - Site Clearing.
4. Section 31 23 16 - Excavation.
5. Section 31 23 17 - Trenching.
6. Section 31 23 23 - Fill.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. The category “Grading” overlaps in part with Sections 31 23 16 – Excavation, 31 23 23 – Fill, and 31 05 13 – Soils for Earthwork. Please refer to these Sections for specific descriptions of the categories used for unit prices.
1. In general, “Grading” refers to earth moved between two locations within the site boundaries for purposes of establishing the required elevations and slopes.
2. “Excavation” and “Fill” refer to cubic yard volumes of dirt being brought into, or removed from, the site.
3. Note that for utilities such as water, sewer, and manhole installation, grading is included in the price of installing these materials

B. Rough Grading (Building Pads):
1. Basis of Measurement: By square yard.
2. Basis of Payment: Includes removal of existing topsoil and placement in a stockpile on site, and grading area to building pad elevations (by excavation or fill) to a tolerance of +/-1/2 inch. Includes loading, placing, and compacting soil. Structural fill not available on site that must be imported falls under the category of “Fill”. Unsuitable soils that cannot be disposed of on site and must be removed fall under the category of “Excavation”.

C. Rough Grading (Roads, Lots & Drives):
1. Basis of Measurement: By square yard.
2. Basis of Payment: Includes removal of existing topsoil and placement in a stockpile on site, grading to subgrade elevations (by excavation or fill) to a tolerance of +/-1 inch. Includes loading, placing, and compacting soil.

Structural fill not available on site that must be imported falls under the category of “Fill”. Unsuitable soils that cannot be disposed of on site and must be removed fall under the category of “Excavation”.

D. Grading (Pond Excavation):
   1. Basis of Measurement: By cubic yard.
   2. Basis of Payment: Includes removal of existing topsoil to a stockpile on site, excavation of pond, placement of excess soil on site (including loading, transport and compaction) and/or removal of excess soil from site. Includes pond berm, banks and earth spillways as well as all areas where excess soil may have been placed. Includes fine grading of pond to a distance of 20 feet beyond the rim in all directions by placement of topsoil to achieve final pond elevations to a tolerance of +/-4 inches.

E. Rough Grading (General):
   1. Basis of Measurement: By square yard.
   2. Definition: This category includes any area not covered under items 1.2B, C or D above. It includes residential lots, ditches, swales, easements, banks, road shoulders and landscaped areas. It excludes areas filled by pond spoil unless additional fill is required to achieve the necessary elevations.
   3. Basis of Payment: Includes removal of existing topsoil and placement in a stockpile on site, and grading to final elevations (by excavation or fill) to a tolerance of +/-4 inches. Includes loading, placing, and compacting soil.

F. Fine Grading:
   1. Basis of Measurement: By square yard.
   2. Definition: This category includes any area not supporting a structure (road, parking lot, driveway or building pad) that has been rough graded to within a tolerance of +/- 3 inches per items 1.2D & E above.
   3. Basis of Payment: Includes breaking dirt clots, placing topsoil, raking, blending grades and fine grading areas to remove low spots and generally drain the area away from structures and toward drainage structures. Prepare area for stabilization per Section 32-92-19 – Seeding and Stabilization.
   4. Tolerances: Final grades shall be +/- 2 inches for seeded areas, and +/- 1/2 inch for inverts of ditches, swales and spillways.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS – Not Used

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.

B. Perform Work in accordance with State of South Carolina DOT standard.

PART 2 PRODUCTS

2.1 MATERIALS

A. Soil material shall consist of suitable material as found available on-site until such supply of on-site material is depleted. The Owner shall retain the services of a testing laboratory to perform all required soils testing. Where on-site soils are questionable, the soils engineer shall make appropriate tests to ensure that the soil is suitable for fill. These tests will be made at no cost to contractor.

B. Topsoil: as specified in Section 31 05 13.

C. Subsoil Fill: as specified in Section 31 05 13.

D. Structural Fill: Type as specified in Section 31 23 23.

E. Granular Fill: Type as specified in Section 31 23 23.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Site grading shall conform to the grades indicated by the finished contours and spot elevations shown on the drawings the Engineer will provide control points and CAD files. The contractor will be responsible for staking of right-of-way and any elevation hubs required.

C. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call Local Utility Line Information service at 811 (South Carolina) not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove or relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

A. Excavation shall be made to the exact elevations, slopes and limits called for in the Drawings.

B. Per Section 31 05 13 – Soils for Earthwork.

3.4 SUBSOIL EXCAVATION

A. Excavation shall be made to the exact elevations, slopes and limits called for in the Drawings.

B. Per Section 31 05 13 – Soils for Earthwork.

3.5 FILLING

A. Fill areas to contours and elevations with unfrozen materials. Refer to Section 31 23 23 – Fill for fill requirements.

B. Fills shall be constructed of material that is reasonably free from grass, roots, rock or other objectionable material. Where natural slopes exceed 3:1, horizontal benches shall be cut to receive fill material. Slopes of less than 3:1 and other areas shall be scarified prior to placing fill material.

C. Fills shall be constructed of acceptable material approved by the Engineer and placed in successive layers of not over 8 inches loose thickness for the full width of section, where practical.

D. Where rock is excavated along with other material, it shall be incorporated in fill sections which are not to support pavement or structures and which do not form dikes. Rock shall be evenly distributed.

E. No organic materials will be allowed in fill.

F. Material for fills shall be spread evenly and the grading equipment routed over the work to obtain uniform compaction. Fills shall be compacted by approved equipment to the following percentages of Standard Proctor (ASTM D-698 or AASHTO T99) maximum dry density at optimum moisture content:
   1. Entire depth of fill the needs all structures - 100%
   2. Top 2 feet of fill beneath all roadways - 98%
   3. All other structural fill for embankments - 95%

G. Maintain optimum moisture content of fill materials to attain required compaction density.

H. Where topsoil, pavement or other items are shown, the rough grade shall be finished to such depth below finished grade as is necessary to accommodate these items.

3.6 FINE GRADING

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.

C. Slope grade away from building minimum 5 percent slope for minimum distance of 10 ft, unless noted otherwise.

D. Repair or replace items indicated to remain, that were damaged by excavation or filling.

E. Backfill around structures shall be performed upon completion of the structure, above finished grade, and after all piping has been properly installed and tested.

F. Scarify subsoil to depth of 3 inches in areas where vehicles or construction equipment has compacted sub-soil.

G. Spread topsoil to minimum depth of 4 inches over area to be seeded. Rake until smooth.

3.7 TOLERANCES

A. Rough Grading (as measured at the top surface of subgrade):
   1. Subgrades beneath roads, parking lots or driveways: +/- 1 inch from required elevation.
   2. Building Pads: +/- 1/2 inch from required elevation.
   3. Yards, road shoulders, banks of ditches, ponds or swales, easements and landscaped areas: +/- 4 inches.

B. Fine Grading (as measured at the top surface of grade):
   1. Yards, road shoulders, banks of ditches, ponds or swales, easements and landscaped areas: +/- 2 inch.
   2. Inverts of ditches, spillways or swales: +/- 1/2 inch.

3.8 FIELD QUALITY CONTROL0

A. Perform laboratory material tests in accordance with ASTM D698 or AASHTO T180.

B. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

C. The Owner will retain the services of a testing laboratory to perform all required soils sampling and testing. These tests will be made at no cost to the Contractor. Areas in which testing reveals compaction below the specified density shall be reworked by the Contractor until specified compaction is attained.

D. Frequency of Tests: per local codes.

END OF SECTION

SECTION 31 23 23 - FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fill under slabs-on-grade.
   2. Fill under paving.
   3. Fill for over-excavation.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. Section 31 05 13 - Soils for Earthwork.
   3. Section 31 05 16 - Aggregates for Earthwork.
   4. Section 31 23 16 - Excavation.
   5. Section 31 23 17 - Trenching.
   6. Section 33 11 16 - Site Water Utility Distribution Piping.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. The category “Fill” overlaps in part with Sections 31 22 13 – Grading and 31 23 16 – Excavation. Please refer to these Sections for specific descriptions of the categories used for Unit Pricing.
   1. Note that for utilities such as water, sewer, and manhole installation, fill is included in the price of installing these materials.

B. Structural Fill (unclassified):
   1. Basis of Measurement: By cubic yard, compacted, in place.
   2. Basis of Payment: Includes supplying fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. South Carolina Department of Transportation (SC DOT):
   1. SCDOT 2007 Standard Specifications For Highway Construction, Sections 203 *Roadway and Drainage Excavation*, and 208 *Subgrade*.

C. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS – Not Used

1.5 QUALITY ASSURANCE

A. The Owner shall retain the services of a testing laboratory to perform all required soils testing. Where on-site soils are questionable, the soils engineer shall make appropriate tests to ensure that the soil is suitable for fill. These tests will be made at no cost to contractor.

B. Perform Work in accordance with SC DOT requirements for fill.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Soil material used as fill, backfill or subgrade for structures shall consist of suitable material or common fill.
   1. Fill shall conform to SCDOT 2007 Standard Specifications For Highway Construction, Section 203, *Roadway and Drainage Excavation*.
   2. Soil material shall consist of suitable material as found available on-site until such supply of on-site material is depleted.
   3. Suitable material or common fill shall consist of granular soil free from organic material, topsoil, debris, frozen soil or other deleterious substances containing no rocks or lumps over 6” in greatest dimension, with not more than 60% of material passing the number 200 sieve and with not more than 15% of the rocks or lumps larger than 2 ½ “ in their greatest dimension.
   4. Do not permit rocks having a dimension greater than 1“in the upper 6” of fill or subgrade.

B. Where select material or structural fill is indicated on the drawings or specified, it should consist of a mineral soil free of organic material, loam, debris, frozen soil or other deleterious material which may be compressible or which cannot be properly compacted. Material used as select material or structural fill should conform to the following gradation requirements:

US Standard Sieve Size	Percent Passing by Weight
3 inches	100
No. 4	20 to 70
No. 40	5 to 75
No. 200	0 to 40

C. Select fill or structural fill should have a maximum liquid limit of 40% and maximum plasticity index of 10%.

D. Select fill or structural fill should have a maximum dry density of not less than 100 lbs/cubic foot at optimum moisture when tested in accordance with SC-T-29. Do not use any soil for embankment with optimum moisture content greater than 25% as defined in accordance with SC-T-29.

PART 3 EXECUTION

3.1 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with granular fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface to depth of one inch.

D. Proof roll per state or local requirements to identify soft spots; fill and compact to density equal to or greater than these requirements for subsequent fill material.

3.2 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Place geotextile fabric over subgrade and between lifts, if specified in the Drawings.

D. Place and compact material in continuous 8 inch lifts.

E. Employ placement method that does not disturb or damage other work.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

H. Slope grade away from building minimum 5 percent slope for minimum distance of 10 ft, unless noted otherwise.

I. Make gradual grade changes. Blend slope into level areas.

J. Remove surplus backfill materials from site.

3.3 TOLERANCES

A. Top Surface of Backfilling within Building Areas: Plus or minus 1 inch from required elevations.

B. Top Surface of Backfilling under Paved Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.4 FIELD QUALITY CONTROL

A. Perform laboratory material tests in accordance with ASTM D1557.

B. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. Proof roll compacted fill surfaces under slabs-on-grade and paving.

3.5 PROTECTION OF FINISHED WORK

A. Section 31 25 00 – Erosion and Sediment Controls.

B. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 23 17 - TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavating trenches for utilities from 5 feet outside building to utility service tie-in point.
   2. Compacted fill from top of utility bedding to subgrade elevations.
   3. Backfilling and compaction.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. Section 31 05 13 - Soils for Earthwork.
   3. Section 31 05 16 - Aggregates for Earthwork.
   4. Section 31 23 16 - Excavation.
   5. Section 31 23 23 - Fill.
   6. Section 33 11 16 - Site Water Utility Distribution Piping.
   7. Section 33 31 00 - Sanitary Utility Sewerage Piping.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Trenching is generally included under the category of utility (water, sewer, etc.). The utility cost covers trenching and backfilling as well as pipe laying. The following categories are for either trenching that is left open, or for fill that is not standard fill.

B. Trenching:
   1. Basis of Measurement: Per linear foot, or as listed on Bid Tab.
   2. Basis of Payment: Includes excavating to required elevations, protecting excavation, and either A) stockpiling excavated materials, or B) removing excavated materials from site. Over Excavating: Payment is not made for over excavated work nor for replacement materials.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. South Carolina Department of Transportation (SC DOT):
   1. SCDOT 2007 Standard Specifications For Highway Construction, Section 203 *Roadway and Drainage Excavation*.

C. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.5 SUBMITTALS – Not Used

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with State of South Carolina DOT standards.

1.7 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of South Carolina.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: as specified in Section 31 05 13 – Soils for Earthwork.

B. Structural or Granular Fill: as specified in Section 31 23 23 - Fill.

C. Bedding: Fine aggregate per Section 31 05 16 – Aggregates for Earthwork.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
   1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Classification: all excavation will be unclassified, for payment purposes, unless stated otherwise.

B. Call Local Utility Line Information service at 811 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

C. Identify required lines, levels, contours, and datum locations.

D. Protect plant life, lawns, and other features remaining as portion of final landscaping.

E. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

F. Maintain and protect above and below grade utilities indicated to remain.

G. Where paving is to be cut, it shall be cut in advance of trenching 1 foot wider than the specified width of the trench.

H. Establish temporary traffic control when trenching is performed in public right-of-way. Relocate controls as required during progress of Work.

3.3 TRENCHING

A. Excavate subsoil required for utilities to utility service tie-in point.

B. When Project conditions permit, slope side walls of excavation starting two (2) feet above top of pipe. When side walls can not be sloped, provide sheeting and shoring to protect excavation as specified in this section.

C. Remove lumped subsoil, boulders, and rock greater than 6” in greatest dimension. Allowable fill shall not contain more than 15% of the rocks or lumps larger than 2 ½ inches in their greatest dimension.

D. Perform excavation within 24 inches of existing utility services in accordance with utility's requirements.

E. Do not advance open trench more than 200 feet ahead of installed pipe.

F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.

G. Trench bottoms shall be hand graded to provide uniform and continuous bearing for the pipe along its entire length, with bell holes being dug for pipe bells. No ridges, sags or under-cutting will be allowed.

H. For sewer mains only, trenches shall be excavated 4 inches below the established subgrade below the bottom of the pipe barrel, full width of the trench, and backfilled per the Drawings.

I. If approved by the Engineer and subject to suitable soil conditions, the trench may be excavated a few inches below the established subgrade and backfilled with selected material (from excavation, if available) well compacted and so shaped as to give the pipes uniform bearing throughout their lengths at the established grade. Bell holes shall be dug to relieve the bells of load and to provide for completing the joints.

J. In rock or other unyielding material, the excavation shall be made at least 6 inches below subgrade elevation. The trench shall be refilled with select material compacted in place as specified for ordinary excavation. Suitable material from excavation may be used, if available. If not, it shall be hauled in.

K. Where the material at grade is unstable, soft and incapable of supporting the pipe, the trench shall be excavated below grade, as directed by the Engineer, and refills to grade with crushed stone or gravel so as to form a firm foundation for the pipe. Stone shall be compacted and graded so as to provide stable foundation and a uniform bearing for the pipe. Bell holes shall be provided as in other types of foundation.

L. Should groundwater be encountered in the bottom of the trench, the material, as directed by the Engineer, shall be excavated below grade sufficiently to allow a bed of crushed rock or gravel to be placed in which to bed the pipe. The work shall be done as for unstable foundations. The depth of cut below grade shall be sufficient to accomplish the purpose, and shall be as directed by the Engineer.

M. The Contractor shall furnish all machinery for pumping and bailing and shall pump, bail or otherwise remove any water may be found or shall accumulate in the trenches, and shall perform all work necessary to keep them clear of water while the pipe is being laid. The disposal of water after removal shall be satisfactory to the Engineer.

N. Do not interfere with 45 degree bearing splay of foundations.

O. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

P. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

Q. Remove excess subsoil not intended for reuse, from site.

3.4 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 4 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work, unless otherwise instructed by the Engineer.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BACKFILLING

A. Backfilling around the pipe into a depth of at least 1 foot above the top of pipe shall only be select material containing no rocks or other objectionable material. As fast as the material is placed, it shall be cut under the haunches of the pipe with a shovel and thoroughly compacted with light mechanical tamps for the full width of the trench to provide support for the bottom and sides of the pipe. Filling shall be carried up evenly on both sides.

B. For remainder of the backfill, no frozen earth, debris, or rocks measuring more than 6 inches in size shall be used.

C. In streets, roads and shoulders, the backfill shall be placed in layers of not over 8 inches and thoroughly compacted with mechanical tempers, so as to avoid settlement. The Contractor shall correct any future settlement within the guarantee period.

D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

E. Place geotextile fabric over utility and between lifts, if specified in the Drawings.

F. Employ placement method that does not disturb or damage other work.

G. Maintain optimum moisture content of backfill materials to attain required compaction density.

H. In unpaved streets and shoulders of roads, the top 6 inches of trench shall be filled with select compacted material. In paved areas, the top of the trench shall be filled with the specified base for pavement, well mixed and compacted. Any settlement of backfill below finish grade shall be promptly corrected.

I. Remove surplus backfill materials from site.

J. Place protective barrier around open trenches when left unattended.

K. Protect open trench to prevent danger to the public.

L. Cleanup of the site shall be made upon completion of the grading work of any major part thereof and all excess material disposed of to the Engineers satisfaction. Excess material shall be disposed of and dressed off on the site, or adjacent thereto, whenever possible.

M. Topsoil shall be placed on the entire shoulder and ditch graded area, when required by drawings, the bid, or directed by the Engineer. It shall be distributed to a depth of 4 inches, measured loose, dressed off neatly to finish grade and all sticks, weeds, and other debris removed.

N. Maintenance: the Contractor shall repair any damage due to erosion or other cause and shall maintain all slopes and grassed areas in good condition until grass cover acceptable to the Engineer is obtained.

3.6 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch (0.08 feet) from required elevations.

B. Top Surface of General Backfilling: Plus or minus 1 inch (0.08 feet) from required elevations.

3.7 FIELD QUALITY CONTROL

A. Perform laboratory material tests in accordance with ASTM D1557.

B. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

D. Frequency of Tests: per local codes.

3.8 PROTECTION OF FINISHED WORK

A. Section 31 25 00 – Erosion and Sediment Controls.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 32 11 23 - AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate base course.

B. Related Sections:
   1. Section 31 05 16 – Aggregates for Earthwork.
   2. Section 31 22 13 - Rough Grading.
   3. Section 31 23 17 - Trenching.
   4. Section 31 23 23 - Fill.
   5. Section 31 37 00 - Riprap.
   6. Section 32 12 16 - Asphalt Paving.
   7. Section 32 13 13 - Concrete Paving.
   8. Section 32 17 13 - Parking Bumpers.
   9. Section 33 05 13 - Manholes and Structures.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Aggregate Base Course:
   1. Basis of Measurement: By the square yard to elevations indicated on Drawings.
   2. Basis of Payment: Includes supplying fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.

B. South Carolina Department of Transportation (SC DOT):
   1. SCDOT 2007 Standard Specifications For Highway Construction, Section 305 *Graded Aggregate Base*.

C. ASTM International:
   1. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   2. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   4. ASTM D2940 - Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways or Airports.

5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS – Not Used

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with State of South Carolina DOT standards.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

A. Coarse Aggregate: Type **GABC** as specified in Section 32 05 16, Aggregates for Earthwork.

2.2 ACCESSORIES

A. Geotextile Fabric: AASHTO M288; non-woven, non-biodegradable polypropylene.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify compacted substrate is dry and ready to support paving and imposed loads.
   1. Proof roll substrate per SCDOT and local standards to identify soft spots.
   2. Remove soft substrate and replace with compacted fill as specified in Section 31 23 23.

C. Verify substrate has been inspected, gradients and elevations are correct.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Install geotextile fabric over subgrade in accordance with manufacturer's instructions.
   1. Lap ends and edges minimum 6 inches.

2. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.

B. Place aggregate equal thickness layers to total compacted thickness indicated on Drawings.
   1. Maximum Layer Compacted Thickness: 8 inches.
   2. Minimum Layer Compacted Thickness: 4 inches.

C. Roller compact aggregate to density indicated on Drawings.

D. Level and contour surfaces to elevations, profiles, and gradients indicated.

E. Maintain optimum moisture content of fill materials to attain specified compaction density.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch measured with 10 foot straight edge.

B. Maximum Variation From Thickness: 1/4 inch.

C. Maximum Variation From Elevation: 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Section [01 40 00 - Quality Requirements] [01 70 00 - Execution and Closeout Requirements]: Field inspecting, testing, adjusting, and balancing.

B. Compaction testing will be performed in accordance with State, local and County requirements.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. Frequency of Tests: Per local requirements.

3.6 COMPACTION

A. Compact materials to 98 percent of maximum density as determined from test strip, in accordance with ASTM D2940. Testing frequency is per local requirements.

B. Verify compaction with a proof roll test per SCDOT requirements.

END OF SECTION

SECTION 32 12 16 - ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Hot Mixed Asphalt (HMA) materials.
2. Asphalt paving base course, binder course, and wearing course.
3. Asphalt paving overlay for existing paving.
4. Surface operations: milling, planeing & patching.
5. Surface slurry.

B. Related Requirement:
1. Section 31 22 13 - Rough Grading.
2. Section 31 23 23 - Fill.
3. Section 31 05 16 - Aggregates for Earthwork.
4. Section 32 11 23 - Aggregate Base Courses.
5. Section 32 17 13 - Parking Bumpers.
6. Section 32 17 23 - Pavement Markings.
7. Section 33 05 13 - Manholes and Structures.

1.2 PRICE AND PAYMENT PROCEDURES

A. Asphalt Paving:
1. Basis of Measurement: By square yard.
2. Basis of Payment: Includes a separate bid item for each asphalt layer. Any priming, tack coat, furnishing, placing, compacting, and testing asphalt course will be included with respective bid item.

B. Asphalt Cut & Patch:
1. Basis of Measurement: By linear foot.
2. Basis of Payment: Includes saw cutting, removal of existing asphalt, replacement of excavated fill with appropriate material specified on plan detail sheet, traffic control, furnishing, placing, compacting, and testing asphalt patch.

C. Milling:
1. Basis of Measurement: By square yard.
2. Basis of Payment: Includes traffic control, milling and disposal.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO M17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M29 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
3. AASHTO M140 - Standard Specification for Emulsified Asphalt.
4. AASHTO M320 - Standard Specification for Performance-Graded Asphalt Binder.
5. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
6. AASHTO MP1a - Standard Specification for Performance-Graded Asphalt Binder.

B. South Carolina Department of Transportation (SC DOT):
1. SCDOT 2007 Standard Specifications For Highway Construction, Division 400: Asphalt Pavements.
2. SCDOT Qualified Product List 37.

C. Asphalt Institute:
1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.

D. ASTM International:
1. ASTM D242 - Standard Specification for Mineral Filler For Bituminous Paving Mixtures.
2. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
3. ASTM D977 - Standard Specification for Emulsified Asphalt.
4. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
5. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
6. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
7. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
8. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
9. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
10. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
11. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
12. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit product information for asphalt and aggregate materials.
   2. Submit mix design with laboratory test results supporting design.

C. Manufacturer's Certificate: Certify Products meet or exceed specified DOT requirements.

1.5 QUALITY ASSURANCE

A. Mixing Plant: Conform to State of South Carolina Department of Transportation (DOT) standards.

B. Obtain materials from same source throughout.

C. Perform Work in accordance with State of South Carolina DOT standards.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum three years' experience.

B. Supplier: Technician designing asphalt mixes must be certified as Level 2S, HMA Mix Design Technician. Mixes must be prepared in a laboratory approved by the AME following SC-T-82 and follow SC-T-80 and AASTO T312.

1.7 AMBIENT CONDITIONS

A. Do not place asphalt mixture when ambient air or base surface temperature is less than 40 degrees F, or if surface is wet or frozen.

PART 2 PRODUCTS

2.1 ASPHALT PAVING

A. Asphalt Materials:
   1. Binder: AASHTO M320
      a. Use binder from sources listed in *SC DOT Qualified Product List 37*.
      b. When required, use polymer modified binder complying to Product Specification PG76-22 as specified in AASHTO M320 or neat binder complying to PG64-22.
      c. Use "straight run" materials that have not been "air blown" or blended with acid.
      d. Must be heat and storage stable.

2. Primer: ASTM D2027, medium curing, cutback asphalt. In accordance with State of South Carolina DOT standards.

1. Tack Coat: In accordance with SCDOT 2007 Standard Specifications For Highway Construction, Division 401: Hot Mixed Asphalt (HMA) Pavement.
2. Reclaimed Asphalt Pavement (RAP): in accordance with SCDOT 2007 Standard Specifications For Highway Construction, Division 401: Hot Mixed Asphalt (HMA) Pavement.
3. Oil: In accordance with State of South Carolina DOT standards.

B. Aggregate Materials: per Section 31 05 16, Aggregates for Earthwork.

C. Aggregate Subbase: Specified in Section 32 11 23, Aggregate Base Courses.

2.2 MIXES

A. Use dry material to avoid foaming. Mix uniformly.

B. Asphalt Paving Mixtures: Designed in accordance with SCDOT 2007 Standard Specifications for Highway Construction, Division 401: Hot Mixed Asphalt (HMA) Pavement.

C. Surface Slurry: ASTM D3910, emulsified asphalt slurry.
1. Fine mix (surface cracks): Type A.
2. Medium mix (surface repair): Type B.
3. Coarse mix (crowning and build-up): Type C.

2.3 ACCESSORIES

A. Geotextile Fabric: per Section 32 11 23, Aggregate Base Course
1. AASHTO M288; non-woven, polypropylene.

B. Sealant: ASTM D6690, hot applied type, per SC DOT Specifications.

2.4 SOURCE QUALITY CONTROL

A. Submit proposed mix design of each class of mix for review prior to beginning of Work.

B. Test samples in accordance with AI MS-2.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

3.2 DEMOLITION

A. Saw cut and notch existing paving as indicted on Drawings.

B. Clean existing paving to remove foreign material, excess joint sealant and crack filler from paving surface.

C. Repair surface defects in existing paving to provide uniform surface to receive new paving.

3.3 PREPARATION

A. Verify compacted subgrade and base course are dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

C. Verify catch basin and manhole frames are installed in correct position and elevation.

3.4 INSTALLATION

A. Subbase:
1. Aggregate Subbase: Install as specified in Section 32 11 23, Aggregate Base Course.
2. Proof roll subbase in accordance with State and local standards.

B. Primer:
1. Prime the base course only when specified on the drawings.
2. Apply primer in accordance with SCDOT 2007 Standard Specifications For Highway Construction, Section 305.4.6 as applicable.
3. Use clean sand to blot excess primer.

C. Tack Coat:
1. Use only when specified on the drawings.
2. Ensure that the existing base surface or unsealed asphalt surface is dry and thoroughly cleaned before applying the tack material.
3. Apply tack coat in accordance with SCDOT 2007 Standard Specifications For Highway Construction, Section 401.4.18, *Application of Prime or Tack Coat.*
4. Apply tack coat to contact surfaces of curbs, gutters, edges of existing pavement, manholes, and catch basins.
5. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.
6. Apply the tack coat as outlined above in a sufficient length of time in advance of the laying of the HMA to permit drying but not so far in advance or over such an area to cause it to lose its adhesiveness.

D. Single Course Asphalt Paving:

1. Install Work in accordance with SCDOT 2007 Standard Specifications for Highway Construction, Section 401.4.19, *Spreading and Finishing.*
2. Place asphalt within 24 hours of applying primer or tack coat.
3. Place asphalt wearing course to thickness indicated on Drawings.
4. Compact paving by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
5. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.
6. To avoid intermixing HMA, do not pave the same lane using mix from more than one plant during a day's production.
7. Locate the finished surface of surface courses placed adjacent to curbs, gutter, manholes, etc., approximately ¼ inch above the edges of these structures.

E. Double Course Asphalt Paving:
1. Place asphalt binder course within 24 hours of applying primer or tack coat.
2. Place binder course to thickness indicated on Drawings.
3. Coordinate times for placement to allow for inspection and testing of each course.
4. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
5. Place wearing course to thickness indicated on Drawings.
6. If multiple lifts are being placed in a single day, ensure that the interior mat temperature of the previous lift is less than 175 degrees Fahrenheit when measures at the mid-point of the depth of mat with a calibrated thermometer following SC-T-84.
7. To avoid intermixing HMA, do not pave the same lane using mix from more than one plant during a day's production.
8. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
9. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

F. Asphalt Paving Overlay
1. The contractor will perform required patching and leveling before resurfacing. The deteriorated pavement shall be removed as specified below. Clipping dirt and grass from street and road edges and brooming will be performed. Contractor will clean up and re-grade disturbed shoulder material.
2. Apply tack coat to existing paving surface at rate recommended by geotextile fabric manufacturer.
3. Install geotextile fabric in accordance with manufacturer's instructions to permit asphalt saturation of fabric. Lap fabric edge and end joints 4 inches.

4. Place wearing course to thickness indicated on Drawings.
5. Driveway tie-ins (aprons extending 1 foot beyond pavement edge) will be required at all drives unless otherwise specified on the plans.
6. Compact overlay by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
7. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

G. Patching
1. Deteriorated Pavement - the deteriorated pavement shall be removed to the width and length indicated by the plans, with the face of the cut to be straight and vertical. The pavement shall be removed to the depth indicated on the plans.
2. In the event unstable material is encountered at this point than such additional material shall be removed as directed by the Engineer. The volume of material removed below the patch shall be backfilled with crushed stone and thoroughly compacted in 4 inch layers with vibratory compactors.
3. The work shall be conducted so that the patches are removed and replaced each day, with the roadway being opened to traffic by late afternoon.
4. Utility Cuts - patching for utility cuts shall be performed as detailed on the plans.

H. Surface Slurry
1. Install uniform thickness surface slurry over existing paving in accordance with ASTM D3910.
2. Allow slurry to cure.
3. Roll paving to achieve uniform surface.

I. Use herbicide “Primatol” prior to placing asphalt on all parking lots or as stated on the drawings.

3.5 OPERATIONS ON EXISTING PAVEMENT

A. Milling: per SC DOT 2007 Standard Specifications For Highway Construction, Division 401.3.14 and 401.4.12.

B. Surface Planing: per SC DOT 2007 Standard Specifications For Highway Construction, Division 401.3.15 and 401.4.13.

C. Full Depth HMA Patching: per SC DOT 2007 Standard Specifications For Highway Construction, Division 401.4.14.

D. Rumble Strips (Milled-In): per SC DOT 2007 Standard Specifications For Highway Construction, Division 401.3.13 and 401.4.24.

3.6 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation from Indicated Elevation: Within 1/2 inch.

3.7 FIELD QUALITY CONTROL

A. Take samples and perform tests in accordance with State and County standards.

B. Asphalt Paving Mix Temperature: Measure temperature at time of placement.

C. Asphalt Paving Thickness: ASTM D3549; test one core sample from every 1000 square yards compacted paving.

D. Asphalt Paving Density: ASTM D1188 or ASTM D2726; test frequency: per local requirements.

3.8 PROTECTION

A. Immediately after placement, protect paving from mechanical injury for 12 hours or until surface temperature is less than 140 degrees F.

END OF SECTION

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thermoplastic traffic lines and markings.

B. Related Requirements:
   1. Section 32 12 16 - Asphalt Paving.

1.2 PRICE AND PAYMENT PROCEDURES

A. Traffic Lines and Markings:
   1. Basis of Measurement: per linear foot.
   2. Basis of Payment: Includes furnishing, layout, installing and inspecting.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M247 - Standard Specification for Glass Beads Used in Traffic Paint.
   2. AASHTO M249 – Standard Specification for White and Yellow Reflective Striping Material (Solid Form).

B. South Carolina Department of Transportation (SCDOT):
   1. SCDOT 2007 Standard Specifications For Highway Construction:
      a. Section 625 Permanent Pavement Markings, Fast Dry Waterborne Paint.
      b. Section 626 Epoxy Pavement Markings.
      c. Section 627 Thermoplastic Pavement Markings.

C. ASTM International:
   1. ASTM D34 - Standard Guide for Chemical Analysis of White Pigments.
   2. ASTM D126 - Standard Test Methods for Analysis of Yellow, Orange, and Green Pigments Containing Lead Chromate and Chromium Oxide Green.
   3. ASTM D562 - Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.
   4. ASTM D711 - Standard Test Method for No-Pick-Up Time of Traffic Paint.
   5. ASTM D713 - Standard Practice for Conducting Road Service Tests on Fluid Traffic Marking Materials.
   6. ASTM D969 - Standard Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint.
   7. ASTM D1301 - Standard Test Methods for Chemical Analysis of White Lead Pigments.
   8. ASTM D1394 - Standard Test Methods for Chemical Analysis of White Titanium Pigments.

9. ASTM D1475 - Standard test Method for Density of Liquid Coatings, Inks, and Related Products.
10. ASTM D1640 - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.
11. ASTM D2202 - Standard Test Method for Slump of Sealants.
12. ASTM D2371 - Standard Test Method for Pigment Content of Solvent-Reducible Paints.
13. ASTM D2621 - Standard Test Method for Infrared Identification of Vehicle Solids from Solvent-Reducible Paints.

1.4 SUBMITTALS

A. Upon request, be able to provide the following data:
   1. Product Data: Submit paint formulation for each type of paint.
   2. Test and Evaluation Reports: Submit source and acceptance test results in accordance with AASHTO M247.
   3. Manufacturer's Instructions: Submit instructions for application temperatures, eradication requirements, application rate, line thickness, type of glass beads, bead embedment and bead application rate, and any other data on proper installation.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with South Carolina Department of Transportation (SCDOT) standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Invert containers several days prior to use when paint has been stored more than 2 months. Minimize exposure to air when transferring paint. Seal drums and tanks when not in use.

B. Glass Beads. Store glass beads in cool, dry place. Protect from contamination by foreign substances.

1.8 AMBIENT CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

B. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

C. Volatile Organic Content (VOC). Do not exceed State or Environmental Protection Agency maximum VOC on traffic paint.

1.9 WARRANTY

A. Furnish one year manufacturer's warranty for traffic paints.

PART 2 PRODUCTS

2.1 PAINTED PAVEMENT MARKINGS

A. Furnish materials in accordance with South Carolina Department of Transportation standards.

B. Thermoplastic Pavement Markings:
   1. Performance / Design Criteria: per SCDOT Section 627, *Thermoplastic Pavement Markings*.
   2. Paint: per SCDOT Section 627, *Thermoplastic Pavement Markings*.
   3. Glass Beads: per SCDOT Section 627, *Thermoplastic Pavement Markings*.

2.2 EQUIPMENT

A. Per **SCDOT Section 627, *Thermoplastic Pavement Markings,*** use equipment that enables the installation of thermoplastic pavement markings by methods in accordance with AASHTO M249 with the addition of the following requirements:
   1. Applicators may be either a truck-mounted liner or a portable unit. A truck-mounted unit is defined as a self-propelled vehicle with six or more wheels and an enclosed cab for housing a driver. Make certain that the operator has controls that allow override of preset automatic cycles in order to extend the line or to begin a new cycle at any selected point.
   2. Prepare material with an insulated batching machine recommended or furnished by the manufacturer and consists of a special kettle for melting and heating the composition. Ensure that heating of kettles and melters is done by controlled heat transfer systems that are oil jacketed or indirect flame air jacketed. Make certain that all kettles and melters are equipped with an automatic thermostatic control device and proper thermometers to control the temperature of the material at the manufacturer's recommended application temperature range. Ensure that all mixing and conveying parts up to the final dispensing nozzle/shaping die maintain the material at the appropriate temperature. Ensure that the applicator and cattle are equipped and arranged to satisfy the requirements of all state and local requirements.
   3. Ensure that the batching machine provides continuous mixing and agitation of the material. Make certain that all parts of the equipment that come in contact with the material are easily accessed and exposed for cleaning and maintenance and are designed to prevent accumulation and clogging.

4. Apply thermoplastic pavement markings by extrusion methods. Extrusion may be accomplished either with a conventional extrusion equipment, wherein one side of the shaping die is the pavement surface and the other three sides are contained by, or are part of, suitable equipment for heating and controlling the flow of material, or with ribbon gun extrusion devices. Make certain that the applicators have a means for cleanly cutting off square ends.
5. Ensure that the applicators are capable of producing the various widths of traffic markings required in the MUTCD and or on the plans. Make certain that the applicators are mobile and maneuverable so that it can follow straight lines and make normal curves in a true arc. Use a truck-mounted liner with a method of automatically applying “skip” or solid longitudinal lines, including right and left edge lines, or any combination of single or double line configurations (color and pattern) as illustrated in the MUTCD. Adjust application equipment to prevent nozzle/shaping die overruns without the use of hands, aprons, or other devices.
6. Apply glass beads to the surface of the completed marking with an automatic bead dispenser attached to the applicator so that the beads are dispensed almost instantly following application of the marking material.

B. Equipment on-site.
   1. Ensure that the equipment necessary for the proper construction of the work is on site and in acceptable working condition before the start of work under this section.
   2. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not apply paint to concrete surfaces until concrete has cured for 28 days.

3.2 PREPARATION

A. Maintenance and Protection of Traffic:
   1. Provide short term traffic control in accordance with SCDOT Regulations.
   2. Prevent interference with marking operations and prevent traffic on newly applied markings before markings dry.

B. Surface Preparation.
   1. Clean and dry paved surface prior to painting.
   2. Blow or sweep surface free of dirt, debris, oil, grease or gasoline.
   3. Spot location of final pavement markings as specified and as indicated on Drawings by applying pavement spots 25 feet on center.
   4. Notify Engineer after placing pavement spots and minimum 3 days prior to applying traffic lines.

3.3 APPLICATION

A. Install Work in accordance with the following SCDOT Specifications:
   1. Section 625, Permanent Pavement Markings, Fast Dry Waterborne Paint.
   2. Section 626, Epoxy Pavement Markings.
   3. Section 627, Thermoplastic Pavement Markings.

3.4 TOLERANCES

A. Maximum Variation from Wet Film Thickness: 1 mil.

B. Maximum Variation from Wet Paint Line Width: Plus or minus 1/8 inch.

C. Maintain cycle length for skip lines at tolerance of plus or minus 6 inches per 40 feet and line length of plus or minus 3 inches per 10 feet.

3.5 FIELD QUALITY CONTROL

A. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.

B. Repair lines and markings, which after application and curing do not meet following criteria:
   1. Incorrect Location:
      a. Remove and replace incorrectly placed patterns.
   2. Insufficient Thickness, Line Width, Paint Coverage, Glass Bead Coverage or Retention:
      a. Prepare defective material by acceptably grinding or blast cleaning to remove substantial amount of beads and to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.
   3. Uncured or Discolored Material, Insufficient Bonding:
      a. Remove defective markings in accordance with this Section and clean pavement surface one foot beyond affected area. Apply new markings on cleaned surface in accordance with this Section.

3.6 PROTECTION

A. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free. Follow manufacturer's recommendations or use minimum of 30 minutes. Consider barrier cones as satisfactory protection for materials requiring more than 2 minutes dry time.

END OF SECTION

SECTION 32 92 19 – SEEDING AND STABILIZATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil Preparation.
   2. Fertilizing.
   3. Seeding.
   4. Hydro seeding.
   5. Sodding.
   6. Mulching.
   7. Maintenance.

B. Related Sections:
   1. Section 31 22 13 - Grading.
   2. Section 31 23 17 - Trenching.
   3. Section 32 05 13 - Soils for Earthwork.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Erosion and Sediment Control is bid as a lump sum and encompasses all stabilization items (excluding paving) shown on the construction plans. This includes seeding, stabilization, sediment control structures, erosion control blankets, silt fence, and any other required sediment control materials or items. This lump sum also includes maintenance and replacement, if necessary, due to normal wear and tear.

B. The items listed below are for changes or additions not shown on the construction plans and not considered part of the regular maintenance.

C. Grassed Areas (Seed or Hydro seeding):
   1. Basis of Measurement: Lump Sum.
   2. Basis of Payment: Includes preparation of top soil, seeding, watering and maintenance to specified time limit.

D. Sodding
   1. Basis of Measurement: Square foot.
   2. Basis of Payment: Includes preparation of topsoil, seeding, watering and maintenance to specified time limit.

1.3 REFERENCES

A. South Carolina DHEC (Department of Health and Environmental Control) documents:
   1. NPDES General Permit for Storm water Discharges Form Construction Activities, latest release.
   2. SC DHEC BMP (Best Management Practices) Handbook, latest edition.

B. ASTM International:
   1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

1.4 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

1.5 SUBMITTALS – Not Used

1.6 CLOSEOUT SUBMITTALS

A. Per the SC DHEC Storm water Permit, permanent structures must be surveyed to show final locations, contours and inverts.

B. Removal of temporary erosion and sediment control structures must be approved by SC DHEC or the SWPPP preparer; see Notice of Termination (NOT) requirements.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with State and County requirements as documented on the construction plans and in the approved SWPPP (Storm Water Pollution Prevention Plan).

B. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

D. Sod shall be harvested and delivered within 24 hours.

1.9 MAINTENANCE SERVICE

A. Maintain seeded areas for six months from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 SEED MIXTURE

A. Furnish materials in accordance with State of South Carolina Department of Health and Environmental Control (SC DHEC).

B. Grass seeding mixtures and requirements are on the construction plans, in the SWPPP (Storm Water Pollution Prevention Plan) on site, and are also available at the SC DHEC web site. Seed mixtures vary by season and geographical location within South Carolina.

2.2 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis.

C. Lime: ASTM C602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

D. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

E. Erosion Fabric: See drawing details.

F. Stakes: Softwood lumber, chisel pointed.

G. String: Inorganic fiber.

2.3 SOURCE QUALITY CONTROL

A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

B. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.

C. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

3.2 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.

C. Scarify subsoil to depth of 3 inches in areas where vehicles or construction equipment has compacted sub-soil.

D. Spread topsoil to minimum depth of 4 inches over area to be seeded. Rake until smooth.

E. Place topsoil during dry weather and on dry unfrozen subgrade.

3.3 FERTILIZING

A. Apply lime at application rate recommended by soil analysis. Work lime into top 6 inches of soil. pH should be in the range of 5.5 – 7.7.

B. Apply fertilizer at application rate recommended by soil analysis.

C. Apply after smooth raking of topsoil.

D. Do not apply fertilizer at same time or with same machine used to apply seed.

E. Mix fertilizer thoroughly into upper 2 inches of topsoil.

F. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.4 SEEDING

A. Apply evenly in two intersecting directions. Rake in lightly. See drawing details for permanent seeding mixes and rates.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

D. Immediately following seeding, apply mulch to thickness of 1/8 inches. Maintain clear of shrubs and trees.

E. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.5 HYDROSEEDING

A. Apply fertilizer, mulch and seeded slurry with hydraulic seeder at a rate of approximately 50 lbs of seed per acre evenly in one pass.

B. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels two to four inches.

3.6 SODDING

A. Apply fertilizer and lime as needed based on soil testing.

After application, apply water with fine spray immediately after each area is sodded. Wet to a depth of 2-inches.

3.7 SEED PROTECTION

A. Cover seeded slopes where grade is sloped at 3:1 (H:V) or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

B. Lay fabric and stake per manufacturer's recommendations.

C. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

D. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

E. Sod shall be laid across the angle of the slope (perpendicular), with staggered joints and secured by tamping, pegging, stapling or other approved methods of temporarily securing each piece.

3.8 MAINTENANCE

A. Water to prevent grass and soil from drying out.

B. Reseed areas showing bare spots.

C. Repair washouts or gullies.

END OF SECTION

SECTION 33 01 30 - SEWER DISTRIBUTION SYSTEM TESTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing Manholes:
      a. Visual Inspection.
      b. Vacuum Test.
      c. Exfiltration Test.
   2. Testing Gravity Sewer Piping:
      a. Lamping.
      b. Low-pressure Air Test.
      c. Infiltration Test.
      d. Deflection Testing of Plastic Piping (Mandrel Test).
      e. Camera/Video Inspection.
   3. Testing Force Mains:
      a. Hydrostatic Pressure Test.

B. Related Sections:
   1. Section 33 05 13 – Manholes and Structures.
   2. Section 33 31 00 - Sanitary Utility Sewerage Piping.
   3. Section 33 34 00 - Sanitary Utility Sewerage Force Mains.

1.2 UNIT PRICE

A. The cost of testing is included in the cost for utility Sewerage Piping (Section 33 31 00).

1.3 REFERENCES

A. ASTM International:
   1. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure Vacuum Test Prior to Backfill.
   3. ASTM D2122 - Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

1.4 SUBMITTALS

A. Test Reports: Indicate results of manhole and piping tests.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify manholes and piping are ready for testing.

B. Verify trenches are backfilled.

C. Verify pressure piping concrete reaction support blocking or mechanical restraint system is installed.

3.2 PIPING PREPARATION

A. The contractor shall furnish all necessary testing equipment including hose, temporary piping, force pump, pressure gauges, approved pipe plugs, mandrels, lamps, tank trucks and flow measurement facilities.

B. Notify the Engineer 24 hours in advance of the testing to allow sufficient time for the Engineer to arrange to witness the tests.

C. Cleaning and Flushing Lines:
   1. On completion of the pipe installation, the contractor shall flush all lines and remove any sediment. On large sewer lines if flushing does not remove foreign material, the contractor shall use a vacuum truck or other acceptable means to clean the line to the satisfaction of the Owner and Engineer.

D. If pressure testing, plug outlets, wye-branches and laterals; brace plugs to resist test pressures.

3.3 TESTING

A. The sanitary sewer lines shall be tested for their full length. The contractor will have the option of testing the full-length at one time or testing in separate length increments.

B. Test pipe larger than 36 inches diameter with exfiltration test not exceeding 100 gallons for each inch of pipe diameter for each mile per day for each section under test. Perform test with minimum positive head of 2 feet.

C. Lamping (Gravity Sewer Piping):
   1. Lamp gravity piping after flushing and cleaning.
   2. Perform lamping operation by shining light at one end of each pipe section between manholes; observe light at other end; reject pipe not installed with uniform line and grade; remove and reinstall rejected pipe sections; re-clean and lamp until pipe section achieves uniform line and grade.

D. Low Pressure Air Test (Gravity Sewer Piping):
   1. Test each section of gravity sewer piping between manholes.
   2. Introduce air pressure slowly to approximately 4 psig.
      a. Determine ground water elevation above spring line of pipe for every foot of ground water above spring line of pipe, increase starting air test pressure by 0.43 psig; do not increase pressure above 10 psig.
   3. Allow pressure to stabilize for at least five minutes. Adjust pressure to 3.5 psig or increased test pressure as determined above when ground water is present. Start test.
   4. Test:
      a. Determine test duration for sewer section with single pipe size from the following table. Do not make allowance for laterals.

Nominal Pipe Size, inches	Minimum Test Time, min/ 100 feet
3	0.2
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0

      b. Record drop in pressure during test period; when air pressure has dropped more than 1.0 psig during test period, piping has failed; when 1.0 psig air pressure drop has not occurred during test period, discontinue test and piping is accepted.
      c. When piping fails, determine source of air leakage, make corrections and retest; test section in incremental stages until leaks are isolated; after leaks are repaired, retest entire section between manholes.

E. Infiltration Test (Gravity Sewer Piping and Manholes):
   1. Use only when gravity piping is submerged in ground water minimum of 4 feet above crown of pipe for entire length being tested.
   2. Maximum Allowable Infiltration: 100 gallons per inch of pipe diameter for each mile per day for section under test, include allowances for leakage from manholes. Perform test with minimum positive head of 2 feet.

F. Camera/Video Inspection (Gravity Sewer):
   1. Per Section 33 01 30.16 – TV Inspection of Sewer Pipelines.

G. Pressure Test (Force Mains):

1. Pressure test system in accordance with AWWA C600 and the following:
2. Hydrostatically test each portion of pressure piping, including valved section, at 1.5 times working pressure of piping based on elevation of lowest point in piping corrected to elevation of test gauge.
3. Conduct hydrostatic test for at least two-hour duration.
4. Fill section to be tested with water slowly, expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
5. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.
6. Correct visible deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
7. Compute maximum allowable leakage by the following formula:

Ductile Iron

$L = SD(P^{2})/ 148,000$

PVC

$L = ND(P^{2})/ 8,223$

For the ductile iron pipe equation, “L” is the allowable leakage in gallons per hour, “S” is the length of water main tested in feet, “D” is the nominal diameter of the water main in inches, and “P” is the test average pressure in pounds per square inch (psi).

For the PVC pipe equation, “L” is the allowable leakage in gallons per hour, “N” is the number of joints in the length of water main tested, “D” is the nominal diameter of the water main in inches, and “P” is the test average pressure in pounds per square inch (psi).

8. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

H. Deflection Testing of Plastic Sewer Pipe (Gravity Sewer Piping):

1. Perform vertical ring deflection testing on PVC and ABS sewer piping, after backfilling has been in place for at least 30 days but not longer than 12 months.
2. Allowable maximum deflection for installed plastic sewer pipe limited to 5 percent of original vertical internal diameter.
3. Perform deflection testing using properly sized rigid ball or 'Go, No-Go' mandrel.
4. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe as determined by ASTM standard to which pipe is manufactured. Measure pipe in compliance with ASTM D2122.
5. Perform test without mechanical pulling devices.

6. Locate, excavate, replace and retest pipe exceeding allowable deflection.

I. Visual Inspection (Manholes):
   1. Visually inspect the following:
      a. Steps (for stability, cracking, spacing)
      b. Sewer pipe inlets / outlet (for obstructions, seal)
      c. Trough slopes
      d. Frame & cover (for seal, apron slope & transition, vertical changes)
      e. Walls (for cracking, coverage)

J. Vacuum Test (Manholes):
   1. General: Test using air whenever possible prior to backfilling to assist in locating leaks. Make joint repairs on both outside and inside of joint to ensure permanent seal. Test manholes with manhole frame set in place.
   2. Vacuum test in accordance with ASTM C1244 and as follows:
      a. Plug pipe openings; securely brace plugs and pipe.
      b. Inflate compression band to effect seal between vacuum base and structure; connect vacuum pump to outlet port with valve open; draw vacuum to 10 inches of Hg; close valve; start test.
      c. Test:
         1) Determine test duration for manhole from the following table:

Manhole Diameter	Test Period
4 feet	60 seconds
5 feet	75 seconds
6 feet	90 seconds

         2) Record vacuum drop during test period; when vacuum drop is greater than 1 inch of Hg during test period, repair and retest manhole; when vacuum drop of 1 inch of Hg does not occur during test period, discontinue test and accept manhole.
         3) When vacuum test fails to meet 1 inch Hg drop in specified time after repair, repair and retest manhole.
   3. When unsatisfactory test results are achieved, repair manhole and retest until result meets criteria; repair visible leaks regardless of quantity of leakage.

K. Exfiltration Test (Manholes):
   1. Plug pipes in manhole; remove water in manhole; observe plugs over period of not less than 2 hours to ensure there is no leakage into manhole.
   2. Determine ground water level outside manhole.
   3. Fill manhole with water to within 4 inches of top of cover frame. Prior to test, allow manhole to soak from minimum of 4 hours to maximum of 72 hours; after soak period, adjust water level inside manhole to within 4 inches of top of cover frame.

4. Measure water level from top of manhole frame; at end of 4 hour test period, again measure water level from top of manhole frame; compute drop in water level during test period.
5. Manhole exfiltration test is considered satisfactory when drop in water level is less than values listed in table below:

Manhole Depth feet	Allowable Leakage inches for Manhole Diameter		
	4 feet	5 feet	6 feet
4	0.11	0.14	0.17
6	0.17	0.21	0.26
8	0.23	0.29	0.35
10	0.28	0.35	0.42
12	0.34	0.43	0.51
14	0.40	0.50	0.60
16	0.45	0.56	0.68
18	0.51	0.64	0.77
20	0.57	0.71	0.86
22	0.62	0.78	0.93
24	0.68	0.85	1.02
26	0.74	0.93	1.11
28	0.79	0.99	1.19
30	0.85	1.06	1.28

6. When unsatisfactory test results are achieved, repair manhole and retest until result meets criteria; repair visible leaks regardless of quantity of leakage.

END OF SECTION

SECTION 33 05 13 – MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Monolithic concrete manholes with masonry transition to cover frame, covers, anchorage, and accessories.
   2. Modular precast concrete manhole with tongue-and-groove joints with masonry transition to cover frame, covers, anchorage, and accessories.
   3. Bedding and cover materials.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. Section 31 05 13 - Soils for Earthwork.
   3. Section 31 05 16 - Aggregates for Earthwork.
   4. Section 31 23 16 – Excavation.
   5. Section 31 23 23 - Fill.
   6. Section 33 01 30 – Sewer Distribution System Testing.
   7. Section 33 05 16 – Precast Concrete Utility Structures.
   8. Section 33 31 00 – Sanitary Utility Sewerage Piping.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Manhole:
   1. Basis of Measurement: Each.
   2. Basis of Payment: Includes excavating, concrete base pad, concrete manhole sections, brick masonry transition to cover frame, cover frame and cover, to indicated depth, testing, benches, forming and sealing pipe inlets and outlets.

1.3 REFERENCES

A. American Association of State Highway Transportation Officials:
   1. AASHTO S99-HB - Standard Specifications for Highway Bridges.

B. American Concrete Institute:
   1. ACI 318 - Building Code Requirements for Structural Concrete.
   2. ACI 530/530.1 - Building Code Requirements for Masonry Structures and Specifications for Masonry Structures.

C. ASTM International:
   1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
   2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM C55 - Standard Specification for Concrete Brick.
4. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).
5. ASTM C150 - Standard Specification for Portland Cement.
6. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
7. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
9. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
10. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
12. ASTM C877 – Standard Specification for External Sealing Bands for Concrete pipe, Manholes, and Precast Box Sections.
13. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Section Precast Concrete Water and Wastewater Structures
15. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
16. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
17. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
18. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
19. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

D. State Standards:
1. South Carolina Department of Health and Environmental Control (SC DHEC).

1.4 DESIGN REQUIREMENTS

A. Design structures for minimum loads in accordance with ASTM C857 and ASTM C890.
1. Roof Live Load: Comply with the following loading conditions, including impact load.
a. Heavy Traffic: AASHTO S99-HB; HS20-44, maximum 16,000 lb each wheel.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate manhole locations, elevations, piping, sizes and elevations of penetrations.

C. Product Data: Submit cover and frame construction, features, configuration, and dimensions.

1.6 QUALITY ASSURANCE

A. Perform masonry Work in accordance with ACI 530 and ACI 530.1.

B. Perform Work in accordance with state and local standards.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes.

C. Store precast concrete manholes and structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.

D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

B. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 PRODUCTS

2.1 MANHOLES

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 with gaskets in accordance with ASTM C923.

B. Manhole Sections ("doghouse" type manholes): Reinforced Cast-In-Place concrete as specified in Section 03 30 00 – Cast-In-Place Concrete.

C. Reinforcement: as specified in Sections 33 05 16 – Precast Concrete Utility Structures, or Section 03 30 00 – Cast-In-Place Concrete.

D. Joint Sealants and Joint Gaskets:
   1. Gasket Joints for Circular Concrete Pipe: ASTM C443; standard rubber gaskets.
   2. External Sealing Bands: ASTM C877.
   3. Preformed Joint Sealants for Concrete Pipe and Box Sections: ASTM C990.
   4. Elastomeric Joint Sealants: ASTM C920.

E. Pipe Entry Connectors: ASTM C923.

F. Grout:
   1. Cement Grout: Portland cement, sand and water mixture with stiff consistency to suit intended purpose.
   2. Non-Shrink Grout: ASTM C1107/C1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

G. Mortar: Portland Cement, ASTM C150, Type 1, white color, or mortar cement with fine aggregate.

2.2 FRAMES AND COVERS

A. Manufacturers:
   1. US Foundry, Medley, Florida. www.usfoundry.com
   2. Substitutions: Permitted with Engineer's approval.

B. Product Description: Manhole Frame and Cover.
   1. South Carolina Department of Transportation 719-13 "Manhole Standard Ring & Cover"
   2. USF 678 Ring with USF Type KM covers.
   3. ASTM A48/A48M, Class 30B Cast iron construction, machined flat bearing surface
   4. Removable 22 1/8" diameter lid with 1" diameter non-penetrating pickhole.
   5. Heavy duty rating per AASHTO S99-HB (H-20 loading).

2.3 COMPONENTS

A. Manhole Steps: Formed galvanized steel rungs, vinyl coated; 3/4 inch diameter, 12 inches wide, spaced 16" vertically. Formed integral with manhole sections.

B. Base Pad: Cast-in-place concrete of type specified in Section 03 30 00, with leveled top surface.

2.4 CONFIGURATION

A. Shaft Construction: Concentric with eccentric cone top section; lipped male/female joints; sleeved to receive pipe sections.

B. Shape: Cylindrical.

C. Clear Inside Dimensions: As indicated on Drawings.

D. Design Depth: As indicated on Drawings.

E. Clear Cover Opening: As indicated on Drawings.

F. Pipe Entry: Furnish openings as required.

G. Steps: As required by code.

2.5 BEDDING AND COVER MATERIALS

A. Bedding: fine to coarse aggregate as specified in Section 31 05 16 – Aggregates for Earthwork.

B. Cover: as specified in Section 31 05 13 – Soils for Earthwork, or 31 23 23 - Fill.

C. Soil Backfill from Above Pipe to Finish Grade: as specified in Section 31 05 13 - Soils for Earthwork (Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter).

2.6 FINISHING - STEEL

A. Galvanizing: ASTM A123/A123M; hot dip galvanize after fabrication.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify built-in items are in proper location, and ready for roughing into Work.

D. Verify correct size of manhole excavation.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe required by other sections.

B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.

C. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION

A. Excavation and Backfill:
   1. Excavate for manholes in accordance with Section 31 23 16 in location and to depth shown. Provide clearance around sidewalls of structure for construction operations.
   2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes in dry trench.
   3. Where possibility exists of watertight structure becoming buoyant in flooded excavation, extend base to allow soil weight to anchor structure.

B. (Precast Manholes) Install manholes supported at proper grade and alignment as shown on Drawings.

C. (Doghouse Manhole) Place base pad, trowel top surface level. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.

D. Backfill excavations for manholes in accordance with Section 31 23 23.

E. Form and place manhole cylinder plumb and level, to correct dimensions and elevations.

F. Cut and fit for pipe.

G. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel.

H. Set cover frames and covers level without tipping, to correct elevations.

I. Coordinate with other sections of Work to provide correct size, shape, and location.

3.4 PRECAST CONCRETE MANHOLE INSTALLATION

A. Lift precast components at lifting points designated by manufacturer.

B. When lowering manholes into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.

C. Set precast structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 23 23 or on other support system shown on Drawings.

D. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections.

E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

F. Joint sealing materials may be installed on site or at manufacturer's plant.

G. Verify manholes installed satisfy required alignment and grade.

H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.

I. Cut pipe to finish flush with interior of structure.

J. Shape inverts through manhole as shown on Drawings.

3.5 FRAME AND COVER INSTALLATION

A. Set frames using mortar and masonry. Install radially laid concrete brick with 1/4 inch thick vertical joints at inside perimeter. Lay concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.

B. Set frame and cover 2 inches above finished grade for manholes with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.

3.6 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test concrete manhole and structure sections in accordance with ASTM C497.

C. Perform acceptance tests per Section 33 01 30 – Sewer and Manhole Testing.

D. Vertical Adjustment of Existing Manholes:
   1. Where required, adjust top elevation of existing manholes to finished grades shown on Drawings.
   2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
   3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated Drawings.

4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete in accordance with Section 03 30 00.

END OF SECTION

SECTION 33 05 16.13 - PRECAST CONCRETE UTILITY STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes precast concrete utility structures:
   1. Sanitary sewer lift station pits.
   2. Knock out boxes.
   3. Valve pits.
   4. Frames and covers.
   5. Access hatches.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. Section 31 23 16 - Excavation.
   3. Section 31 23 23 - Fill.
   4. Section 33 05 13 – Manholes and Structures.
   5. Section 33 31 00 - Sanitary Utility Sewerage Piping.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Precast Concrete Utility Structures:
   1. Basis of Measurement: By each complete structure.
   2. Basis of Payment: Includes excavating, concrete foundation slab, concrete structure sections, cover frame and cover, to indicated depth, forming and sealing pipe inlets and outlets.

1.3 REFERENCES

A. American Association of State Highway Transportation Officials:
   1. AASHTO M306 - Drainage Structure Castings.
   2. AASHTO S99-HB - Standard Specifications for Highway Bridges.

B. American Concrete Institute:
   1. ACI 318 - Building Code Requirements for Structural Concrete.

C. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
   3. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   4. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   5. ASTM C150 - Standard Specification for Portland Cement.

6. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
8. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
9. ASTM C877 – Standard Specification for External Sealing Bands for Concrete pipe, Manholes, and Precast Box Sections.
10. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Section Precast Concrete Water and Wastewater Structures.
11. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
12. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
13. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
14. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
16. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
17. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
18. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure Vacuum Test prior to Backfill.
20. ASTM C1433 - Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.
21. ASTM C1504 - Standard Specification for Manufacture of Precast Reinforced Concrete Three-Sided Structures for Culverts, Storm Drains, and Sewers.

D. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.
   2. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

E. National Precast Concrete Association:
   1. NPCA Quality Control Manual for Precast Plants.
   2. NPCA Plant Certification Program.

F. Precast/Prestressed Concrete Institute:
   1. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
   2. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete.
   3. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete

1.4 DESIGN REQUIREMENTS

A. Design structures for minimum loads in accordance with ASTM C857 and ASTM C890.
   1. Roof Live Load: Comply with the following loading conditions, including impact load.

a. Heavy Traffic: AASHTO S99-HB; HS20-44, maximum 16,000 lb each wheel.
b. Medium Traffic: AASHTO S99-HB; HS15-44, maximum 12,000 lb each wheel.
c. Light Traffic: AASHTO S99-HB; HS10, maximum 8,000 lb each wheel.
d. Walkway Traffic: ASTM C857; A-0.3, maximum 300 psf.

2. Box Culvert Roof Live Load: AASHTO S99-HB HS20, interstate live loads including impact load.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
1. Indicate structure locations, elevations, sections, piping, sizes and elevations of penetrations.
2. Indicate design, construction and installation details, typical reinforcement and additional reinforcement at openings for each type, size and configuration.

C. Product Data:
1. Submit data for frames and covers, steps, component construction, features, configuration, and dimensions.

D. Design Data:
1. Submit concrete mix design for each different mix.
2. Submit design calculations for custom fabrications signed and sealed by professional engineer.

1.6 QUALITY ASSURANCE

A. Where possible, obtain precast concrete utility structures from single source.

B. Perform structural design in accordance with ACI 318.

C. Preform Work in accordance with NPCA Quality Control Manual for Precast Plants.

D. Conform to the following for material and fabrication requirements:
1. Single Cell Box Culverts: ASTM C1433.
2. Three Sided Structures: ASTM C1504.
3. Other Structures: ASTM C913.

E. Perform welding in accordance with the following:
1. Structural Steel: AWS D1.1.
2. Reinforcing Steel: AWS D1.4.

F. Perform Work in accordance with State and Local standards.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Design utility structures under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of South Carolina.

C. Welders: AWS qualified within previous 12 months.

1.8 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast structures. Lift structures from designated lifting points.

C. Do not deliver products until concrete has cured 5 days or attained minimum 75 percent of specified 28 day compressive strength.

D. Store precast concrete structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.

E. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE UTILITY STRUCTURES

A. Materials: Furnish materials in accordance with Florence County, SC standards.

B. Reinforcement: All reinforcing steel shall be shop fabricated in accordance with approved shop drawings.

C. Fabrication Tolerances: Conform to PCI MNL-116.

2.2 CONCRETE MATERIALS

A. Cement: White Portland, conforming to ASTM C150 Type I.

B. Aggregate, Sand, Water, Admixtures: Determined by precast fabricator, as appropriate to design requirements.

C. Reinforcement / Structural Steel: ASTM A36/A36M; galvanized.

2.3 FRAMES AND COVERS

A. Manufacturers:
1. US Foundry, Medley, Florida. www.usfoundry.com
2. Substitutions: Permitted with Engineer's approval.

2.4 ACCESS HATCHES

A. Access Hatch: Aluminum welded construction; single door, sized per drawings.
1. Cover: ¼" aluminum diamond pattern plate reinforced with structural stiffeners to withstand a live load of 300 lbs/sq ft.
2. Frame: ¼" aluminum channel type; with integral seat to support cover stiffeners; anchor flange or straps around frame perimeter for concrete embedment.
3. Hinges: Type 316 Stainless steel.
4. Lift Handle: Flush drop handle, non-removable type mounted in cover.
5. Lifting Mechanism: Stainless steel compressions spring with automatic hold open and dead stop to retain cover in open position. Cover springs to prevent contact by personnel entering utility structure.
6. Latch Mechanism: Stainless steel lock with removable external handle and permanent internal release mechanism.
7. Hardware: Type 316 Stainless steel.
8. Finish: Factory mill finish with bituminous coating on the exterior of the frames in contact with concrete.

2.5 ACCESSORIES

A. Steps: Formed galvanized steel rungs, vinyl coated; 3/4 inch diameter, 12 inches wide, spaced 16" vertically. Formed integral with structure sections.

B. Inserted and Embedded Items:
1. Structural Steel Sections: ASTM A36/A36M; galvanized.

C. Joint Sealants and Joint Gaskets:
1. Gasket Joints for Circular Concrete Pipe: ASTM C443; standard rubber gaskets.
2. External Sealing Bands: ASTM C877; Type II plastic film and mesh reinforced bands.
3. Preformed Joint Sealants for Concrete Pipe and Box Sections: ASTM C990.
4. Elastomeric Joint Sealants: ASTM C920; silicone; Grade NS, Class 25.

D. Pipe Entry Connectors: ASTM C923.

E. Grout:

1. Cement Grout: Portland cement, sand and water mixture with stiff consistency to suit intended purpose.
2. Non-Shrink Grout: ASTM C1107/C1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.6 REINFORCEMENT

A. Install reinforcing by tying or welding to form rigid assemblies. Secure reinforcement to prevent displacement when placing concrete. Maintain concrete cover around reinforcement based on exposure to the environment:
   1. Concrete permanently exposed to earth: 3 inches.
   2. Concrete exposed to soil, water, sewage, sludge or weather: 2 inches.
   3. Concrete not exposed to soil, water, sewage, sludge or weather: 1 inch.

B. Position and secure embedded items to prevent displacement when placing concrete.

C. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on Drawings.

D. Tension reinforcement tendons as required to achieve design load criteria.

E. Fabricate required openings with dimension larger than 10 inches and embed accessories provided by other Sections, at indicated locations.

F. Weld steel fabrications in accordance with AWS D1.1. Weld reinforcing steel in accordance with AWS D1.4. Do not tack weld reinforcing.

2.7 SOURCE QUALITY CONTROL

A. Test and analyze concrete in accordance with PCI MNL-116 and ACI 318.

B. Make test results available to Engineer upon request.

2.8 FINISHING - STEEL

A. Galvanizing: ASTM A123/A123M; hot dip galvanize after fabrication.

2.9 FABRICATION

A. Fabrication procedure to conform to PCI MNL-116, ACI 318, and NPCA Quality Control Manual for Precast Plants.

B. Maintain plant records and quality control program during production of precast members. Make records available upon request.

C. Fabricate precast concrete utility structures to size, configuration, and openings as indicated on Drawings.

2.10 FINISHES

A. Provide initial curing by retaining moisture using one of the following methods:
   1. Cover with polyethylene sheets.
   2. Cover with burlap or other absorptive material and keep continually moist.
   3. Apply curing compound in accordance with manufacturer's instructions.

B. Provide final curing in accordance with manufacturer's standard.

C. Cure members under identical conditions to develop required concrete quality, and minimize appearance blemishes including non-uniformity, staining, or surface cracking.

D. Plant Finish (Finish A): Normal plant finish; surface may contain small surface holes caused by air bubbles, minor chips or spalling at edges or ends, without major discoloration or honeycombing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify correct size and elevation of excavation.

D. Verify subgrade (and bedding, if specified on the drawings) is properly prepared, compacted and ready to receive Work of this section.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.

C. Inspect precast concrete structures immediately prior to placement in excavation to verify are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION

A. Install underground precast utility structures in accordance with ASTM C891.

B. Lift precast concrete structures at lifting points designated by manufacturer.

C. When lowering structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.

D. Install precast concrete base to elevation and alignment indicated on Drawings.

E. Assemble multi-section structures by lowering each section into excavation.
   1. Clean joint surfaces.
   2. Install watertight joint seals in accordance with manufacturer's instructions.

F. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with grout.

G. Connect pipe to structure and seal watertight. Cut pipe flush with interior of structure.

H. Grout base to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel.

I. Paint interior with 2 coats of bituminous interior coating at rate of 120 square feet per gallon for each coat, unless otherwise specified on Drawings.

J. Set frame and cover level without tipping, to elevations indicated on Drawings.
   1. Set cover 2 inches above finished grade for structures located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.
   2. Connect drain from access hatch frame to storm drainage system.

K. Touch up damaged galvanized coatings.

L. Backfill excavations for structures in accordance with Section 31 23 23 - Fill.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform the following tests and inspections for structures:
   1. Vacuum Test for Sewer Manholes: ASTM C1244.
   2. Hydrostatic Exfiltration Test: In accordance with manufacturer's instructions.

END OF SECTION

SECTION 33 31 00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sanitary sewage pipe (Gravity Sewer Mains)
   2. Sanitary sewerage pipe (Sewer Services).
   3. Underground pipe markers.

B. Related Sections:
   1. Section 31 05 13 - Soils for Earthwork.
   2. Section 31 05 16 - Aggregates for Earthwork.
   3. Section 31 23 16 - Excavation.
   4. Section 31 23 17 - Trenching.
   5. Section 31 23 23 - Fill.
   6. Section 33 01 30 – Sewer Distribution System Testing.
   7. Section 33 05 13 – Manholes and Structures.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Gravity Sewer Main (Pipe and Fittings 8” or greater, with manholes):
   1. Basis of Measurement: By the linear foot.
   2. Basis of Payment: Includes hand trimming excavation, bedding, pipe and fittings, testing, and connection to municipal sewer.

B. Sanitary Sewer Services (Pipe and Fittings 6” or smaller, tie-in to building or lot):
   1. Basis of Measurement: By the unit.
   2. Basis of Payment: Includes hand trimming, excavation, bedding, pipe and fittings, cleanouts, testing and connection to building sewer (5 feet outside of building footprint, or cleanout at property line of undeveloped residential lot).

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
   1. ASME/ANSI B16.1-1998 – Cast Iron Pipe Flanges and Flanged Fittings.

C. ASTM International:
   1. ASTM A746 – Standard Specification for Ductile Iron Gravity Sewer Pipe.
   2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
5. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
6. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
7. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
8. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
9. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
10. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
11. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
12. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
13. ASTM F679 – Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

D. American Water Works Association:
   1. AWWA C111/A21.11-00 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   2. AWWA C150/A21.50-02 – American National Standard for Thickness Design of Ductile-Iron Pipe.
   3. AWWA C151/A21.51 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
   4. AWWA C606-11/A21.10 – Grooved and Shouldered Joints.

E. State Standards:
   1. South Carolina Department of Health and Environmental Control (SC DHEC).

1.4 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit data indicating pipe material used, pipe accessories, and fittings.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with State of South Carolina Department of Health and Environmental Control (SC DHEC) standards.

1.8 FIELD MEASUREMENTS

A. Verify field measurements and elevations are as indicated on the Plans.

1.9 COORDINATION

A. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, roadway construction, and trenching. Note that the roadway contractor is not to pave the road or parking lot until verification that the sewer has been installed in that area.

PART 2 PRODUCTS

2.1 SANITARY SEWAGE PIPE (GRAVITY SEWER MAIN)

A. Ductile Iron Pipe: 60-42-10 ductile cast iron, AWWA C150, AWWA C151, ASTM A746.
   1. Pipe less than 30” shall be thickness class 53, pressure rating of 150 psi unless otherwise specified.
   2. Pipe 30” in diameter shall have a pressure rating of 250 psi.
   3. All pipe shall have standard Protecto 401 lined interior and 2-mil thick bituminous exterior coating.
   4. Fittings: Ductile iron grade 70-50-05.
   5. Joints: Push-on or mechanical joint ends, AWWA C111, rubber gasket joint devices.
   6. Flanges: AWWA C606, Class 125 except where Class 250 is specifically noted. Drilling and facing shall conform to ASME/ANSI B16.1-1998 – Cast Iron Pipe Flanges and Flanged Fittings.
   7. All pipe shall be clearly marked with the following information:
      a. Manufacturer’s name.
      b. Nominal pipe size.
      c. Pressure class.
      d. Material designation.

B. Plastic Pipe (Gravity Sewers): ASTM D3034, ASTM F679, Poly (Vinyl Chloride) (PVC).

1. Pipe wall thickness:
   a. Depth of cover 3’ through 12’ - SDR 35.
   b. Depth of cover greater than 12’ – SDR 26.
   c. Do not use PVC pipe for depth of cover less than 3’ without specific pipe protection noted on plans.
2. Pipe: 20 foot or 12.5 foot (+/-1 inch) laying lengths, smooth and free of cracks or other imperfections.
3. Fittings: PVC, same class as the pipe.
4. Couplings: integrally formed, factory fabricated.
5. Joints: bell and spigot style rubber ring sealed gasket joints, ASTM F477, elastomeric gaskets.
6. All pipe shall be clearly marked with the following information:
   a. Manufacturer’s name.
   b. Nominal pipe size.
   c. SDR Class Number.
   d. ASTM Designation.
   e. Material designation.

2.2 SANITARY SEWAGE PIPE (SEWER SERVICES)

A. Plastic Pipe: SDR 35, Poly (Vinyl Chloride) (PVC) material (ASTM D3034); inside nominal diameter of 4 or 6 inches, with slip joint fittings.
   1. Fittings: ASTM D1336, SDR 27 PVC.
   2. Joints: ASTM D212
   3. Gaskets: ASTM F477.

2.3 BEDDING AND COVER MATERIALS

A. Bedding: Fine aggregate per Section 31 05 16 – Aggregates for Earthwork.

B. Cover/Backfill: per Section 31 23 23 - Fill.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Correct over excavation with fine aggregate.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 SPECIAL CONDITIONS

A. Potable Water Supply Interconnections. There shall be no physical connections between the public or private potable water supply system and a sewer, or appurtenance thereto, which may permit the passage of any sewage or polluted water into the potable supply. No potable water pipe shall pass through or come into contact with any Part of a sewer manhole.

B. Horizontal and Vertical Separation from Potable Water Mains. Sewers shall be laid at least ten (10) feet horizontally from any existing or proposed potable water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the Department may allow deviation on a case by case basis, if supported by data from the design engineer.

   Such deviation may allow installation of the sewer closer to a potable water main, provided that the potable water main is in a separate trench or on in undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the potable water main is at least 18 inches above the top of the sewer.

C. Crossings. Sewers crossing potable water lines shall be laid to provide a minimum vertical separation of 18 inches between the outside of the potable water main and the outside of the sewer. This shall be the case where the possible water main is either above or below the sewer. Whenever possible, the potable water main shall be located above the sewer main.

   Where a new sewer line crosses and new potable water main, a full-length of pipe shall be used for both the sewer line and potable water main and the crossing shall be arranged so that the joints of each line shall be as far as possible from the point of crossing and each other. Where a possible water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the potable water main while maintaining line and grade.

3.4 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17 - Trenching.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 8 inches.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.5 INSTALLATION - PIPE

A. Pipe Installation:

1. Distribute the pipe and appurtenances neatly along the trench prior to laying. Handle the pipe carefully handled to prevent damage; use mechanical hoists or other approved methods when necessary.
2. Keep pipe and appurtenances clean and plug open ends securely when not actively laying pipe. Inspect and clean the inside of pipe, bell and spigots thoroughly prior to lowering into the ditch.
3. Each section of pipe shall be laid uniformly to the line or grade shown on the drawings, working in the upstream direction with the bell end laid upgrade. Ductile iron pipe shall be installed when minimum available cover is less than 3 feet and as shown on the drawings.
4. Seat spigots fully in the bells. Bed the pipe uniformly along and do the bottom of the trench for its entire length with bells lying in previously-dug bell holes sufficiently large to allow proper bedding and jointing. Take care when bedding and backfilling to prevent excessive deflection.
5. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.
6. Lay pipe to slope gradients noted on drawings. For service connections, minimum grade shall be ¼" per foot.
7. Install bedding per Drawings.
8. Depth of cover shall not be less than 3'0" to the top of pipe except where shown differently on a profile or specifically authorized by the Engineer.
9. Refer to Section 31 23 17 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
10. Make all necessary pipe connections. For sewer services, wye branches will be used for services on new sewer mains. On existing mains, a saddle secured with two stainless steel clamps will be utilized. No threaded connections will be allowed except for cleanout plug. Adapters for gasketed to solvent-weld pipe shall be furnished as recommended by pipe manufacturer.
11. Install plastic ribbon tape continuous over top of pipe, buried 18 inches below finish grade, above pipe line; coordinate with Section 31 23 23.
12. For non-metallic pipe, Install trace wire continuous over top of pipe, located 6 inches above pipe line; coordinate with Section 31 23 23.
13. Install site sanitary sewage system piping to 5 feet of building. For undeveloped residential lots, terminate at the property line.
14. Connect to building sanitary waste system. Service connections not designated for immediate use shall be plugged and covered and a 2"x4" wooden stake shall be driven near the plug to indicate location. Alternatively, the pipe can be turned upwards with a 90 degree fitting and capped above grade.
15. Repairs to damaged utilities shall be promptly made at the contractor's expense. The contractor shall use every effort to avoid damaging or breaking water, sewer, gas, power, telephone or other utility services. However, should damage occur, immediate action shall be initiated to affect satisfactory repairs. All repair work shall be satisfactory to the Engineer and owner of the damaged utility.
16. On completion of the pipe installation, the contractor shall flush all lines and remove any sediment. On large sewer lines if flushing does not remove foreign

material, the contractor shall use a vacuum truck or other acceptable means to clean the line the to the satisfaction of the Owner and Engineer.

3.6 OBSTRUCTION WORK

A. Though every effort has been made to minimize conflicts with existing utilities, sometimes conflicts arise. The contractor shall be responsible for the satisfactory resolution of all conflicts between the construction project and existing utilities or other obstructions encountered in the area of the proposed sanitary sewer work except as specifically delineated herein, as shown on the drawings, or as specifically approved by the Engineer.

B. Any water line relocation work shall be done using ductile or cast-iron pipe and fittings. All fittings, pipe, blocking, tiebacks and other accessories necessary for a complete and acceptable installation shall be provided.

3.7 FIELD QUALITY CONTROL

A. Perform test on site sanitary sewage system in accordance with local codes.

B. The Contractor shall furnish all necessary equipment including plugs and mandrel. The Contractor shall notify the Engineer 24 hours in advance of the testing to allow sufficient time for the Engineer to arrange to witness the test.

C. Perform acceptance tests per Section 33 01 30 – Sewer and Manhole Testing.

D. Services: sewer service connections shall be tested with main sewer line piping.

E. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

3.8 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 05 23 – PIPE BORING OPERATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavation for approach trenches pits and open trench.
2. Casing Pipe
3. Carrier Pipe
4. Directional Bore

B. Related Requirements:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 23 16 - Excavation.
3. Section 31 23 17 - Trenching.
4. Section 31 23 23 - Fill.
5. Section 33 11 16 - Water Utility Distribution Piping.
6. Section 33 34 00 - Sanitary Utility Sewerage Force Mains.
7. Section 33 31 00 - Sanitary Utility Sewerage Piping.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Casing – In Open Trench
1. Basis of Measurement: Linear Feet
2. Basis of Payment: Includes casing, carrier pipe, spiders and end seals.

B. Casing – Jack and Bore
1. Basis of Measurement: Linear Feet
2. Basis of Payment: Includes casing, carrier pipe, spacers (spiders) and end seals.

C. Directional Bore
1. Basis of Measurement: Linear Feet
2. Basis of Payment: Includes HDPE pipe and MJ fittings on each end.

1.3 REFERENCE STANDARDS

A. ASTM International:
.
1. ASTM A53 - Steel. Standard Specification for Pipe, Steel, Welded And Seamless
2. ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings

1.4 SUBMITTALS

A. Design Data: Submit manufacturer's latest published literature for casing, spiders and end seals.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents:
   1. Record actual locations of both ends of bore/casing and the length of casing
   2. Supply marked-up plan sheets to Engineer.

1.6 QUALITY ASSURANCE

A. Perform Work according to State, county and local standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

B. Do not place materials on private property or in areas obstructing pedestrian or vehicle traffic.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.9 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Record Drawings.

PART 2 PRODUCTS

2.1 CASING

A. Boring Operations may include directional boring and or bore and case as stated on the Drawings and encroachment permits. Installation of encasement and carrier pipes shall include all related work and services such as mobilization of equipment, constructing and maintaining working pits, right-of-way maintenance and restoration, traffic maintenance, mining, excavations, dewatering, protection, sheeting, shoring, bracing, cleaning up and moving out. Adequate sheeting, shoring and bracing for

embankments, operating pits, and as elsewhere required shall be placed and maintained in order that work may proceed safely and expeditiously.

B. Boring Under Roadway: See enclosed SCDOT encroachment permit if applicable.

C. Boring Under Railroad: See enclosed encroachment permit if applicable.

D. Casing Pipe

1. Casing pipe shall be of the sizes shown on the drawings, and it shall be welded steel pipe.
2. Welded Steel Pipe shall conform to ASTM A53, Grade A, with minimum yield strength of 35,000 psi. Pipe shall be bituminous coated on the inside and outside. Minimum wall thickness shall be per the following table:

Diameter (inches)	**Thickness (inches)**
Under 14”	0.188”
14” to 16”	0.219”
18”	0.50”
20”	0.281”
22”	0.312”
24”	0.344”
28” to 30”	0.406”
32”	0.438”

2.2 CARRIER PIPE

A. Use C900 PVC unless noted otherwise on the drawings.

2.3 DIRECTIONAL BORE PIPE

A. See piping specification for water mains and or force mains.

2.4 ACCESSORIES FOR JACK AND BORE

A. Spacers:
1. Steel and Plastic: Stainless-steel band, stainless-steel flange bolts, heavy-duty PVC liner, polyethylene or phenolic skids.
2. Spacing: Per manufacturers recommendations.

B. Casing End Seals:
1. Casing end seals shall be a pull-over type construction and made from Neoprene with
Stainless steel bands for securing the ends of the end seal to the casing pipe and carrier pipe

PART 3 EXECUTION

3.1 PITS OR APPROACH TRENCHES

A. Excavate approach trenches or pits as site conditions require.

B. Verify all alignment and grade settings prior to setting up boring rig. Alignment and uniform grade shall be maintained.

3.2 CASING PIPE INSTALLATION

A. Jack and Bore:
   1. Push pipe into ground with boring auger, rotating within pipe to remove soil.
   2. If unstable soil is encountered during boring, retract cutting head into casing to permit balance between pushing pressure and ratio of pipe advancement to quantity of soil.
   3. If boring is obstructed, relocate, jack, or tunnel as directed by Engineer.

B. Directional Bore:
   1. Verify with Engineer location of bore including start location, depth and finish location.
   2. The minimum cover under streams shall be 3 – 4 feet.
   3. Provide adequate supply of boring fluids.

3.3 CARRIER PIPE INSTALLATION

A. Provide spacers (spiders) approximately 24” from each end of casing pipe and additional spaces as required by the manufacturer based on pipe diameter.

B. Provide seals on both ends of the casing pipe.

END OF SECTION

SECTION 33 32 22 – BYPASS PUMPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bypass Pumping

B. Related Requirements:
   1. Section 33 01 30.62 – Manhole Grout Sealing
   2. Section 33 01 30.72 - Relining Sewers.
   3. Section 33 01 32 - Sewer Distribution System Testing.
   4. Section 33 31 00 - Sanitary Utility Sewerage Piping.

1.2 PRICE AND PAYMENT PROCEDURES

A. Bypass Pumping:
   1. Basis of Measurement: N/A.
   2. Basis of Payment: Payment for bypass pumping/sewage flow control, including provisions for wet weather flow control, shall be included in the contract bid price.

1.3 REFERENCE STANDARDS

A. State Standards:
   1. South Carolina Department of Health and Environmental Control (SC DHEC).

1.4 COORDINATION

A. Coordinate the Work with connection to existing tie-in municipal sewer utility service.

B. Coordinate the Work with lift station construction, roadway construction, and trenching. Note that the roadway contractor is not to pave the road or parking lot until verification that the sewer has been installed in that area.

1.5 SUBMITTALS – Not Used

1.6 CLOSEOUT SUBMITTALS – Not Used

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with State of South Carolina Department of Health and Environmental Control (SC DHEC) standards.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not place materials on private property without written permission of property owner.

B. During loading, transporting and unloading, exercise care to prevent damage to equipment.

C. Do not drop pipe or fittings.

D. Avoid shock or damage to pipe and equipment.

E. Take measures to prevent damage to exterior surface or internal lining of pipe.

PART 2 PRODUCTS

2.1 Perform work in accordance with all State, County and local standards.

2.2 PUMP AND TRANSFER EQUIPMENT

A. For suction lifts of less than 25 feet, use an above ground self-priming, or prime-assisted pump.

B. For depths greater than 25 feet, consult with pump engineer for type of pump.

C. Size pump according to length & diameter of transfer hose, depth of source manholes, intervening terrain and anticipated peak sewerage loading. Contact Owner for direction on historical loading at source manhole.

D. The pump must be capable of pumping trash- and sewage-laden effluent. Unless otherwise specified, the pump must be capable of passing a minimum three-inch diameter solid.

2.3 VALVES AND PIPING

A. Piping shall be rugged construction high density polyethylene (HDPE) rated for sewerage transfer. Steel or PVC piping is allowed where applicable.

B. Valves shall be rated for sewerage transfer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Determine the “Source” manhole. If not indicated on the Plans, it is typically the manhole immediately upstream of the pipe to be remediated.

B. Determine the “Destination” manhole. If not indicated on the Plans, it is typically the manhole immediately downstream of the pipe to be remediated.

C. Verify distance, dimensions, and elevations of source and destination manholes.

3.2 PREPARATION

A. It shall be the responsibility of the Contractor to contact the local highway representative and to determine the requirements for work to be done. Requirements shall include, but are not limited to the following:
   1. The Contractor shall erect adequate warning signs and where necessary, place flagmen with appropriate red flags, to control traffic at construction site.
   2. The Contractor will provide adequate barricades to properly protect the work and to warn all pedestrians and drivers as to the construction.
   3. From sundown to sun-up, adequate lighting will be provided to mark all construction and hazards at night.
   4. The Engineer and his construction observer shall have the right to require such barricades and lighting as they feel is required if the Contractor fails to provide same.
   5. Signs and flagman shall be placed at sufficient distances from the work site so that ample warning is given to approaching traffic.

B. Locate pump and bypass piping in such a way as to allow access for maintenance, to accommodate traffic, and to insure the safety of pedestrians. Access to buildings shall not be blocked. Use signage, barricades and other means to alleviate tripping hazards. Route bypass piping through non-traffic (vehicular or pedestrian) areas as much as practical.

C. When crossing sidewalks or roadways, use plastic or wooden ramps to allow vehicles to cross over without damaging the pipe.

3.3 SPECIAL CONDITIONS

A. Potable Water Supply Interconnections. There shall be no physical connections between the public or private potable water supply system and a sewer, or appurtenance thereto, which may permit the passage of any sewage or polluted water into the potable supply. No potable water pipe shall pass through or come into contact with any Part of a sewer manhole.

B. Horizontal and Vertical Separation from Potable Water Mains. Sewers shall be laid at least ten (10) feet horizontally from any existing or proposed potable water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the Department may allow deviation on a case by case basis, if supported by data from the design engineer.

   Such deviation may allow installation of the sewer closer to a potable water main, provided that the potable water main is in a separate trench or on in undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the potable water main is at least 18 inches above the top of the sewer.

   .

END OF SECTION

SECTION 33 34 00 - SANITARY UTILITY SEWERAGE FORCE MAINS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Force mains.
   2. Bedding and cover materials.

B. Related Requirements:
   1. Section 31 05 13 - Soils for Earthwork.
   2. Section 31 05 16 - Aggregates for Earthwork.
   3. Section 31 23 16 - Excavation.
   4. Section 31 23 17 - Trenching.
   5. Section 31 23 23 - Fill.
   6. Section 33 01 32 - Sewer and Manhole Testing.
   7. Section 33 31 00 - Sanitary Utility Sewerage Piping.
   8. Section 33 32 19 – Utility Wastewater Pumping Stations.

1.2 PRICE AND PAYMENT PROCEDURES

A. Force Main Pipe:
   1. Basis of Measurement: By linear foot.
   2. Basis of Payment: Includes hand trimming excavation, backfill, bedding, MJ restraints, and pipe and pressure test.

B. Force Main Fittings:
   1. Basis of Measurement: By the pound.
   2. Basis of Payment: Contractors estimate of fitting costs for the force main distribution system per the construction drawings.

C. Force Main Valves:
   1. Basis of Measurement: Each.
   2. Basis of Payment: Includes valve, testing, backfill, boxes and accessories.

1.3 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   2. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
   3. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

4. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

B. American Water Works Association:
   1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
   2. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
   3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   4. AWWA C150/A21.50-02 – American National Standard for Thickness Design of Ductile-Iron Pipe.
   5. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

C. Ductile Iron Pipe Research Association:
   1. DIPRA Section 1X, Thrust Restraint.

D. State Standards:
   1. South Carolina Department of Health and Environmental Control (SC DHEC).

1.4 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with connection to existing tie-in municipal sewer utility service.

C. Coordinate the Work with lift station construction, roadway construction, and trenching. Note that the roadway contractor is not to pave the road or parking lot until verification that the sewer has been installed in that area.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit data indicating manufacturer, pipe material used, pipe accessories, restrained joint details and materials.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents: Record location of pipe runs, connections, and invert elevations. Document pressure test results.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with State of South Carolina Department of Health and Environmental Control (SC DHEC) standards.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Do not place materials on private property without written permission of property owner.

C. During loading, transporting and unloading, exercise care to prevent damage to materials.

D. Do not drop pipe or fittings.

E. Avoid shock or damage to pipe.

F. Take measures to prevent damage to exterior surface or internal lining of pipe.

G. Do not stack pipe higher than recommended by pipe manufacturer.

H. Store gaskets for mechanical and push-on joints in cool, dry location out of direct sunlight and not in contact with petroleum products.

1.9 EXISTING CONDITIONS

A. Verify field measurements prior to fabrication. Indicate field measurements on shop drawings.

PART 2 PRODUCTS

2.1 FORCE MAIN

A. DUCTILE IRON PIPE: 60-42-10 ductile cast iron, AWWA C150, AWWA C151, AWWA C104.
   1. To be used when cover over pipe is less than 36”, or where specified on drawings.
   2. Pressure Class – 350 psi.
   3. All pipe shall have standard cement-lined interior and 2-mil thick bituminous exterior coating.
   4. Fittings: Ductile iron grade 70-50-05, AWWA C110.
   5. Joints: Push-on or mechanical joint ends, AWWA C111, rubber gasket joint devices.
   6. Rubber Gaskets, Lubricants, Glands, Bolts and Nuts: AWWA C111.
   7. Flanges: AWWA C606, Class 250. Drilling and facing shall conform to ASME/ANSI B16.1-1998 – Cast Iron Pipe Flanges and Flanged Fittings.
   8. All pipe shall be smooth and free of cracks or other imperfections.

9. All pipe shall be clearly marked with the following information:
    a. Manufacturer's name.
    b. Nominal pipe size.
    c. Pressure class.
    d. Material designation.

B. POLYVINYL CHLORIDE (PVC) PIPE: Rigid pressure sewer pipe, AWWA C900, Class 100, Green.

1. All PVC pipe must have 36" or more of cover; otherwise Ductile Iron Pipe (DIP) shall be used.
2. Pipe 4" through 12" diameter: AWWA C-900, DR 25
3. Pipe less than 4" in diameter: Must be specified as ASTM D1785 or ASTM D2241, DR 21, Class 200.
4. Solvent weld PVC pipe and fittings shall not be used in force mains three (3) inches and larger.
5. Nominal laying lengths shall be a minimum of 18 feet.
6. All pipe shall be smooth and free of cracks or other imperfections.
7. All pipe shall be clearly marked with the following information:
    a. Manufacturer's name.
    b. Nominal pipe size.
    c. DR class number.
    d. ASTM designation.
    e. Material designation.
    f. Manufactured date.
8. Fittings: 3" and greater, AWWA C900; AWWA C905, ductile iron with mechanical joint.
9. Fittings: Less than 3" pipe diameter, schedule 40 PVC with solvent weld.
10. Joints: ASTM D3139, integrally formed, factory fabricated bells, or twice gasketed couplings with flexible elastomeric seals. Solvent-cement couplings are not permitted.

C. HD Polyethylene Pipe: AWWA C901, ASTM D3350-12e1.

1. To be used in directional bores only.
2. Pipe Materials: Virgin resins exhibiting a cell classification of PE 345444C as defined in ASTM D3350 with an established hydrostatic-design-basis of 1600 psi for water at 73 degrees F. The resin shall be listed by the PPI (Plastic Pipe Institute) in its pipe-grade registry Technical Report (TR) 4, "Listing of Plastic Pipe Compounds".
3. Pipe: DR 11, Class 160.
4. Fittings: AWWA C901, molded.
5. Joints: Heat fusion, flanges, or other mechanical joint systems proven for HDPE pipes.
6. All pipes shall be smooth and free of cracks or other imperfections.
7. All pipe shall be clearly marked with the following information:
    a. Manufacturer's name.
    b. Nominal pipe size.
    c. Pressure class.

d. Material designation.
e. National Sanitation Foundation Seal of Approval for Potable Water.

2.2 VALVES AND VALVE BOXES

A. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron; including the manufacturer's name, pressure rating, and year of fabrication cast into valve body.
   1. Resilient seats.
   2. Stem: Non-rising bronze stem.
   3. Operating Nut: Square; open counterclockwise unless otherwise indicated.
   4. Ends: Flanged, mechanical joint or bell end connections.
   5. Coating: AWWA C550; interior/exterior.
   6. Pressure Rating: 200 psig.

B. Check valves:
   1. Anti-Syphon Ball Check Valves, Cast Iron, unless a different model is noted on the drawings:
      a. Housing: ASTM A48/A48M, Class 30, cast iron.
      b. Ball: Natural rubber.
      c. Plug: ASTM D2466 Schedule 40 PVC.
      d. Temperature: 176 degrees F and 212 degrees F peak.
      e. Pressure Test: 150 psig.
   2. Anti-Syphon Ball Check Valves, 4 inch and 6 inch, Cast Iron unless a different model is noted on the drawings:
      a. Housing: ASTM A48/A48M, Class 30, cast iron.
      b. Seal: Natural rubber.
      c. Ball: Natural rubber covered hollow iron.
      d. Hardware: 18-8 Stainless steel.
      e. Access Plate: ASTM A48/A48M, Class 30 Cast iron.
      f. Temperature: 176 degrees F and 212 degrees F peak.
      g. Pressure Test: 125 psig.
   3. Air Release valves:
      a. Use Crispin SL20 with 1/4” orifice unless a different model is noted on the drawings.
      b. Seat: PVC.
      c. Body: Cast Iron.

C. Valve boxes:
   1. Valve boxes shall be of suitable size for the valve with which they are used and fully adjustable for depth of setting, extension pieces being furnished where necessary.
   2. Drop type covers shall be provided for each box with the proper word designating the valve service cast into its top surface.
   3. Basis shall be provided and shall be so designed to fully support the box without weight of the box or superimposed load being transmitted to any part of the valves or adjacent pipe on either side.
   4. Materials: Domestic cast iron, two-piece, screw type.

2.3 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

B. Trace Wire: Electronic detection materials for non-conductive piping products.
   1. Unshielded 12 AWG THWN insulated copper wire.
   2. Conductive tape.

2.4 BEDDING AND COVER MATERIALS

A. Bedding (if required – see Drawings): Per Section 31 23 23 - Fill.

B. Cover: Per Section 31 23 23 - Fill.

C. Soil Backfill from Above Pipe to Finish Grade: Per Section 31 23 23 - Fill.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify subgrade is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Correct over excavation with fine aggregate.

B. Remove large stones or other hard matter capable of damaging pipe or impeding consistent backfilling or compaction.

C. Excavate pipe trench in accordance with Section 31 23 17 – Trenching.

3.3 SPECIAL CONDITIONS

A. Potable Water Supply Interconnections. There shall be no physical connections between the public or private potable water supply system and a sewer, or appurtenance thereto, which may permit the passage of any sewage or polluted water into the potable supply. No potable water pipe shall pass through or come into contact with any Part of a sewer manhole.

B. Horizontal and Vertical Separation from Potable Water Mains. Sewers shall be laid at least ten (10) feet horizontally from any existing or proposed potable water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the Department may allow deviation on a case by case basis, if supported by data from the design engineer.

Such deviation may allow installation of the sewer closer to a potable water main, provided that the potable water main is in a separate trench or on in undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the potable water main is at least 18 inches above the top of the sewer.

C. Crossings. Sewers crossing potable water lines shall be laid to provide a minimum vertical separation of 18 inches between the outside of the potable water main and the outside of the sewer. This shall be the case where the possible water main is either above or below the sewer. Whenever possible, the potable water main shall be located above the sewer main.

Where a new sewer line crosses and new potable water main, a full-length of pipe shall be used for both the sewer line and potable water main and the crossing shall be arranged so that the joints of each line shall be as far as possible from the point of crossing and each other. Where a possible water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the potable water main while maintaining line and grade.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with Drawings.

B. Route piping in straight line.

C. Refer to Section 31 23 17 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

D. Connect to municipal sewer system manhole per Drawings.

E. Install Work in accordance with SC DHEC and local standards.

3.5 INSTALLATION - THRUST RESTRAINT

A. Provide pressure pipeline with restrained joints at bends, tees, and changes in direction.

3.6 FIELD QUALITY CONTROL

A. Pressure Test: Test in accordance with Section 33 01 30 for Force Mains.

B. Compaction Testing: In accordance with Section 31 23 17 - Trenching.

C. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

D. Frequency of Compaction Tests: Per local requirements.

3.7 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION